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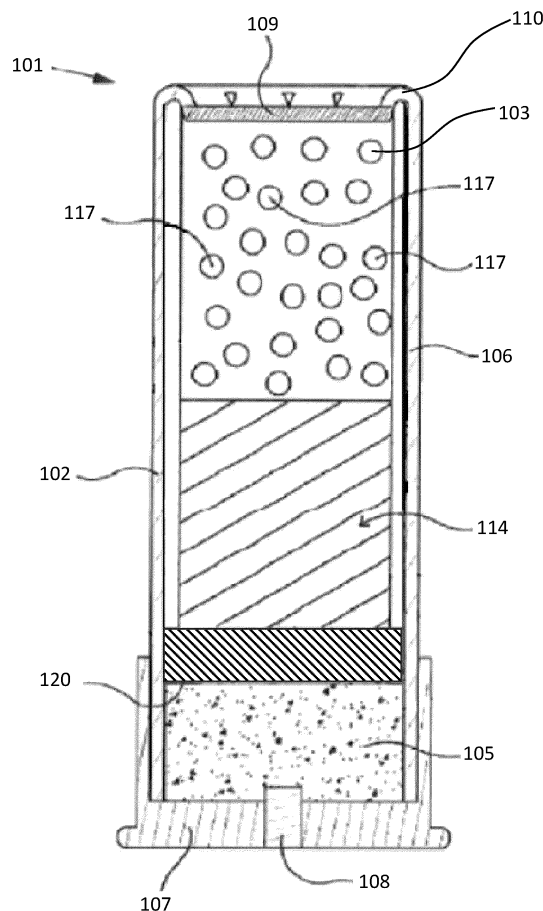
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A SHOTGUN CARTRIDGE
- (57)

A shotgun cartridge comprising a casing and a projectile received within the casing, the projectile comprising a coating of a food grade fluid lubricant or a food grade grease lubricant.
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- Fig. 2
- EP 4 459 222 A1
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Description

[0001] The present application relates to a shotgun cartridge, a process for manufacturing the same, and a process for treating a projectile, e.g. shot, for a shotgun cartridge.

Background

[0002] Shotgun ammunition, known as shotgun cartridges, typically comprise a projectile of lead shot. When fired, shot contacts the wall of the gun barrel causing a small amount of wear. Because lead is softer than the metals used for manufacturing gun barrels, this wear remains at an acceptable level. However, in recent years there has been a move toward non-toxic projectile variants for the shooting of game and other forms of sporting shooting. Non-toxic projectiles are typically harder than lead and include steel shot. This increased hardness significantly increases the wear rate of gun barrels and is a particular problem for owners of valuable older guns, where the metal used is relatively soft.

[0003] Furthermore, ammunition manufacturers currently put steel shot in a cup in the cartridge known in the industry as a wad cup. Wad cups help to prevent the steel shot contacting the walls of the shotgun barrel and therefore help prevent wear to the shotgun barrel. Wad cups however are required to be biodegradable, and furthermore the friction caused by the wad cup against the walls of the shotgun barrels causes its own problems, for example the friction reduces the kinetic energy transferred to the projectile. Wad cups also have to be made to separate from the steel shot load upon leaving the barrel, so that the shot load will separate and form a shot pattern in flight instead of the wad cup and the pellets sticking together and forming a solid mass.

[0004] Still furthermore, shotgun barrels comprise restrictions called chokes which serve to group the shot pellets together prior to leaving the barrel so that the pellets will disperse and form a pattern in flight to deliver a spread of shot down range on the target. The choke restrictions in shotgun barrels are normally numbered in size, depending on how tight the restriction is. It is an accepted practice within the industry that when using steel shot, the choke restriction should be no tighter than a half choke measurement. This is because, whereas lead shot compresses, steel shot encased in a wad cup will not compress to the same extent. Thus, ammunition manufacturers have been unable to successfully load smaller caliber shotgun cartridges with steel shot (in particular, .410 and 28 bore calibers) as there is not enough space in the small caliber cartridges for both a wad cup and a full shot load.

[0005] Yet still furthermore, steel shot has a tendency to rust or corrode, causing the pellets to stick together and not separate properly upon leaving the shotgun barrel. Furthermore, it is undesirable for rusty or oxidized steel shot in the carcass of game to enter the food chain

and become ingested by humans or other animals. While some manufacturers coat the steel pellets with industrial rust inhibitors, such rust inhibitors can cause environmental contamination. Other manufacturers instead copperplate the steel shot pellets to minimise rust and corrosion, however the copperplating itself can disintegrate, for example due to galvanic corrosion occurring between the dissimilar copper and steel, and furthermore contact between the copper and the shotgun barrel can cause wear to the shotgun barrel due to the direct metal-on-metal contact between the two.

[0006] The present invention aims to alleviate, at least to a certain extent, the problems and or address at least to a certain extent the difficulties associated with the prior art.

Summary

[0007] According to an aspect of the present disclosure, there is provided a shotgun cartridge comprising:

a casing, propellant, wadding and a projectile; the propellant, wadding and projectile being received within the casing with the wadding disposed between the propellant and the projectile to separate the propellant from the projectile; wherein the wadding comprises a cylindrical wall forming a tube and an end wall closing one end of the tube, wherein the wadding is provided with a lubricant located on an outwardly facing surface of the cylindrical wall, and wherein the lubricant is a food grade fluid or grease lubricant.

[0008] The projectile may be within the cylindrical wall of the wadding.

[0009] The projectile may be entirely within the cylindrical wall of the wadding.

[0010] The lubricant may be a food grade grease.

[0011] The food grade grease may be a silicone grease.

[0012] The lubricant may be provided on the outwardly facing surface in an amount between $40 \mu\text{g}/\text{mm}^2$ and $200 \mu\text{g}/\text{mm}^2$; or between $50 \mu\text{g}/\text{mm}^2$ and $150 \mu\text{g}/\text{mm}^2$; or between $90 \mu\text{g}/\text{mm}^2$ and $140 \mu\text{g}/\text{mm}^2$.

[0013] The wadding may be formed from a fibre-based material.

[0014] The projectile may comprise pellets.

[0015] The projectile may comprise steel pellets.

[0016] According to another aspect of the present disclosure, there is provided wadding for a shotgun cartridge, the wadding being configured to separate the propellant from a projectile within a casing of a shotgun cartridge, wherein the wadding comprises a cylindrical wall forming a tube and an end wall closing one end of the tube, wherein the wadding is provided with lubricant located on an outwardly facing surface of the cylindrical

wall, and wherein the lubricant is a food grade fluid or grease lubricant.

[0017] The lubricant may be a food grade grease.

[0018] The food grade grease may be a silicone grease.

[0019] The lubricant may be provided on the outwardly facing surface in an amount between 40 $\mu\text{g}/\text{mm}^2$ and 200 $\mu\text{g}/\text{mm}^2$; or between 50 $\mu\text{g}/\text{mm}^2$ and 150 $\mu\text{g}/\text{mm}^2$; or between 90 $\mu\text{g}/\text{mm}^2$ and 140 $\mu\text{g}/\text{mm}^2$.

[0020] The wadding may be formed from a fibre-based material.

[0021] According to another aspect of the present disclosure, there is provided a process of manufacturing wadding for a shotgun cartridge, the process comprising:

providing wadding comprising a cylindrical wall forming a tube and an end wall closing one end of the tube,
providing the wadding with a lubricant on an outwardly facing surface of the cylindrical wall, wherein the lubricant is a food grade fluid or grease lubricant.

[0022] Providing the wadding with a lubricant may comprise rolling the wadding across a surface provided with the lubricant.

[0023] According to another aspect of the present disclosure, there is provided a process of manufacturing a shotgun cartridge, the process comprising:

providing wadding comprising a cylindrical wall forming a tube and an end wall closing one end of the tube,
providing the wadding with a lubricant on an outwardly facing surface of the cylindrical wall, wherein the lubricant is a food grade fluid or grease lubricant; and
incorporating the wadding into a case of the cartridge.

[0024] According to another aspect of the present disclosure, there is provided a shotgun cartridge comprising:

a casing; and
a projectile received within the casing, the projectile comprising a coating of a food grade fluid lubricant or a food grade grease lubricant.

[0025] The cartridge may comprise a plurality of projectiles received within the casing, each of the plurality of projectiles comprising a coating of a food grade fluid lubricant or a food grade grease lubricant.

[0026] The food grade fluid or food grade grease may comprise PTFE.

[0027] The food grade grease may be a silicone grease.

[0028] The projectile may comprise or may be a slug or a flechette.

[0029] The projectile may comprise or may be shot. The shot may be or may comprise pellets. The pellets

may be (e.g individually) coated with the food grade fluid lubricant or the food grade grease lubricant. The pellets may be steel pellets.

[0030] The pellets may be plated, such as metal plated, for example the pellets may be copperplated or nickel-plated.

[0031] The coating may be configured to cover a majority of an external surface of the projectile. The coating may be configured to cover a majority of an external surface of each pellet.

[0032] The coating may be configured to fully encapsulate the projectile. The coating may be configured to fully encapsulate each pellet.

[0033] The coating may have a thickness of less than 2mm, such as less than 1mm, less than 0.5mm, less than 0.3mm, less than 0.2mm, less than 0.1mm, less than 0.05mm, or less than 0.01mm; or the coating may have a thickness defined by a range of any two of these values.

[0034] The shotgun cartridge may further comprise a propellant received within the casing.

[0035] The shotgun cartridge may not comprise a wadding. The shotgun cartridge may not comprise a wad cup.

[0036] According to another aspect of the present disclosure, there is provided a process of treating a projectile for a shotgun cartridge, the process comprising:

providing the projectile with a coating of a food grade fluid lubricant or a food grade grease lubricant.

[0037] The process may be a process of treating a plurality of projectiles, the processing comprising the step of providing a plurality of projectiles with a coating of a food grade fluid lubricant or a food grade grease lubricant.

[0038] The step of providing the projectile with a coating may comprise rolling the projectile in the lubricant. The step of providing the projectile with a coating may comprise rolling the projectile across a surface provided with the lubricant.

[0039] The step of providing the projectile with a coating may comprise providing the lubricant and the projectile together in a rotatable container and rotating the container to cause the projectile to become coated with the lubricant.

[0040] The food grade fluid or food grade grease lubricant may comprise PTFE.

[0041] The food grade grease lubricant may be a silicone grease.

[0042] The projectile may comprise or may be a slug or a flechette.

[0043] The projectile may be or may comprise shot. The shot may be or may comprise pellets. The pellets may be steel pellets.

[0044] The pellets may be plated, such as metal plated. The pellets may be copperplated or nickelplated.

[0045] The coating may be configured to cover a majority of an external surface of the projectile. The coating may be configured to cover a majority of an external surface of each pellet.

[0046] The coating may be configured to fully encapsulate the projectile. The coating may be configured to

fully encapsulate each pellet.

[0047] The coating may be provided as a layer on an external surface of the projectile, for example as a layer on an external surface of each pellet.

[0048] The coating may have a thickness of less than 2mm, such as less than 1mm, less than 0.5mm, less than 0.3mm, less than 0.2mm, less than 0.1mm, less than 0.05mm, or less than 0.01mm; or the coating may have a thickness defined by a range of any two of these values.

[0049] According to another aspect of the present disclosure, there is provided a process of manufacturing a shotgun cartridge, the process comprising:

providing a projectile with a coating of a food grade fluid lubricant or a food grade grease lubricant; and incorporating the projectile into a casing of the cartridge.

[0050] The process may comprise the steps of providing a plurality of projectiles with a coating of a food grade fluid lubricant or a food grade grease lubricant; and incorporating the projectiles into a casing of the cartridge.

[0051] The step of providing the projectile with a coating may comprise rolling or immersing the projectile in the lubricant.

[0052] The step of providing the projectile with a coating may comprise rolling the projectile across a surface provided with the lubricant.

[0053] The step of providing the projectile with a coating may comprise providing the lubricant and the projectile together in a rotatable container and rotating the container to cause the projectile to become coated with the lubricant.

[0054] The food grade fluid or food grade grease lubricant may comprise PTFE.

[0055] The food grade grease lubricant may be a silicone grease.

[0056] The projectile may be or may comprise pellets. The pellets may be steel pellets.

[0057] The pellets may be plated, such as metal plated. The pellets may be copperplated or nickelplated.

[0058] The coating may be configured to cover a majority of an external surface of the projectile. The coating may be configured to cover a majority of an external surface of each pellet.

[0059] The coating may be configured to fully encapsulate the projectile. The coating may be configured to fully encapsulate each pellet.

[0060] The coating may have a thickness of less than 2mm, such as less than 1mm, less than 0.5mm, less than 0.3mm, less than 0.2mm, less than 0.1mm, less than 0.05mm, or less than 0.01mm; or the coating may have a thickness defined by a range of any two of these values.

[0061] The process may further comprise the step of providing a propellant within the casing.

Brief Description of the Drawings

[0062]

5 Fig. 1 illustrates a first shotgun cartridge comprising wadding comprising a food grade fluid or grease lubricant.

10 Fig. 2 illustrates a second shotgun cartridge comprising pellets coated with a food grade fluid or grease lubricant.

Detailed Description

[0063] Fig. 1 illustrates a first shotgun cartridge 1 in cross section. The cartridge 1 comprises a casing 2 which houses a projectile 3, wadding 4 and a propellant 5. The casing 2 has a cylindrical wall 6 forming a tube that is closed at one end by a cap 7 containing a primer 8 and at the other by disc shaped lid 9 secured by an inwardly turned crimped end 10 of the cylindrical wall 6. The wadding 4 divides an interior of the casing 2 in two, separating the propellant 5 from the projectile 3 - the propellant 5 is provided adjacent the cap 7, while the projectile 3 is provided on the other side of the wadding 4. In use, the shotgun cartridge 1 is loaded and fired in the conventional way. The primer 8 is set into the cap 7 and is configured to ignite the propellant 5 when contacted by a firing pin to displace the wadding 4 and discharge the projectile 3 down a barrel of a shot gun. The wadding 4 seals the gasses generated by ignition of the propellant 5 and ensures that energy in the gas is not wasted by leakage between the projectile 3 and the cylindrical wall 6 of the casing 2 and, thereafter, between the projectile 3 and the barrel. In the example of Fig. 1, the wadding 4 is cup-shaped wadding 4, comprising a cylindrical wall 12 forming a tube and an end wall 13 closing one end of the tube. The cylindrical wall 12 has a diameter substantially equal to or slightly less than the diameter of the cylindrical wall 6 of the casing 2 so that the wadding tightly fits within the cylindrical wall 6 of the casing 2. A nitro card 20 is provided between the wadding 4 and the propellant 5. The nitro card is a thin treated disc of fire-resistant card that acts to prevent burning propellant 5 igniting the wadding 4.

[0064] The end wall 13 may be formed as a disc shaped plug 14 within the cylindrical wall 12, as illustrated, or, alternatively, may be formed from cut and folded ends of the cylindrical wall 12. The end wall 13 is provided adjacent the propellant 5 and separates an interior 15 of the wadding 4 from the propellant. The projectile 3 is provided within the interior 15 of the wadding 4 - that is to say, within the cylindrical wall 12 of the wadding 4. When the cartridge of Fig. 1 is fired, the wadding 4 and the projectile 3 are driven down the barrel together with the projectile 3 retained within the interior 15 of the wadding 4. In this way, the projectile 3 is kept separate from the barrel's inner surface by the cylindrical wall 12 of the wadding 4, protecting the barrel from abrasion that would otherwise

be caused by the projectile 3 contacting the barrel. This reduces wear to the barrel that would otherwise result from contact between the projectile 3 and the barrel. As mentioned, the wadding 4 helps to seal the gasses generated by ignition of the propellant 5. This sealing effect of the wadding 4 may be assisted by an optional skirt 16. The skirt 16 is a relatively short extension of the cylindrical wall 12 beyond the end wall 13. In this example, the skirt 16 comprises crimped ends that secure the nitro card 20 up against the end wall 13 of the wadding 4. Alternatively, the nitro card 20 can also be loaded resting on top of the propellant 5 without the need for crimping. Both options can be implemented for ease of manufacturing.

[0065] The illustrated projectile of the above-described example cartridge 1 comprises shot comprising pellets of steel 17. The pellets 17 are spherical for optimal flight characteristics. While steel pellets 17 are used in the illustrated example, other projectiles 3 may be swapped out as appropriate and depending on the intended use of the cartridge 1. For example, the pellets 17 may be formed from other metals. Slugs and flechettes are just two further unillustrated examples that will be familiar to the skilled person which could instead be used.

[0066] The wadding 4 of the above-described example cartridge 1 may be made from any suitable material such as plastic, cork or a fibre-based material such as paper. Additionally, the fibre-based material may be biodegradable. It is to be appreciated that any suitable grammage of fibre-based material may be selected for use as the wadding material. Typically, a fibre-based material with a grammage between 100 gsm and 400 gsm may be used.

[0067] Food grade fluid or grease lubricant 18 (hereinafter 'lubricant 18') is located on an outwardly facing surface of the cylindrical wall 12 of the wadding 4.

[0068] It will be appreciated that the wadding 4 is produced separately and can be provided as such for combination with the remaining features of the cartridge 1 in any suitable way. Details of manufacture of the cartridge 1 will be omitted for being within the purview of a skilled person presented with the wadding 4 manufactured according to the example described herein.

[0069] In one example, the lubricant 18 is applied to the cylindrical wall 12 of the wadding 4 by rolling the wadding across a surface provided with the lubricant 18. In this way, the external surface of the cylindrical wall 12 of the wadding 4 is coated in the lubricant 18. In one example, the lubricant 18 has a flash point greater than 100 Celcius or, more preferably, 150 Celcius. The lubricant 18 is thereby prevented from burning off as a result of ignition of the propellant 5, allowing at least a portion of the lubricant to serve the advantages identified herein.

[0070] In one example, the lubricant 18 is a grease. A grease has the advantage of being relatively more viscous than a fluid lubricant when not subject to mechanical shear. In such examples, the wadding 4 is provided with a longer shelf-life as the grease more readily persists on the surface of the wadding 4, particularly where the wad-

ding 4 is made of a fibrous material. In one example, the lubricant 18 is a grease with a NLGI number of between 1 and 3. In one example, the NLGI number is 2. The NLGI number is a measure of consistency and, therefore, the stability of the lubricant at an ambient temperature (25 Celcius).

[0071] An example grease that accords with the requirements established herein is provided by Brit-Lube under their part number BL-10512. The identified grease is a chemically inert, high temperature silicone grease that is food safe. It will be appreciated that equivalent food safe greases or silicone greases may provide the advantages identified herein.

[0072] In some examples, the lubricant 18 may be applied to the exterior of the cylindrical wall 12 of the wadding 4 in an amount between 40 $\mu\text{g}/\text{mm}^2$ and 200 $\mu\text{g}/\text{mm}^2$. Preferably, the amount of lubricant 18 applied may be between 50 $\mu\text{g}/\text{mm}^2$ and 150 $\mu\text{g}/\text{mm}^2$. More preferably, the amount of lubricant 18 applied may be between 90 $\mu\text{g}/\text{mm}^2$ and 140 $\mu\text{g}/\text{mm}^2$. In such examples, the wadding 4 may be formed of a fibrous material such as paperboard and maintain the advantages set out herein. In such examples, the wadding 4 maintains the advantages set out herein irrespective of whether a grease or fluid lubricant 18 is used.

[0073] In one example, wadding 4 for a 0.410 shotgun cartridge is provided. The cylindrical wall 12 of the wadding 4 of the present example comprises an external surface area of about 1100mm² and is evenly loaded with 0.15g of grease, resulting in a lubricant loading of $136 \pm 10 \mu\text{g}/\text{mm}^2$. The wadding 4 of this example may be made of a fibrous material such as paperboard.

[0074] In another example, wadding 4 for a 10-bore shotgun cartridge is provided. The cylindrical wall 12 of the wadding 4 of the present example comprises an external surface area of about 2900mm² and is evenly loaded with 0.25g of grease, resulting in a lubricant loading of $86 \pm 10 \mu\text{g}/\text{mm}^2$. The wadding 4 of this example may be made of a fibrous material such as paperboard.

[0075] In the examples described herein, due to the lubricant 18 being provided on the exterior surface of the cylindrical wall 12 of the wadding 4, the lubricant 18 lubricates the exterior surface of the wadding 4 contacting the barrel when the cartridge 1 is discharged in use.

[0076] Providing the wadding 4 with lubricant 18 has a number of advantages. Two example advantages are: 1) Improved ballistic performance of the cartridge; and 2) reduced wear to the barrel of the gun, particularly when using steel shot or other relatively hard projectiles 3.

1) Improved ballistic performance:

[0077] Providing the wadding 4 with a lubricant 18 reduces the friction between the wadding 4 and the barrel of the gun through which it is discharged. As the wadding 4 travels down the barrel, the wadding 4 tends to remain in contact with the internal surface of the barrel over substantially the full length of the barrel. Reducing the friction

between the wadding 4 and the internal surface of the barrel significantly decreases the proportion of the propellant's 5 energy spent overcoming this friction, allowing a larger proportion of the energy to be converted to the kinetic energy of the projectile 3. This in turn allows the projectile 3 to retain more momentum down range for a better effect on target.

[0078] Practically speaking, in the case of shooting game, this retention of momentum increases the chance of a clean kill at ranges beyond that usually achieved for 'conventional' cartridges - that is to say, cartridges having wadding without lubricant 18. The coefficient of friction between the wadding 4 and the barrel using the lubricant 18 is between 0.09 and 0.19, depending on the metallurgy of the barrel. This is a significant improvement over wadding without lubricant, particularly traditional fibrous wad cups, which can have a coefficient of friction as high as 0.57.

2) Reduced wear to the gun barrel

[0079] Small amounts of the lubricant 18 will be deposited on the internal surface of the barrel by the wadding 4 following discharge of the cartridge. These deposits help to mitigate wear caused by the projectile 3 contacting the internal surface of the barrel by acting as a barrier between the projectile 3 and the barrel. This prevents direct contact of the projectile 3 and barrel as the projectile 3 traverses the barrel when fired, reducing the abrasive wear that would otherwise result.

[0080] Another wear mechanism associated with the use of conventional cartridges is the deposition of microscopic particles of projectile in the barrel between shots acting as an abrasive during subsequent shots. In particular, subsequently fired wadding adheres to these microscopic deposits and drags them down the barrel. This will cause gradual wear to the barrel and choke tubes as well as making shots less effective due to reduced velocity of the projectile caused by the increased friction between the wadding and the internal surface of the barrel. This is particularly problematic where steel shot is used due to its hardness and high abrasiveness. This wear mechanism is mitigated by the use of the lubricated wadding 4 described herein. The deposits of lubricant 18 that collect in the barrel when discharging the cartridge 1 act as a barrier to these abrasive particles to prevent their contact with the barrel. Furthermore, with each subsequent shot, the abrasive particles and deposits of lubricant 18 are wiped away by the transit of wadding 4 down the barrel and a fresh layer of lubricant 18 laid in its stead. Therefore, use of such a cartridge 1 negates the negative effects of such build-up of abrasive particles, particularly where steel shot and other hardened projectiles are used.

[0081] Furthermore, the wadding 4 described herein ensures that the cartridge can be used for the shooting of game which is to be sold to game dealers as the lubricant 18 is food grade and non-toxic and can thus be

present in the food chain.

[0082] Figure 2 illustrates a second shotgun cartridge 101 in cross section. Features of the second shotgun cartridge 101 which correspond with features of the first shotgun cartridge 1 are referred to with corresponding reference numerals but increased by 100.

[0083] The cartridge 101 comprises a casing 102 which houses a projectile 103, and a propellant 105. In contrast to the first cartridge 1, the second cartridge does not comprise a wadding 4, for example a wad cup. The casing 102 has a cylindrical wall 106 forming a tube that is closed at one end by a cap 107 containing a primer 108 and at the other by disc shaped lid 109 secured by an inwardly turned crimped end 110 of the cylindrical wall 106. A barrier 114 divides an interior of the casing 102 in two, separating the propellant 105 from the projectile 103 - the propellant 105 is provided adjacent the cap 107, while the projectile 103 is provided on the other side of the barrier 104. In some embodiments, the barrier may in some embodiments be a cylindrical plug which may in some embodiments have an outer diameter corresponding to, e.g. substantially the same as, a diameter of the cylindrical wall 106. The barrier 104 may be made from cork, plastic or a fibre-based material such as paper. In use, the shotgun cartridge 101 is loaded and fired in the conventional way. The primer 108 is set into the cap 107 and is configured to ignite the propellant 105 when contacted by a firing pin to discharge the projectile 103 down a barrel of a shotgun. The barrier 104 serves as a barrier between the projectile 103 and a nitro card 120, the nitro card 120 being provided between the barrier 104 and the propellant 105. The nitro card 120 is a thin treated disc of fire-resistant card that acts to prevent burning propellant 105 igniting the barrier 104.

[0084] The illustrated projectile 103 of the above-described example cartridge 101 comprises pellets 117 which may in some embodiments be steel pellets 117. The pellets 117 may in some embodiments be plated, such as metal plated, for example, in some embodiments, the pellets 117 may be copperplated or nickelplated, for example by electro-plating. In some embodiments the pellets 117 may for example be copperplated steel pellets 117. The pellets 117 are spherical for optimal flight characteristics. While steel pellets 117 are used in the illustrated example, other projectiles 103 may be swapped out as appropriate and depending on the intended use of the cartridge 101. For example, the pellets 117 may be formed from a metal or alloy other than steel. Slugs and flechettes are just two further unillustrated examples that will be familiar to the skilled person which could instead be used.

[0085] In the illustrated example, the projectile 103 comprises pellets 117 individually coated with a food grade fluid or grease lubricant provided on their external surface. Thus, the coating provides a layer of food grade fluid or grease lubricant covering an external surface of each pellet 117. The food grade grease lubricant may in some embodiments be a silicone grease. The food grade

grease lubricant may in some embodiments comprise PTFE. The food grade grease lubricant or PTFE may serve to reduce friction between the projectile 103 and the shotgun barrel.

[0086] The coating of food grade fluid or grease lubricant allows for the cartridge 101 to omit a wadding 4 as the lubricant coating substantially removes or at least reduces direct metal-to-metal contact between the pellets 117 (or other projectile 103 as may instead be used) and the shotgun barrel, thereby reducing wear to the shotgun barrel. Advantageously, the omission of a wadding allows for smaller caliber shotgun cartridges to be loaded with steel shot as more space is provided within the cartridges for a full shot load.

[0087] Furthermore, the coating of food grade fluid or grease lubricant reduces frictional losses in the shotgun barrel such that more kinetic energy is transferred to the projectile 103.

[0088] Furthermore, the coating of food grade fluid or grease inhibits rust and corrosion of the projectile 103 and, thus, where the projectile 103 comprises pellets 117, the pellets 117 are better able to spread apart after leaving the shotgun barrel. Furthermore, the coating of food grade fluid or grease allows for the pellets 117 to omit a metal plating, for example a copperplating or nickelplating, which has to date been used to reduce corrosion of steel pellets in particular, although providing metal plated pellets (such as metal plated steel pellets with a coating of the food grade fluid or grease lubricant) helps to further reduce corrosion of the pellets. A food grade fluid or grease lubricant coated pellet is also better for the environment than pellets coated with industrial corrosion inhibitors which have to date been used to inhibit corrosion of pellets because a food grade fluid or grease lubricant is less toxic when ingested by animals and humans.

[0089] The food grade fluid or grease lubricant may in some embodiments be provided on a majority of the external surface of each pellet or the lubricant may fully coat or cover or encapsulate each pellet. The coating of lubricant of each pellet may in some embodiments have a thickness of less than 2mm, such as less than 1mm, less than 0.5mm, less than 0.3mm, less than 0.2mm, less than 0.1mm, less than 0.05mm, or less than 0.01mm; or the coating may have a thickness defined by a range of any two of these values.

[0090] Details of manufacture of the cartridge 101 will be omitted for being within the purview of a skilled person presented with the projectile 103 according to the example described herein.

[0091] In one example, the projectile 103 (e.g. pellets 117) is coated in the food grade fluid or grease lubricant by rolling the projectile 103 in the lubricant, for example by rolling the projectile 103 across a surface provided with the lubricant, for example across a base surface of a tray or other container having a surface provided with the lubricant. For example, a roller, such as a rubber roller, may be applied to the projectile 103 to roll the projectile 103 in the lubricant and across the surface. In other em-

bodiments the projectile 103 (e.g. pellets 117) may be immersed in a vat of the lubricant and then removed from the vat so as to provide the coating.

[0092] In another example, the projectile 103 (e.g. pellets 117) may be placed in a rotatable container, or drum, containing the food grade fluid or grease lubricant and the container may then be rotated to cause the projectile 103 to move within the container and through the lubricant so as to become coated with the lubricant.

[0093] In one example, the food grade fluid or grease lubricant has a flash point greater than 100 Celcius or, more preferably, 150 Celcius. The lubricant is thereby prevented from burning off as a result of ignition of the propellant, allowing at least a portion of the lubricant to serve the advantages identified herein.

[0094] In one example, the lubricant is a food grade grease. A grease has the advantage of being relatively more viscous than a fluid lubricant when not subject to mechanical shear. In such examples, the projectile 103 (e.g. pellets 117) is provided with a longer shelf-life as the grease more readily persists on the surface of the projectile 103, particularly where the projectile 103 comprises steel pellets 117. In one example, the food grade grease lubricant is a grease with a NLGI number of between 1 and 3. In one example, the NLGI number is 2. The NLGI number is a measure of consistency and, therefore, the stability of the lubricant at an ambient temperature (25 Celcius).

[0095] An example grease that accords with the requirements established herein is provide by Brit-Lube under their part number BL-10512. The identified grease is a chemically inert, high temperature silicone grease that is food safe. It will be appreciated that equivalent food safe greases or silicone greases may provide the advantages identified herein.

[0096] In the examples described herein, due to the lubricant being provided as a coating on the exterior surface of the projectile 103 (e.g. pellets 117), the lubricant lubricates contact between the projectile 103 and the barrel when the cartridge 101 is discharged in use.

[0097] Providing projectile 103 (e.g. pellets 117) with a food grade fluid or grease lubricant coating has a number of advantages. Four example advantages are: 1) improved ballistic performance of the cartridge; 2) reduced wear to the barrel of the gun, particularly when using steel shot or other relatively hard projectiles; 3) allowing for smaller caliber cartridges to be loaded with steel shot; 4) reduced environmental and health impact; 5) addressing the problems associated with wad cups.

1) Improved ballistic performance:

[0098] Providing the projectile 103 with a food grade fluid or grease lubricant coating reduces the friction between the projectile 103 and the barrel of the gun through which it is discharged. Reducing the friction between the projectile 103 and the internal surface of the barrel decreases the proportion of the propellant's 105 energy

spent overcoming this friction, allowing a larger proportion of the energy to be converted to the kinetic energy of the projectile 103. This in turn allows the projectile 103 to retain more momentum down range for a better effect on target. Practically speaking, in the case of shooting game, this retention of momentum increases the chance of a clean kill at ranges beyond that usually achieved for 'conventional' cartridges - that is to say, cartridges having a projectile without a food grade fluid or grease lubricant coating.

[0099] Furthermore, the food grade fluid or grease coating inhibits rust and corrosion of the projectile 103 which, when the projectile 103 comprises pellets 117, allows for an improved distribution of the pellets 117 when fired from the gun barrel as rusty and corroded pellets 117 have a tendency to stick together.

2) Reduced wear to the gun barrel

[0100] The projectile having a coating of food grade fluid or grease lubricant removes direct metal-to-metal contact between the projectile 103 and the gun barrel and the lubricant serves as a barrier between the projectile 103 and the gun barrel. Furthermore, small amounts of the lubricant will be deposited on the internal surface of the barrel by the projectile 103 following discharge of the cartridge. These deposits further help to mitigate wear caused by the projectile 103 contacting the internal surface of the barrel by acting as a barrier between the projectile 3 and the barrel.

3) Allowing for smaller caliber cartridges to be loaded with steel shot

[0101] As projectiles 103 (e.g. pellets 117) having a food grade fluid or grease coating allows for the omission of the wad cup, smaller caliber cartridges are able to be loaded with a full load of steel shot as the omission of the wad cup allows for more internal space of the cartridge to be used for the shot.

4) Reduced environmental and health impact.

[0102] It is undesirable for rusted and corroded projectiles 103 such as pellets 117 to enter the food chain. Previously, steel-plated pellets 117 were coated in an industrial corrosion inhibitor in order to reduce corrosion of the pellets 17, however such inhibitors can cause environmental contamination and may be ingested by animals and humans. The present invention provides a safer and more environmentally-friendly way of reducing corrosion of the projectile 103 (e.g. pellets 117) as a food grade fluid or grease lubricant is less toxic than industrial corrosion inhibitors.

5) Addressing the problems associated with wad cups

[0103] The present invention also addresses the prob-

lems associated with wad cups, such as the need for wad cups to be biodegradable, the need for the wad cup to separate from the projectile after leaving the gun barrel, and the carbon footprint associated with manufacturing and transporting the wad cups, as the present invention allows for the wad cup to be omitted from the cartridge.

Claims

1. A shotgun cartridge comprising:

a casing; and
a projectile received within the casing, the projectile comprising a coating of a food grade fluid lubricant or a food grade grease lubricant.

2. The shotgun cartridge of claim 1, wherein the food grade fluid or food grade grease comprises PTFE.

3. The shotgun cartridge of claim 1 or 2, wherein the food grade grease lubricant is a silicone grease.

4. The shotgun cartridge of any preceding claim, wherein the projectile comprises pellets.

5. The shotgun cartridge of claim 4, wherein the pellets are metal plated.

6. The shotgun cartridge of any preceding claim, wherein the coating is configured to cover a majority of an external surface of the projectile.

7. The shotgun cartridge of any preceding claim, wherein the coating has a thickness of less than 2mm, such as less than 1mm, 0.5mm, 0.3mm, 0.2mm, 0.1mm, 0.05mm, or 0.01mm.

8. A process of treating a projectile for a shotgun cartridge, the process comprising: providing the projectile with a coating of a food grade fluid lubricant or a food grade grease lubricant.

9. The process of claim 8, wherein the step of providing the projectile with a coating comprises rolling the projectile in the lubricant.

10. The process of claim 8, wherein the step of providing the projectile with a coating comprises providing the lubricant and the projectile together in a rotatable container and rotating the container to cause the projectile to become coated with the lubricant.

11. The process of any one of claims 8 to 10, wherein the projectile is or comprises pellets.

12. A process of manufacturing a shotgun cartridge, the process comprising:

providing a projectile with a coating of a food grade fluid lubricant or a food grade grease lubricant; and
incorporating the projectile into a casing of the cartridge.

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- 13.** The process of claim 12, wherein the step of providing the projectile with a coating comprises rolling or immersing the projectile in the lubricant.

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- 14.** The process of claim 13, wherein the step of providing the projectile with a coating comprises providing the lubricant and the projectile together in a rotatable container and rotating the container to cause the projectile to become coated with the lubricant.

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- 15.** The process of any one of claims 12 to 14, wherein the projectile is or comprises pellets.

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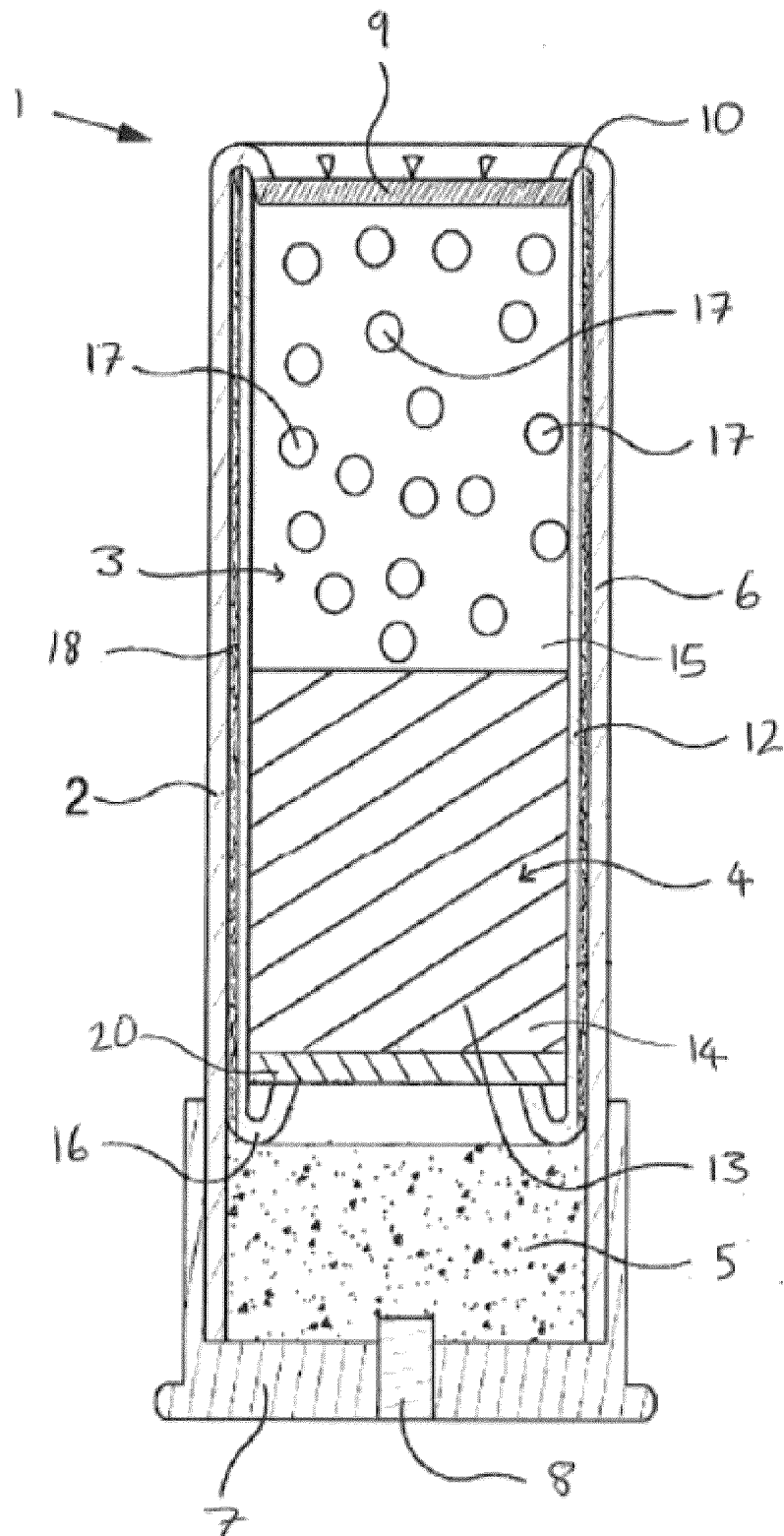


Fig. 1

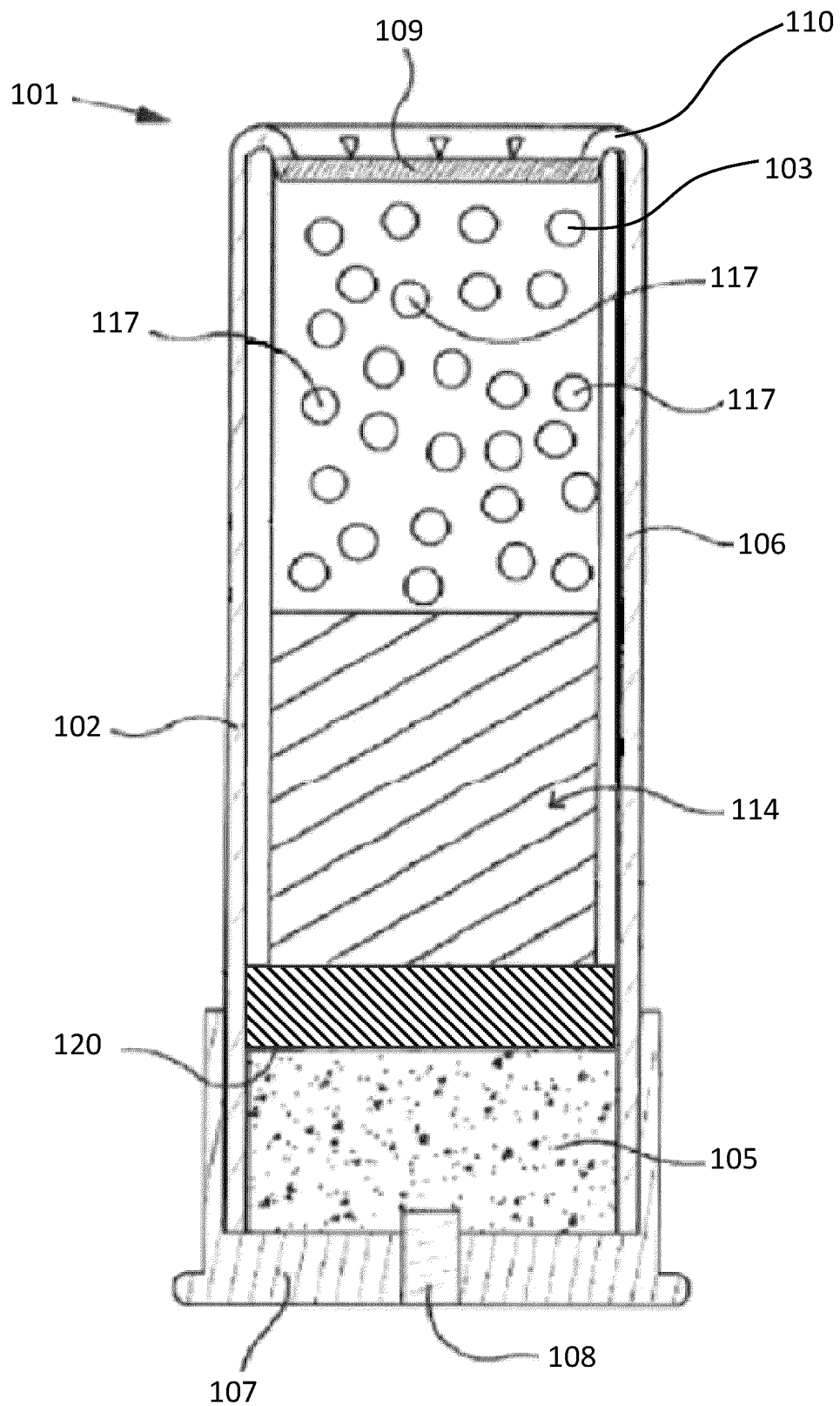


Fig. 2



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