MODULAR CASE AMMUNITION AND METHODS OF ASSEMBLY

Inventor: Vin Battaglia, Easton, CT (US)

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ABSTRACT

A hybrid ammunition cartridge for a firearm includes a substantially cylindrical casing defining a body portion having a neck at a forward end and a base at a rearward end, the base including a rim. A projectile is mounted in the neck. Brass is used in the casing at the neck to hold the projectile at the proper crimp. Brass is also used in the rim to house the primer and to provide a surface at which a hook or any suitable mechanism can be used to extract the cartridge from the firearm. The remaining body portion is then manufactured from a composite material having suitable mechanical properties.
Raw material cartridge case brass acquired

Constant elevation strip material formed

Skeleton casing manufacturing - folded primer pocket

Secondary machining - rim cut, primer hole, degrease - store as subcomponent

FIG. 3
Raw material cartridge case brass acquired

Determine elevation engineered strip material

Skeleton casing manufacturing - solid primer pocket

Secondary machining - rim cut, primer hole, degrease - store as subcomponent

FIG. 4
Skeleton casing held fast

Charge vessel presented to skeleton casing

Charge vessel urged into skeleton casing

Charge vessel is sized

FIG. 11
FIG. 12

- Pull Inventory: Skeleton Case Loaded Charge Vessel
- Simultaneous Puncture Blister gate via Flash Hole
- Dynamic Insertion
- Primer Installation
- Potential Bullet Insertion and final sizing
- Thermal Barrier/Waterproof Coating Application
- Live Ammunition
Pull Inventory: Direct Insert molded Vessel/Skeleton Case

104 Use directly in substitution of brass case into SCAMP line or traditional process

106 Thermal/Water Proof Coating

Live Ammunition

FIG. 14
MODULAR CASE AMMUNITION AND METHODS OF ASSEMBLY

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Patent Application No. 61/175,906, filed on May 6, 2009, the content of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present invention relates to ammunition and, more particularly, to ammunition that can be assembled in a modular fashion from separate components and methods for assembling such ammunition.

BACKGROUND OF THE INVENTION

[0003] Standard ammunition cartridges for firearms are typically unitary in construction with the structural components of the cartridge being made from metal. In general, the cartridge includes four sections, namely, a casing of a generally cylindrical shape and terminated at a rearward end by a rim, a propellant contained in the casing, a primer located at the rearward end, and a bullet or projectile frictionally held in a forward end of the casing. The casing is sized to a particular caliper, which closely approximates the diameter of the projectile and is less than the diameter of the bore defined by the barrel of the firearm through which the projectile moves. When the cartridge is in a firing chamber located at a rearward end of the bore, operating the firearm causes the primer to be ignited (e.g., via impact from a firing pin), which in turn ignites the propellant (usually gunpowder). Gases from the ignition of the gunpowder, when contained, increase the pressure within the casing and cause it to expand. As the casing expands, it seals against the wall resulting in a buildup of pressure in the casing. The built-up pressure causes the projectile to separate from the casing and travel through and out of the bore. The empty casing can then be removed from the chamber.

[0004] At present most small arms ammunition is manufactured with drawn brass casings. Brass generally allows for proper neck retention of the projectile, provides suitable elastic qualities, and has acceptable abrasion characteristics, thereby minimizing damage to the internal surfaces of the firearm.

[0005] One of the material properties of brass that makes it suitable for use in casings is its elasticity. During firing of the cartridge, large loads are imparted to the casing. The elasticity of the material of the casing allows the casing to quickly deform under pressure to provide a suitable seal in the firing chamber and then to quickly return to its original (or near original) condition. This quality, which is known as the “springback” of the casing, facilitates the extraction of the casing from the firing chamber. Without sufficient springback, the casing would plastically deform, thereby hindering or preventing extraction of empty casings.

[0006] Another desirable material property of brass is that it limits the cook off of cartridges. Cook off, also known as thermally-induced firing, occurs when the propellant is ignited due to heat in the surrounding environment. Cook off is especially limiting in automatic weapons, although semi-automatic weapons can also be affected. This is due at least in part to a final round being fed to the firing chamber after the trigger is released. The round will be “cooked off” if the temperature in the firing chamber, due to the firing cycle, is sufficiently high to cause the propellant to ignite. The use of brass as the casing material inhibits the amount of heat transferred from the firing chamber through the wall of the casing to the propellant, thus minimizing the opportunity for cook off to occur.

The brass casing in a standard cartridge typically comprises a substantial portion of the total weight of the cartridge. For example, in a standard 5.56 mm (NATO) cartridge, the brass accounts for about half of the total weight of the cartridge. Any reduction in the weight of the cartridge beyond the nominal weight would enable a person carrying large quantities of rounds to either be laden with less weight or to carry additional cartridges.

SUMMARY OF THE INVENTION

[0007] In one aspect, a hybrid ammunition cartridge for use in a firearm is disclosed herein. This hybrid ammunition cartridge includes a substantially cylindrical skeleton casing defining a body portion having a neck at a forward end and a base at a rearward end, the base including a rim. A projectile is mounted in the neck of the skeleton casing. A suitable material such as (but not limited to) brass is used in the skeleton casing at the neck to frictionally retain the projectile at the proper crimp. This suitable material can also be used in the rim to house the primer and to provide a surface at which a suitable mechanical properties, is located in the skeleton casing. The polymer weighs less than traditional cartridge materials such as brass, thereby resulting in a reduction in cartridge weight.

[0009] In another aspect, the present invention resides in a method for manufacturing a hybrid ammunition body. This method includes providing a skeleton casing formed from a first material, the skeleton casing defining an interior area and a first distal end portion adapted to frictionally receive a projectile. A charge vessel is also provided and is molded from a second material. The charge vessel is removably positioned in, and retained by the skeleton casing. A propellant is located in an interior area defined by the charge vessel.

[0010] In still another aspect, the present invention resides in a method of assembling live ammunition. The method includes the steps of retrieving a skeleton casing from a casing inventory; retrieving a charge vessel from a charge vessel inventory; inserting the charge vessel into the skeleton casing so that the charge vessel is retained therein, thereby providing an assembled skeleton casing and charge vessel. A primer is inserted into the assembled skeleton casing and charge vessel, and a thermal barrier and/or a waterproof coating is applied thereto.

[0011] In another aspect, the present invention resides in a hybrid ammunition cartridge. Such a cartridge includes a skeleton casing formed from a first material. The skeleton casing includes a base portion defining a pocket therein. A charge vessel formed from a second material is inserted into the skeleton casing. A propellant is located in the charge vessel, and a projectile is frictionally mounted in an end of the skeleton casing. The hybrid ammunition cartridge can be rendered live upon insertion of a primer, at least a portion of which is in communication with the propellant.

[0012] In another aspect, a method of manufacturing a hybrid ammunition body includes providing a skeleton cas-
ing formed from a first material, the skeleton casing defining an interior area. A charge vessel is molded into the interior area defined by the skeleton casing. The charge vessel is formed from a second material. A propellant is located in an interior area defined by the charge vessel, and a projectile is positioned in and frictionally retained by a first distal end portion of the skeleton casing.

[0013] In yet another aspect, the present invention resides in an ammunition body including a skeleton casing formed from a first material, the skeleton casing defining an interior area. A charge vessel is formed from a second material, the charge vessel being positioned in the interior area defined by the skeleton casing. A propellant is located in the charge vessel. The skeleton casing also includes a first distal end portion defining a pocket therein adapted to receive a primer.

[0014] In another aspect, the present invention resides in a hybrid ammunition cartridge including a skeleton casing formed from a first material and having a base portion defining a pocket therein. A charge vessel is formed from a second material molded directly into the skeleton casing. A propellant is located in the charge vessel, and a projectile is frictionally mounted in the skeleton casing. The hybrid ammunition cartridge can be rendered live upon insertion of a primer, at least a portion of which is in communication with the propellant.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. 1 is a perspective view of a modular cartridge of the present invention.

[0016] FIG. 2 is a sectional view of the modular cartridge of FIG. 1.

[0017] FIG. 3 is a flow chart illustrating a first method of forming a skeleton casing of a modular cartridge of the present invention.

[0018] FIG. 4 is a flow chart illustrating a second method of forming a skeleton casing of a modular cartridge of the present invention.

[0019] FIG. 5 is a side sectional view of a skeleton casing of a modular cartridge made by the method of FIG. 3.

[0020] FIG. 6 is a top sectional view of the skeleton casing of the modular cartridge made by the method of FIG. 3.

[0021] FIG. 7 is a side sectional view of a skeleton casing of a modular cartridge made by the method of FIG. 4.

[0022] FIG. 8 is a top sectional view of the skeleton casing of the modular cartridge made by the method of FIG. 4.

[0023] FIG. 9 is a perspective view of a charge vessel.

[0024] FIG. 10 is a schematic representation of a dynamic insertion process of the present invention.

[0025] FIG. 11 is a flow chart illustrating a process of dynamically inserting a charge vessel into a skeleton casing.

[0026] FIG. 12 is a flow chart illustrating a first method of assembling live ammunition.

[0027] FIG. 13 is a schematic representation of a press used in a direct molding process of assembling a modular cartridge of the present invention.

[0028] FIG. 14 is a flow chart illustrating a second method of assembling live ammunition.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0029] Referring to FIGS. 1 and 2, a modular cartridge for use in a firearm is shown generally at 10 and comprises a skeleton casing 12 and a charge vessel 14 located in an interior area defined by the skeleton casing. A projectile 16 is mounted (e.g., frictionally) in a neck 18 at a forward end of the skeleton casing. The skeleton casing 12 includes a base 20 having a rim 22 that defines a primer pocket 26. A primer is positioned in the primer pocket 26 for igniting a propellant carried in the charge vessel 14.

[0030] As shown in FIG. 2, the skeleton casing 12 defines a channel 27 via which the primer positioned in the primer pocket 26 is in communication with the charge vessel 14.

[0031] As illustrated in FIG. 3, the skeleton casing 12 may be formed from a suitable material such as, but not limited to, brass via a metal stamping operation 30 in which a flat blank is taken from a continuous coil and separated into two target portions for the neck and rim, each portion being separately drawn and extruded into the form of the skeleton casing. In this operation 30, raw material is obtained in an acquisition step 32. If not already done so, the raw material is cut or otherwise formed into strips and manipulated in a formation step (if necessary) to have a uniform thickness or elevation. The skeleton casing 12 is then formed in a manufacturing step 36 in which the strips are folded to define the primer pocket 26. A secondary step 38 is then performed in which the rim 22 is machined, any desired cutting is performed, and the channel 27 extending from the primer pocket 26 to the interior of the skeleton casing 12 is formed. Degreasing operations may also be performed.

[0032] In another embodiment as is shown in FIG. 4, the skeleton casing 12 may be formed via a multi-elevation stamping operation 40 from a multi-elevation strip wherein the material at one end of the strip is thicker than the material at the other end and in which the difference in elevation is either a constant taper or a flat-taper-flat configuration. In this operation 40, raw material is obtained in an acquisition step 32. If not already done so, the raw material is then cut or otherwise formed into strips that are thicker (more elevation) at one end than the other in an engineering step 42. Each manner of engineering the raw material is via the use of a planish mill. Subsequent to the engineering step 42, a manufacturing step 44 is carried out in which a skeleton casing 12 having a solid primer pocket 26 is formed. After the manufacturing step 44, a secondary step 46 is then performed in which the rim 22 is machined, any desired cutting is performed, and a channel extending from the primer pocket 26 to the interior of the skeleton casing 12 is formed. Degreasing operations may also be performed.

[0033] Referring now to FIGS. 5 and 6, the skeleton casing 12 manufactured using the metal stamping operation 30 is a substantially cylindrical member defined by a wall 48 and has two elongated openings 50 extending lengthwise along generally opposing sides of the cylindrical member and in the wall intermediate the neck 18 and the base 20. The peripheral edge of the rearward surface of the base 20 forms the rim 22. As can be seen in FIG. 6, an interior surface of the wall 48 is tapered such that the wall is thicker at the rearward end and thinner at the forward end. The degree of taper is determined by the particular manufacturing process. In this embodiment, the material used to fabricate the skeleton casing 12 is folded via the manufacturing step 36 to define the primer pocket 26.

[0034] As can be best seen in FIG. 5, the edges 52 of each opening intermediate the forward and rearward ends of the skeleton casing 12 define strap arm portions 56 that connect the neck 18 and the base 20. Each strap arm portion 56 defines a slight "S" bend that improves flexing of the skeleton casing 12 and facilitates the insertion of the charge vessel 14. Also,
the “S” bends of the strap arm portions 56 allow for the provision of additional length or stretch, which increases the amount of allowable interference between the skeleton casing 12 and the charge vessel 14. In any embodiment, the openings 50 allow a substantial amount of material to be removed from the casing, thereby reducing the weight of the casing.

[0035] Referring now to FIGS. 7 and 8, the skeletal casing 12 manufactured from the multi-elevation strip of the multi-elevation stamping operation 40 comprises a substantially cylindrical member also having two elongated openings 50. In this embodiment, however, the material used to fabricate the skeletal casing 12 is tooled accordingly to provide a solid primer pocket 26 (no folded material). The skeletal casing 12 of this second embodiment provides a hardness gradient having a value that is greater than the skeletal casing of the folded embodiment. Furthermore, material used to manufacture this skeletal casing 12 has a split elevation, is taper planed, rolled, or otherwise manipulated to provide for the multiple thicknesses or elevations in the material.

[0036] As can be seen in FIG. 7, the edges 52 of each opening 50 again define strap arm portions 56 that connect a neck 18 and a base 20, as with the embodiment of FIGS. 5 and 6. Again, the strap arm portions 56 are configured to define slight “S” bends to facilitate several factors in the manufacturing process.

[0037] In either of the above-described methods of forming the skeletal casing 12, the primer pocket 26 in the base 20 of the skeletal casing allows the primer to be press fit into the primer pocket. The present invention is not limited in this regard, however, as other configurations are within the scope of the present invention. The specific types of the other configurations depend upon the actual hardness of the material in the area of the primer pocket 26 and whether extrusion process can reliably retain a standard press fit type of primer. If such a primer cannot be reliably retained, an alternate construction may be used (for example, the primer may be mechanically fastened or the press fit type of primer may be augmented using mechanical fasteners). Furthermore, in order to afford a margin of safety and to accommodate the logistics of handling and transportation of the materials used in construction, the primer configuration may be otherwise changed in consideration of the manufacturing process such that the cartridge 10 is not “live” until the primer is inserted.

[0038] The projectile 16 can be of any suitable configuration (for example, hollow point, armor piercing, tracer, and the like). The neck 18 in which the projectile 16 is mounted is appropriately sized. One advantage of providing the neck 18 of the cartridge 10 as described herein is that projectile retention values commensurate with current practice can be achieved to yield ballistics data that is equivalent or superior to ballistics data of non-modular cartridges.

[0039] The areas proximate the neck 18 and the base 20 are connected via strap arm portions 56. The areas at which the strap arm portions 56 connect to the neck area and base area define points of articulation for the rotation of the neck 18 and base 20 about the common centerline C. The present invention is not limited to the specific configuration as shown, as the strap arm portions 56 are modifiable to facilitate any articulate rotation of the neck 18 and base 20 that is desired for a specific design of the cartridge 10.

[0040] Referring now to FIG. 9, the charge vessel 14, which is located in the skeleton casing 12, can be manufactured via a stand alone molding process. After being molded, the charge vessel 14 is charged with the propellant, purged of any air, sealed with foil, and stored as a component for incorporation into the skeleton casing 12. In the alternative, the charge vessel 14 can be insert-molded directly into the skeleton casing 12. In this embodiment, any flashing is removed from the charge vessel 14, a thermal waterproof coating can be applied, and the assembled charge vessel and skeleton casing 12 are stored as a component. The stand alone molding process of molding the charge vessel 14 is preferable for a method of assembling the modular cartridge 10 of the present invention using dynamic insertion techniques (in which the charge vessel is dynamically inserted into the skeleton casing 12 after being molded). For at least the dynamic insertion method, the charge vessel 14 can be molded using the stand alone molding process in a basic single cavity mold, and the inside shape of the charge vessel can be designed to increase the velocity of the projectile 16 upon firing.

[0041] At least in the dynamic insertion methods of the present invention, the charge vessel 14 is molded from a polymer and holds a desired mass of propellant depending on the type and size of the finished cartridge 10. The weight savings of the modular ammunition of the present invention is attributed at least in part to the density of the polymer used. The polymer selected is considered in view of the characteristics of the final product, such characteristics including mold shrinkage factors and the like. One polymer found to be suitable is a polyphenylsulfone sold as RADEL R-5000, which is available from Solvay Advanced Polymers, L.L.C., of Alpharetta, Ga.

[0042] Referring now to FIG. 10, the charge vessel 14 can be dynamically inserted into the skeleton casing 12. The charge vessel 14 may include a molded blister gate 62 on the rearward end thereof to receive the primer. The outer surfaces of the charge vessel 14 may be relatively smooth, or they may include contours and reliefs or the like to comport with the inner surfaces of the skeleton casing 12 such that after insertion of the charge vessel into the skeleton casing, the contours and reliefs provide a substantially flush outer diameter to the cartridge. The flush outer diameter of the cartridge 10 may facilitate belt feeding of the cartridges and may also ensure efficient extraction of the cartridge during a firing cycle.

[0043] Referring now to FIGS. 10 and 11, a process outlining the dynamic method of inserting the charge vessel 14 into the skeleton casing 12 is shown generally at 70 in FIG. 11 and is hereinafter referred to as “process 70.” In general, the skeletal casing 12 is securely retained, and the charge vessel 14 is presented to the skeleton casing through one of the openings between the strap arm portions 56 in the direction of an arrow 64 (FIG. 10). The charge vessel is compressed, and the skeleton casing 12 is moved to allow the charge vessel to “slide into” the skeleton casing. An interference fit is thereby created to capture the charge vessel 14 in the skeleton casing 12. This differs from conventional ammunition manufacturing practice in that with the above-described components, components of an individual cartridge can be manufactured at different times and/or in different locations, stored (if desired), and assembled as desired (for example, in a just-in-time scenario).

[0044] In process 70, the charge vessel 14 is presented to the skeleton casing 12 in a suitable orientation via tooling and various fixtures. The rim 22 of the base 20 is held fast using a collet. The start point of insertion occurs when the charge vessel 14 makes contact with the skeleton casing 12, which is likely to be proximate the area where the strap arm portions 56 meet the neck 18. The charge vessel 14 is urged into the
skeleton casing 12 and downward at an angle until the charge vessel is seated in the skeleton casing.

[0045] The seated charge vessel 14 is sized with a die in a sizing step. In this sizing step, the edges of the strap arm portions 56 are radiused, which thereby traps the charge vessel 14 within the skeleton casing 12. At this time, the charge vessel 14 carries the propellant, with the propellant being dispensed to the charge vessel prior to its insertion into the skeleton casing 12 and being retained therein via the blister gate in the primer pocket region. After being purged of air and the blister gate being put into place, a foil member is ultrasonically welded over the primer pocket. By doing so, the charge vessel 14 is effectively sealed, thereby allowing for an extended shelf life.

[0046] After being sized, the assembled casing 12 and charge vessel 14 could remain as a subcomponent without a projectile and/or without a primer. By allowing the cartridge 10 to remain in this semi-completed state, beneficial features in integration and logistics can be realized. In particular, the type of projectile can be changed to accommodate last-minute changes in the desired use. Also, semi-completed cartridges can be more easily shipped and stored due to their lighter weight and reduced volume. The final assembly can occur when the projectile and/or the primer are fitted to the charge vessel/skeleton casing subassembly. Additionally, the just-in-time aspect of subcomponent assembly has distinct advantages, particularly with regard to the life of ammunition and the costs of demilling live ammunition that does not pass proof testing (the deliberate over-pressuring of ammunition to verify that the ammunition will not explode in an unexpected manner upon firing). With JIT manufacturing, as much as about 80% of the costs associated with demilling live ammunition can be eliminated.

[0047] Referring now to FIG. 12, a system for the assembly of live ammunition is shown generally at 80 and is hereinafter referred to as “system 80.” System 80 uses JIT principles and fragments the manufacturing process and distributes portions to various parties, thereby allowing for simultaneous subcomponent building.

[0048] In the system 80, inventory is pulled in a pulling step 82. In the pulling step 82, the skeleton casings 12 and the loaded charge vessels 14 are retrieved from storage or otherwise obtained. Three additional steps can then be undertaken, either simultaneously or sequentially. These three steps include a step of puncturing the blister gate 84, the process 70 of inserting the charge vessel 14 into the skeleton casing 12, and the step of inserting the projectile and final sizing 86.

[0049] After the process 70 of inserting the charge vessel 14 into the skeleton casing 12, a primer installation step 88 is undertaken. Subsequent to the primer installation, a coating step 90 is carried out in which a thermal barrier and/or waterproof coating is applied to the primer pocket. This coating step 90 may include or may be ancillary to the placing of the foil member over the primer pocket. Once completed, the ammunition is live.

[0050] The system 80 depicted is a process that is truncated and/or which includes separate independent processes. As such, the need for a large, unitary manufacturing facility is avoided in favor of smaller, separate operations, many of which may be carried out by diverse private entities. Also, production can be streamlined and a minimum of 50% of demill operations for destroying ammunition that fails proof testing can be avoided.

[0051] The present invention is not limited to the use of a dynamic insertion method of inserting a charge vessel 14 into a skeleton casing 12 (as is shown in process 70 of FIG. 11), as the cartridge 10 can be manufactured by molding the charge vessel into the skeleton casing. More specifically, the charge vessel 14 may be insert molded directly into the skeleton casing 12, thereby circumventing the dynamic insertion method as described above. One advantage of an insert molding process is that an existing ammunition production line could be used. Any insert molding process generally involves providing a suitable polymer and using a process of extrusion, blow molding, vacuum forming, compression molding, and/or injection molding to dispose the charge vessel into the skeleton casing. The present invention is not limited to any of the foregoing techniques, as other methods, combinations, and variations thereof are within the scope of the present disclosure.

[0052] One embodiment of an insert molding process utilizes a press 90 as is shown in FIG. 13. The press 90 employs a machine cycle to produce the cartridges 10.

[0053] The machine cycle utilizing this press 90 would allow the skeleton casing to be placed in the mold and the charge vessel to be molded into the skeleton casing. The charge vessel would then be filled with the suitable propellant.

[0054] Referring now to FIG. 14, a system for the assembly of live ammunition is shown generally at 100 and is hereinafter referred to as “system 100.” System 100 is a system of enhancing traditional ammunition with weight savings and potential cost savings. It integrates easily into existing SCAMP or other processes and may also solve problems indicative of other systems in a more efficient fashion.

[0055] In the system 100, inventory is pulled in a pulling step 102. In the pulling step 82, the skeleton casings 12 and the loaded charge vessels 14 are retrieved from storage or otherwise obtained. The skeleton casings 12 and the loaded charge vessels 14 are then used in a step 104 in which they are substituted for brass casings in a SCAMP line or other process. A coating step 106 is carried out in which a thermal barrier and/or waterproof coating is applied to the primer pocket. Once completed, the ammunition is live.

[0056] Although this invention has been shown and described with respect to the detailed embodiments thereof, it will be understood by those of skill in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiments disclosed in the above detailed description, but that the invention will include all embodiments falling within the scope of the appended claims.

1. A method of manufacturing a hybrid ammunition body, said method comprising:
   providing a casing formed from a first material, said casing defining an interior area;
   providing a charge vessel formed from a second material; providing a propellant in an interior area defined by said charge vessel; and
   inserting said charge vessel into said casing; wherein said casing defines a first distal end portion adapted to receive a projectile; and
wherein said charge vessel is removably retained in said casing.

2. The method of claim 1, wherein said first material is metal and said step of providing said casing includes forming said casing, at least in part, by drawing and extruding said metal.

3. The method of claim 1, wherein said casing defines a second distal end portion opposite said first distal end portion, said second distal end portion defining a pocket adapted to receive a primer, said casing further defining a channel extending into said interior area.

4. The method of claim 3, further comprising hermetically sealing said channel.

5. The method of claim 3, further comprising inserting a primer in said pocket.

6. The method of claim 3, wherein said first material is metal, wherein said step of providing said casing further includes forming said casing, at least in part, by drawing and extruding said metal, and wherein said pocket is formed by folding a portion of said second distal end into said interior area.

7. The method of claim 1, wherein said first material is brass and said second material is a polymer.

8. The method of claim 3, wherein said first distal end portion and said second distal end portion are joined by at least two strips extending therebetween.

9. The method of claim 8, wherein at least two strips define at least two openings therebetween.

10. The method of claim 1, wherein said step of inserting said charge vessel into said casing includes: holding said casing using a fixture, presenting said charge vessel to an opening defined by said casing, urging said charge vessel into said opening, and compressing said charge vessel into said casing to seat said charge vessel in said casing.

11. The method of claim 10, further comprising inserting a projectile into said casing.

12. A method of assembling live ammunition, said method comprising the steps of:

   retrieving a casing from a casing inventory;

   retrieving a charge vessel from a charge vessel inventory;

   inserting said charge vessel directly into said casing to provide an assembled casing and charge vessel;

   inserting a primer into said assembled casing and charge vessel;

   and

   applying at least one of a thermal barrier and a waterproof coating to said assembled casing and charge vessel.

13. The method of claim 12, further comprising puncturing said charge vessel to cause said primer to be in communication with a propellant in said charge vessel.

14. The method of claim 13, wherein said step of puncturing said charge vessel comprises puncturing a blister gate.

15. The method of claim 12, further comprising inserting a projectile into said assembled casing and charge vessel.

16. The method of claim 12, further comprising sizing said assembled casing and charge vessel to cause an outer surface of said charge vessel to be flush with an outer surface of said casing.

17. A hybrid ammunition cartridge, comprising:

   a casing formed from a first material and having a base portion defining a pocket therein;

   a charge vessel formed from a second material inserted directly into said casing.

   a propellant located in said charge vessel; and

   a projectile mounted in said casing;

   wherein said hybrid ammunition cartridge can be rendered live upon an insertion of a primer in communication with said propellant.

18. The hybrid ammunition cartridge of claim 17, wherein at least a portion of said charge vessel is exposed through at least a portion of said casing.

19. The hybrid ammunition cartridge of claim 18, wherein said casing comprises said base portion, at least two strips extending from said base portion, and a neck attached to said at least two strips.

20. The hybrid ammunition cartridge of claim 19, wherein said casing includes a hardness gradient along a length thereof.

21. The hybrid ammunition cartridge of claim 20, wherein said hybrid ammunition cartridge includes a material of said base portion of said casing is defined in part by a particular hardness value.

22. The hybrid ammunition cartridge of claim 20, wherein a material of said casing intermediate said base portion and said neck is defined in part by a particular hardness value.

23. The hybrid ammunition cartridge of claim 20, wherein a material of said neck is defined in part by a particular hardness value.

24. The hybrid ammunition cartridge of claim 17, wherein said base portion includes a rim extending peripherally around said base portion.

25. The hybrid ammunition cartridge of claim 17, wherein said first material of said casing is a metal.

26. The hybrid ammunition cartridge of claim 17, wherein said second material of said charge vessel comprises a polymer material.

27. The hybrid ammunition cartridge of claim 26, wherein said polymer material is selected from the group consisting of polyphenylene sulfone, polystyrene, polypropylene, acrylonitrile butadiene styrene, polyvinyl chloride, polyethylene, polyester terephthalate, polymethylmethacrylate, polyamide, styrene-acrylonitrile, and combinations of the foregoing materials.

28. A method of manufacturing a hybrid ammunition body, said method comprising:

   providing a casing formed from a first material, said casing defining an interior area;

   molding a charge vessel into said interior area defined by said casing, said charge vessel being formed from a second material; and

   providing a propellant in an interior area defined by said charge vessel;

   wherein said casing defines a first distal end portion adapted to receive a projectile.

29. The method of claim 28, wherein said first material is metal and said step of providing said casing includes forming said casing, at least in part, by drawing and extruding said metal.

30. The method of claim 28, wherein said casing defines a second distal end portion opposite said first distal end portion, said second distal end portion defining a pocket adapted to receive a primer, said casing further defining a channel extending from said pocket into said interior area.

31. The method of claim 30, further comprising hermetically sealing said channel.

32. The method of claim 30, further comprising inserting a primer in said pocket.
33. The method of claim 30, wherein said first material is metal, wherein said step of providing said casing further includes forming said casing, at least in part, by drawing and extruding said metal, and wherein said pocket is formed by folding a portion of said second distal end into said interior area.

34. The method of claim 28, wherein said first material is brass and said second material is a polymer.

35. The method of claim 30, wherein said first distal end portion and said second distal end portion are joined by at least two strips extending therebetween.

36. The method of claim 35, wherein said at least two strips define at least two openings therebetween.

37. The method of claim 28, wherein said step of molding said charge vessel includes:

- providing a mold defining a mold cavity therein,
- positioning said casing in said mold cavity, said casing defining an open neck portion, said core being inserted through said open neck portion, said core and an inner surface of said mold cavity cooperating to define a void therebetween,
- disposing a polymer in said void, upon said polymer being cured, removing said core, and removing said ammunition body from said mold.

38. The method of claim 37, wherein said step of disposing said polymer in said void comprises vacuum forming softened polymer around said core.

39. The method of claim 37, wherein said step of disposing said polymer in said void comprises injection molding said polymer around said core.

40. The method of claim 28, wherein said step of molding said charge vessel comprises blow molding said charge vessel.

41. The method of claim 28, wherein said step of molding said charge vessel comprises compression molding said charge vessel.

42. The method of claim 28, wherein said step of molding said charge vessel comprises vacuum forming said charge vessel.

43. An ammunition body, comprising:

- a casing formed from a first material, said casing defining an interior area;
- a charge vessel formed from a second material, said charge vessel being positioned in said interior area defined by said casing;
- a propellant located in said interior area defined by said charge vessel; and wherein said casing includes a first distal end portion defining a pocket therein adapted to receive a primer.

44. The ammunition body of claim 43, wherein said casing defines a channel extending from said pocket into said interior area.

45. The ammunition body of claim 43, wherein said charge vessel includes a blister gate in communication with said channel.

46. The ammunition body of claim 43, further comprising a primer located in said pocket.

47. The ammunition body of claim 46, further comprising a hermetic seal on said primer.

48. The ammunition body of claim 43, wherein said casing includes a second distal end portion generally opposite said first distal end portion, and wherein said casing includes at least two strips extending between said first and second distal ends, at least two openings in said casing being located between said first and second strips.

49. The ammunition body of claim 43, further comprising a rim machined into said base portion of said casing.

50. The ammunition body of claim 43, wherein outer surfaces of said casing and said charge vessel are flush with each other.

51. The ammunition body of claim 43, wherein said first material is metal and said second material is a polymer.

52. A hybrid ammunition cartridge, comprising:

- a casing formed from a first material and having a base portion defining a pocket therein;
- a charge vessel formed from a second material molded directly into said casing, a propellant located in said charge vessel; and a projectile mounted in said casing;
- wherein said hybrid ammunition cartridge can be rendered live upon an insertion of a primer in communication with said propellant.

53. The hybrid ammunition cartridge of claim 52, wherein at least a portion of said charge vessel is exposed through at least a portion of said casing.

54. The hybrid ammunition cartridge of claim 53, wherein said casing comprises said base portion, at least two strips extending from said base portion, and a neck attached to said at least two strips.

55. The hybrid ammunition cartridge of claim 54, wherein said casing includes a hardness gradient along a length thereof.

56. The hybrid ammunition cartridge of claim 55, wherein a material of said base portion of said casing is defined in part by a particular hardness value.

57. The hybrid ammunition cartridge of claim 55, wherein a material of said casing intermediate said base portion and said neck is defined in part by a particular hardness value.

58. The hybrid ammunition cartridge of claim 55, wherein a material of said neck is defined in part by a particular hardness value.

59. The hybrid ammunition cartridge of claim 52, wherein said base portion includes a rim extending peripherally around said base portion.

60. The hybrid ammunition cartridge of claim 52, wherein said first material of said casing is metal.

61. The hybrid ammunition cartridge of claim 52, wherein said second material of said charge vessel comprises polymer.

62. The hybrid ammunition cartridge of claim 61, wherein said polymer material is selected from the group consisting of polyphenylsulfone, polystyrene, polypropylene, acrylonitrile butadiene styrene, polyvinyl chloride, polyethylene, polyesters terephthalate, polymethylmethacrylate, polyanhydride, styrene-acrylonitrile, and combinations of the foregoing materials.