C L A I M S

What is claimed is:

1. A cartridge munition comprising a cartridge case and a projectile inserted into the cartridge case and mechanically connected thereto, wherein a propellant charge is disposed in a propulsion chamber of the cartridge case that is ignited by means of an igniter or primer and whose propulsive gases exert a force on the base of the projectile when they burn causing the projectile to be driven out of the cartridge case, and wherein at least one passage exits from the propulsion chamber through the cartridge case that is substantially filled with (1) a fusible, solid, pressure-tight material whose melting temperature is lower than the ignition temperatures of the pyrotechnic igniter and the propellant charge of the projectile, and (2) at least one non-fusible, ruptureable insensitive munition ("IM") plug member positioned between the fusible, solid, pressure-tight material and the propellant charge to provide additional structural integrity to the cartridge case.

2. The cartridge munition of claim 1, wherein the fusible solid material is at least one of a fusible metal and a polymer.

3. The cartridge munition of claim 1, wherein the fusible solid material is a fusible metal consisting of an alloy of at least bismuth and tin and bismuth and lead.

4. The cartridge munition of claim 3, wherein the fusible metal is a bismuth/tin alloy with from about 30 to about 40 % by weight of bismuth and from about 60 to about 70 % by weight of tin, having a melting point of about 140°C.

5. The cartridge munition of claim 2, wherein the fusible solid material is a polymer which has a melting point of about 140°C.

6. The cartridge munition of claim 1, wherein the passages are channels that extend from the base of the propulsion chamber to the outer base of the cartridge case.

7. The cartridge munition of claim 6, wherein the channels are positioned around the primer (or igniter) of the propulsive charge allowing for physical separation of the primer from the propellant.

8. The cartridge munition of claim 6, wherein the channels narrow as they progress from the base of the propulsion chamber to the outer base of the cartridge case.

9. The cartridge munition of claim 1, wherein the IM plug member is a disk or cap.

10. The cartridge munition of claim 1, wherein the IM plug member forms an annular ring.

11. The cartridge munition of claim 1, wherein the IM plug member is scored or weakened.

12. The cartridge munition of claim 1, wherein the IM plug member is made of at least one of a metal and a rigid polymeric material.

13. The cartridge munition of claim 12, wherein the IM plug member is made of a metal consisting of at least one of copper, steel, stainless steel, aluminum, and brass.

14. The cartridge munition of claim 12, wherein the IM plug member is made of polymeric material consisting of at least one of a polycarbonate and polystyrene polymer or copolymer thereof.

15. The cartridge munition of claim 1, wherein at least one of the passages exits from the propulsion chamber through a base (sidewall) of the cartridge case.

16. The cartridge munition of claim 1, wherein the IM plug member comprises a solid material with sufficient strength to sustain structural integrity through normal operating pressures of a feeding, firing, extraction and ejection cycle.

17. The cartridge munition of claim 1, wherein the IM plug member is so configured that, when heated during firing and undergoing extraction and ejection, it does not disintegrate in a manner that could foul a weapon or make the weapon difficult to clean.

18. The cartridge munition of claim 1, wherein the strength of the IM plug member is weakened at higher temperatures to allow for venting.

19. The cartridge munition of claim 1, wherein the IM plug member comprises a solid material that has been modified and configured to retain structural integrity during normal operating pressures in the absence of additional mechanical support.

20. The cartridge munition of claim 1, wherein the IM plug member is made from the cartridge case material by incomplete penetration of at least one passage through the cartridge case.

21. The cartridge munition of claim 1, wherein each passage is filled with a pressure-tight assembly comprising an IM plug member formed of a solid, non-fusible rupture disk or cap that is mechanically reinforced by a fusible, solid material whose melting temperature is lower than the ignition temperature of the pyrotechnic igniter and the propulsive charge of the projectile.

22. The cartridge munition of claim 18, wherein the pressure-tight assembly is removable by threaded or other mechanical means.

23. The cartridge munition of claim 1, wherein heat flow is directed around the IM plug member by a metal shield having low heat transmission properties, thereby to provide for delayed weakening of the IM plug member while the munition is retained in a hot barrel.

24. The cartridge munition of claim 23, wherein the metal shield is made at least in part of zirconium.

25. A cartridge munition comprising, in combination:

(a) a cartridge case having a base and an upper portion forming a propulsion chamber;

(b) a projectile having a base inserted into the upper portion of the cartridge case and mechanically connected thereto;

(c) a pyrotechnic propellant charge disposed in the propulsion chamber of the cartridge case whose propulsive gases exert a force on the base of the projectile when they burn causing the projectile to be driven out of the cartridge case; and

(d) a pyrotechnic igniter or primer disposed in the base of the cartridge case for igniting the propellant charge;

the improvement wherein said cartridge munition includes a pressure release device for venting propulsive gases from the propulsion chamber of the cartridge case if an elevated ambient temperature, lower than the ignition temperature of the igniter and the propulsive charge, presents a risk of self-ignition, said pressure release device having means for retaining the igniter in the base of the cartridge case and for releasing the igniter thereby leaving an opening the base of the cartridge case when it reaches said elevated temperature, said retaining and releasing means including a retaining ring made of shape memory material that surrounds the igniter and which changes its diameter upon reaching said elevated temperature, thereby enabling

separation of the igniter from the base of the cartridge case.

26. The cartridge munition of claim 25, wherein heat flow is directed around the pressure release device by a metal shield having low heat transmission properties, thereby to provide for delayed separation of the igniter while the munition is retained in a hot barrel.

27. The cartridge munition of claim 26, wherein the metal shield is made at least in part of zirconium.

28. The cartridge munition of claim 25, wherein said retaining ring reduces its diameter upon reaching said elevated temperature.

29. The cartridge munition of claim 25, wherein said retaining ring increases its diameter upon reaching said elevated temperature.

30. The cartridge munition of claim 25, wherein said pressure release system further comprises an igniter or primer support surrounding and holding the primer or igniter, and wherein said retaining ring surrounds and retains the igniter support in the base of said cartridge case and releases said igniter support upon reaching said elevated temperature.

31. The cartridge munition of claim 25, wherein said retaining ring is supported, at least in part, in the base

of the cartridge case by a fusible, solid material whose melting temperature is lower than the ignition temperature of the igniter and the propulsive charge.

32. The cartridge munition of claim 25, wherein said pressure release system further includes at least one ring-shaped nut having external threads configured to engage with internal threads in the base of the cartridge case, said ring-shaped nut being adapted to fix said retaining ring in said base.

33. A cartridge munition comprising a cartridge case and a projectile inserted into the cartridge case and mechanically connected thereto, wherein a propellant charge is disposed in a propulsion chamber of the cartridge case that is ignited by means of an igniter or primer and whose propulsive gases exert a force on the base of the projectile when they burn causing the projectile to be driven out of the cartridge case, and wherein at least one passage exits from the propulsion chamber through the cartridge case that is substantially filled with a fusible, solid, pressure-tight material whose melting temperature is lower than the ignition temperatures of the pyrotechnic igniter and the propellant charge of the projectile, the improvement wherein the fusible material in said at least one channel is surrounded by non-fusible material forming an IM plug member positioned adjacent the propellant charge to provide additional structural integrity to the cartridge case.

34. A cartridge munition comprising, in combination:

(a) a cartridge case having a base and an upper portion forming a propulsion chamber;

(b) a projectile having a base inserted into the upper portion of the cartridge case and mechanically connected thereto;

(c) a pyrotechnic propellant charge disposed in the propulsion chamber of the cartridge case whose propulsive gases exert a force on the base of the projectile when they burn causing the projectile to be driven out of the cartridge case; and

(d) a pyrotechnic igniter or primer disposed in the base of the cartridge case for igniting the propellant charge;

wherein said cartridge munition includes at least one pressure release plug for venting propulsive gases from the propulsion chamber of the cartridge case if an elevated ambient temperature, lower than the ignition temperature of the igniter and the propulsive charge, exists for a sufficient period of time to present a risk of self-ignition, said at least one pressure release plug being formed in part by a fusible, solid, pressure-tight material whose melting temperature is lower than the ignition temperatures of the igniter and the propulsive charge,

the improvement comprising a metal shield having low heat transmission properties, thereby to provide for delayed release of the pressure release plug while the munition is retained in a hot barrel.

35. A cartridge munition comprising, in combination:

(a) a cartridge case having a base and an upper portion forming a propulsion chamber;

(b) a projectile having a base inserted into the upper portion of the cartridge case and mechanically connected thereto;

(c) a pyrotechnic propellant charge disposed in the propulsion chamber of the cartridge case whose propulsive gases exert a force on the base of the projectile when they burn causing the projectile to be driven out of the cartridge case;

(d) a pyrotechnic igniter or primer disposed in the base of the cartridge case for igniting the propellant charge; and

(e) a memory metal ring disposed between the cartridge case and the projectile base, said memory metal ring being adapted to expand on heating, thereby separating and dislodging the projectile from the cartridge case and thus preventing undesired or accidental discharge of the projectile at an elevated temperature lower than the ignition temperature of the igniter and the propulsive charge.

CLAIMS

What is claimed is:

1. A cartridge munition comprising a cartridge case and a projectile inserted into the cartridge case and mechanically connected thereto, wherein a propellant charge is disposed in a propulsion chamber of the cartridge case that is ignited by means of an igniter or primer and whose propulsive gases exert a force on the base of the projectile when they burn causing the projectile to be driven out of the cartridge case, and wherein at least one passage exits from the propulsion chamber through the cartridge case that is substantially filled with a frangible member comprising (1) a fusible, solid, pressure-tight material whose melting temperature is lower than the ignition temperatures of the pyrotechnic igniter and the propellant charge of the projectile, (2) a first non-fusible, ruptureable insensitive munition ("IM") plug member positioned in the passage between the fusible solid material and the propellant charge to provide additional structural integrity to the cartridge case, and (3) a second non-fusible plug member positioned in the passage on the side opposite to the IM plug member.

2. The cartridge munition of claim 1, wherein the fusible solid material is at least one of a fusible metal and a polymer.

3. The cartridge munition of claim 1, wherein the fusible solid material is a fusible metal consisting of an alloy of at least bismuth and tin and bismuth and lead.

4. The cartridge munition of claim 3, wherein the fusible metal is a bismuth/tin alloy with from about 30 to about 40 % by weight of bismuth and from about 60 to about 70 % by weight of tin, having a melting point of about 140°C.

5. The cartridge munition of claim 2, wherein the fusible solid material is a polymer which has a melting point of about 140°C.

6. The cartridge munition of claim 1, wherein the passages are channels that extend from the base of the propulsion chamber to the outer base of the cartridge case.

7. The cartridge munition of claim 6, wherein the channels are positioned around the primer (or igniter) of

the propulsive charge allowing for physical separation of the primer from the propellant.

8. The cartridge munition of claim 6, wherein the channels narrow as they progress from the base of the propulsion chamber to the outer base of the cartridge case.

9. The cartridge munition of claim 1, wherein the IM plug member is a disk or cap.

10. The cartridge munition of claim 1, wherein the IM plug member forms an annular ring.

11. The cartridge munition of claim 1, wherein the IM plug member is scored or weakened.

12. The cartridge munition of claim 1, wherein the IM plug member is made of at least one of a metal and a rigid polymeric material.

13. The cartridge munition of claim 12, wherein the IM plug member is made of a metal consisting of at least one of copper, steel, stainless steel, aluminum, and brass.

14. The cartridge munition of claim 12, wherein the

IM plug member is made of polymeric material consisting of at least one of a polycarbonate and polystyrene polymer or copolymer thereof.

15. The cartridge munition of claim 1, wherein at least one of the passages exits from the propulsion chamber through a sidewall of the cartridge case.

16. The cartridge munition of claim 1, wherein the frangible member comprises solid material with sufficient strength to sustain structural integrity through normal operating pressures of a feeding, firing, extraction and ejection cycle.

17. The cartridge munition of claim 1, wherein the frangible member is so configured that, when heated during firing and undergoing extraction and ejection, it does not disintegrate in a manner that could foul a weapon or make the weapon difficult to clean.

18. The cartridge munition of claim 1, wherein the strength of the IM plug member is weakened at higher temperatures to allow for venting.

19. The cartridge munition of claim 1, wherein the IM plug member comprises a solid material that has been modified and configured to retain structural integrity during normal operating pressures in the absence of additional mechanical support.

20. The cartridge munition of claim 1, wherein the IM plug member is made from the cartridge case material by incomplete penetration of at least one passage through the cartridge case.

21. The cartridge munition of claim 1, wherein each passage is filled with a pressure-tight assembly comprising an IM plug member formed of a solid, non-fusible rupture disk or cap that is mechanically reinforced by a fusible, solid material whose melting temperature is lower than the ignition temperature of the pyrotechnic igniter and the propulsive charge of the projectile.

22. The cartridge munition of claim 18, wherein the pressure-tight assembly is removable by threaded or other mechanical means.

23. The cartridge munition of claim 1, wherein heat

flow is directed around the IM plug member by a metal shield having low heat transmission properties, thereby to provide for delayed weakening of the IM plug member while the munition is retained in a hot barrel.

24. The cartridge munition of claim 23, wherein the metal shield is made at least in part of zirconium.

25. A cartridge munition comprising, in combination:

(a) a cartridge case having a base and an upper portion forming a propulsion chamber;

(b) a projectile having a base inserted into the upper portion of the cartridge case and mechanically connected thereto;

(c) a pyrotechnic propellant charge disposed in the propulsion chamber of the cartridge case whose propulsive gases exert a force on the base of the projectile when they burn causing the projectile to be driven out of the cartridge case; and

(d) a pyrotechnic igniter or primer disposed in the base of

the cartridge case for igniting the propellant charge;

the improvement wherein said cartridge munition includes a pressure release device for venting propulsive gases from the propulsion chamber of the cartridge case if an elevated ambient temperature, lower than the ignition temperature of the igniter and the propulsive charge, presents a risk of self-ignition, said pressure release device having means for retaining the igniter in the base of the cartridge case including means for releasing the igniter thereby leaving an opening the base of the cartridge case when it reaches said elevated temperature, said retaining and releasing means comprising a retaining ring made of shape memory material that surrounds the igniter and which increases its diameter upon reaching said elevated temperature, thereby enabling separation of the igniter from the base of the cartridge case.

26. The cartridge munition of claim 25, wherein heat flow is directed around the pressure release device by a metal shield having low heat transmission properties, thereby to provide for delayed separation of the igniter while the munition is retained in a hot barrel.

27. The cartridge munition of claim 26, wherein the metal shield is made at least in part of zirconium.

28. The cartridge munition of claim 25, wherein said retaining ring reduces its diameter upon reaching said elevated temperature.

29. The cartridge munition of claim 25, wherein said pressure release device further comprises an igniter or primer support surrounding and holding the primer or igniter, and wherein said retaining ring surrounds and retains the igniter support in the base of said cartridge case and releases said igniter support upon reaching said elevated temperature.

30. The cartridge munition of claim 25, wherein said retaining ring is supported, at least in part, in the base of the cartridge case by a fusible, solid material whose melting temperature is lower than the ignition temperature of the igniter and the propulsive charge.

31. The cartridge munition of claim 25, wherein said pressure release device further includes at least one ring-shaped nut having engaged external threads or interlocking

sleeved configuration in the base of the cartridge case, said ring-shaped nut being adapted to fix said retaining ring in said base.

32. A cartridge munition comprising a cartridge case and a projectile inserted into the cartridge case and mechanically connected thereto, wherein a propellant charge is disposed in a propulsion chamber of the cartridge case that is ignited by means of an igniter or primer and whose propulsive gases exert a force on the base of the projectile when they burn causing the projectile to be driven out of the cartridge case, and wherein at least one passage exits from the propulsion chamber through the cartridge case that is substantially filled with a fusible, solid, pressure-tight material whose melting temperature is lower than the ignition temperatures of the pyrotechnic igniter and the propellant charge of the projectile, the improvement wherein the fusible material in said at least one channel is surrounded by non-fusible material forming an IM plug member positioned adjacent the propellant charge to provide additional structural integrity to the cartridge case.

33. A cartridge munition comprising, in combination:

(a) a cartridge case having a base and an upper portion forming a propulsion chamber;

(b) a projectile having a base inserted into the upper portion of the cartridge case and mechanically connected thereto;

(c) a pyrotechnic propellant charge disposed in the propulsion chamber of the cartridge case whose propulsive gases exert a force on the base of the projectile when they burn causing the projectile to be driven out of the cartridge case; and

(d) a pyrotechnic igniter or primer disposed in the base of the cartridge case for igniting the propellant charge;

wherein said cartridge munition includes at least one pressure release plug for venting propulsive gases from the propulsion chamber of the cartridge case if an elevated ambient temperature, lower than the ignition temperature of the igniter and the propulsive charge, exists for a sufficient period of time to present a risk of self-ignition, said at least one pressure release plug being formed in part by a fusible, solid, pressure-tight material

whose melting temperature is lower than the ignition temperatures of the igniter and the propulsive charge,

the improvement comprising a metal shield having low heat transmission properties, thereby to provide for delayed release of the pressure release plug while the munition is retained in a hot barrel.

34. A cartridge munition comprising, in combination:

(a) a cartridge case having a base and an upper portion forming a propulsion chamber;

(b) a projectile having a base inserted into the upper portion of the cartridge case and mechanically connected thereto;

(c) a pyrotechnic propellant charge disposed in the propulsion chamber of the cartridge case whose propulsive gases exert a force on the base of the projectile when they burn causing the projectile to be driven out of the cartridge case;

(d) a pyrotechnic igniter or primer disposed in the base of

the cartridge case for igniting the propellant charge; and

(e) a memory metal ring disposed between the cartridge case and the projectile base, said memory metal ring being adapted to expand on heating, thereby separating and dislodging the projectile from the cartridge case and thus preventing undesired or accidental discharge of the projectile at an elevated temperature lower than the ignition temperature of the igniter and the propulsive charge.