APPARATUS AND METHODS FOR CONDITIONAL ACTIVATION OF A CARTRIDGE

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Abstract: A weapon conditionally activates a cartridge. The cartridge has a projectile and a first mechanical feature. The weapon includes an activator and a station. The activator includes a second mechanical feature. The station positions the cartridge so that the first feature opposes the second feature. On condition that the first feature does not mechanically interfere with the second feature, the activator activates the cartridge to launch the projectile from the cartridge. On condition that the first feature mechanically interferes with the second feature resulting in an excess head space, the activator is inhibited by the excess head space from activating the cartridge.

Fig 3
GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).  

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APPARATUS AND METHODS FOR CONDITIONAL ACTIVATION OF A CARTRIDGE

BACKGROUND

In conventional systems design, consumable materials are generally packaged in a cartridge that is replaced when the materials have been consumed by operation of the system. Cartridges may be provided by the system manufacturer or by other manufacturers who may have different quality controls. The consumer may operate the system with any one of several cartridges if the cartridges are interoperable with the system. The intended operation of some systems may be such that some forms of interoperability are to be inhibited. Failing to inhibit interoperability may lead to damage to the system and/or harm to persons and property affected by operation of the system.

As an example of the importance of inhibiting interoperability, consider the field of weapons including weapons intended to be lethal and those intended to be non-lethal. The difference between a lethal and a nonlethal result may be entirely dictated by whether the weapon is used with a lethal round or a nonlethal round. A need exists for improving weapon systems design to more reliably inhibit the use of lethal rounds in an intended nonlethal circumstance.

Generally, a need exists for improving systems design to more reliably inhibit the use of some cartridges of consumable materials while permitting the use of more desirable cartridges of consumable materials.

SUMMARY

A system according to various aspects of the present invention conditionally activates a relatively limited use portion of the system according to whether mechanical features are compatible or incompatible. In one implementation, the system includes a relatively unlimited use portion and a relatively limited use portion. The relatively unlimited use portion includes a first mechanical feature. The relatively limited use portion includes a second mechanical feature. Prior to conditional activation, the first feature and the second feature are combined. Activating the relatively limited use portion by the relatively unlimited use portion is inhibited when the first feature is not mechanically compatible with the second feature. Otherwise, activating is permitted.
BREF DESCRIPTION OF THE DRAWING

Embodiments of the present invention are described with reference to the drawing wherein like designations denote like elements, and:

FIG. 1 is a functional block diagram of a system, according to various aspects of the present invention, that conditionally activates a cartridge;

FIG. 2 is a functional block diagram of another system, according to various aspects of the present invention;

FIG. 3 is a process flow diagram of a method, according to various aspects of the present invention, for conditionally activating a cartridge;

FIG. 4 is a cross-sectional view of a portion of a system according to FIG. 2;

FIGs. 5A, 5B, and 5C are cross-sectional views of incompatible features, according to various aspects of the present invention;

FIG. 6 is a cross-sectional view of a region having compatible features, according to various aspects of the present invention;

FIG. 7 is a plan view of a region having features for conditional activation, according to various aspects of the present invention; and

FIG. 8 is a functional block diagram of a cartridge, according to various aspects of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A system, according to various aspects of the present invention, conditionally activates a relatively limited use portion of the system according to whether features are compatible or incompatible. Activation may include initiating any function of the relatively limited use portion of the system. A system that conditionally activates a relatively limited use portion of the system may inhibit activation of an unsuitable and/or unintended relatively limited use portion of the system. Inhibiting activation may include aborting an automatic or manual activation method and/or making activation improbable. Activation may become improbable when, for example, a user must deviate from methods of ordinary operation of the system and/or use of the system and resort to the use of tools, not customarily accessed for ordinary operation, to modify at least a portion of the system to succeed in achieving activation. Inhibiting activation may be accomplished by the system as a consequence of a portion of the system detecting an incompatibility. The incompatibility may be between at least a portion of the system and at least a portion of the relatively limited use portion of the system. Detecting an incompatibility may be accomplished by failing to detect a sufficient compatibility.

Some of the principles of manufacture and operation of a system according to various aspects of the present invention will be described for clarity with reference to a weapon system,
though other principles and applications in analogous arts will be evident to a person of ordinary skill in analogous arts. Such a weapon system includes a relatively limited use portion and a relatively unlimited use portion. The relatively limited use portion is herein called a cartridge (e.g., a one-time consumable use portion such as a portion containing a single use amount of propellant for propelling the projectile). The relatively unlimited use portion (e.g., used with thousands of cartridges) is herein called a weapon. Consequently, a cartridge is distinguished from a weapon regardless of whether each may or may not be harmful in use or misuse.

A weapon system, according to various aspects of the present invention, may exhibit increased operational safety for the weapon system user and/or may provide more appropriate use of force against a human or animal target. Weapons, cartridges, and weapon systems described herein may be non-interoperable among each other. Non-interoperability may segment the market and/or applications for weapons, cartridges, and weapon systems, promoting user safety among other benefits. Each weapon system may be limited so as to be consistent with particular legal, moral, social, strategic, and/or tactical purposes that may be special to a particular application.

Weapon systems with various superset capabilities are also feasible, according to various aspects of the present invention.

A cartridge, according to various aspects of the present invention, may include any package of materials that are not practical to reuse after operating with a weapon as discussed herein. A cartridge may deploy one or more types of force in one or a limited number of uses (e.g., one type of force per cartridge type, a multi-shot magazine for deploying different forces). A force that has a relatively high likelihood of being lethal to animal and/or human targets is herein called lethal for convenience. A force that has a relatively low likelihood of being lethal is herein called non-lethal for convenience. The force may comprise blunt impact, intimidate or distract the target, cause pain due to electric current through the target tissue, and/or exert electric control of the target. Electric control may be accomplished in a conventional manner by passing a current through target tissue that interferes with voluntary use by the target of its skeletal muscles. Electric control may halt locomotion by the target. For a cartridge having wire-tethered electrodes, the current may be passed between wire-tethered electrodes that connect a signal generator (not shown) in the weapon with the electrodes that impale the clothing and/or tissue of the target. For a cartridge using a wireless electrified projectile, electric control may be accomplished without tether wires when the signal generator and electrodes are packaged in a conventional electrified projectile that hits the target, and conducts the current through electrodes of the projectile and through the target.

A weapon, according to various aspects of the present invention, may include any apparatus having an activator and a station that accepts a cartridge, the cartridge not being part of the weapon. Weapons that may be adapted to use the technology disclosed herein include, for
example, hand-held electronic control devices (e.g., TASER brand models M26, X26, C2 marketed by TASER International, shields), conventional arms (e.g., pistols, shot guns, rifles, dart guns), conventional tactical weaponry (e.g., grenade launchers, area denial devices, TASER brand model ShockWave marketed by TASER International, mines, vehicle and/or robot mounted arms and electronic control devices), and electrified projectiles (e.g., TASER brand model XREP marketed by TASER International).

Activating the cartridge may accomplish a deployment of a force against a target. For example, weapon system 100 of FIG. 1 includes a weapon having activator 102 and station 104. Activator 102 has feature 106 and activates (108) cartridge 110. Cartridge 110 includes projectile 112 and feature 114. A feature 106 of an activator interacts (109) with a feature 114 of a cartridge. Activation is conditioned on compatibility of feature 106 and feature 114. Weapon system 100 emits a projectile 112 from cartridge 110 to deploy a force against a target. Cartridge 110 may correspond to a relatively limited use portion of weapon system 100.

An activator, according to various aspects of the present invention, activates (e.g., by mechanical, electrical, magnetic, and/or electromagnetic cooperation) propulsion (e.g., launching) of a projectile of a cartridge if at least one condition is met; and, does not activate when at least one condition is not met. An activator includes a feature that is compatible or incompatible with a feature of a cartridge. Incompatibility results when the condition is not met. Incompatibility may be evident as excess head space, as discussed herein. An activator may include any structure that inhibits activation when a condition is not met.

An activator may include a feature that is not compatible with a feature of a cartridge. Compatible features may be complementary. Incompatible features may be similar, for example, a first type of activator 102 may include a protrusion 106 that opposes a protrusion 114 of a first type of cartridge 110. Incompatibility may result when an activator omits any structure that would have been sufficient for satisfying a condition imposed by an opposing feature of a cartridge. For example, a second type of activator 102 may omit a recess 106 for nesting with a protrusion 114 of a second type of cartridge 110. Other types of activators, according to various aspects of the present invention, may include one or more features that are not complementary to features of particular types of cartridges and, in addition, may omit one or more features that would have been sufficient to be compatible with particular types of cartridges.

Activation may be inhibited. For an activator (e.g., a percussion firing mechanism) that includes a trigger (e.g., a manual hammer or bolt mechanism), activation may be inhibited by decoupling the trigger from the activator and/or blocking operation of the trigger. For a weapon that includes a station, activation may be inhibited by decoupling the activator from the station and/or blocking operation of the activator to affect activation of the cartridge at the station. For a weapon that has a station that receives a cartridge prior to activation, inhibiting activation may
include blocking the cartridge from being received by the station and/or blocking an operation of the station. Blocking may include introducing a mechanical interference (e.g., an abutment surface, an increased friction) that interferes with attaining a position of the station relative to the cartridge and/or relative to the activator (e.g., blocking closure of the station, blocking movement between the cartridge and a breech block and/or bolt of the station that would otherwise locate such against the cartridge). For a weapon that has a station that encloses a cartridge prior to activation, inhibiting activation may include blocking the cartridge from being enclosed (e.g., blocking closure of the station). For percussion-fired cartridges (e.g., center-fired, rim-fired), an activator may include a firing pin. For electrically-fired cartridges, an activator may include contacts for conducting a firing current through the cartridge. One or more of these contacts may also be used for conducting a current through the target, as discussed above. An activator may include a source of electromagnetic energy (e.g., electricity, magnetism, radiation, light) for activating a cartridge via a transfer of energy and/or communication of a signal. Inhibiting activation may include blocking operation of a firing pin or blocking (or shunting) a current for activation.

A station accepts a cartridge. A station may maintain a position of the cartridge so that the cartridge may be effectively activated by an activator. A cartridge may be combined with a station prior to activation. Combining may include the station accepting, receiving, supporting, holding, and/or enclosing the cartridge. Effective activation may occur at the station at least in part because the station is located proximate to the activator (e.g., within a tolerance of a prescribed distance).

A station may support a cartridge. A station may hold a cartridge for later activation. A station may produce, control, and/or direct a force of propulsion. A station may enclose a cartridge. For propulsion by expanding gas, a station may direct an explosive release of gas that propels a projectile from the cartridge away from the station. For example, station 104 accepts and holds cartridge 110 within a distance from activator 102 from before activation and at least until activation is begun.

A cartridge, according to various aspects of the present invention, includes a projectile and one or more features. A cartridge holds at least one projectile prior to propelling the projectile away from the cartridge. The projectile may be tethered to the cartridge before, during, and after being propelled away from the cartridge, as discussed herein for wire-tethered electrode systems. The projectile may be propelled free of the cartridge, as discussed above for wireless electrified projectile systems. A projectile deploys a force against the target, as discussed above. A cartridge may include a propellant for propelling the projectile (e.g., a pyrotechnic charge and/or a container of compressed gas). A cartridge may omit the propellant when, for example, an activator includes (or cooperates with) a suitable propellant (e.g., a compressed gas supply).

A feature, of an activator or a cartridge, may govern whether the cartridge meets at least one condition sufficient for activation. When a condition of effective activation is satisfied on
condition that the station is proximate to the activator (e.g., within a tolerance of a prescribed
distance), one or more features may interfere with achieving such a condition by separating the
station from the activator and/or enforcing a separation.

A feature may have dimensions and location so as not to interfere with removal (e.g.,
extraction) of a cartridge from a station. A feature may have dimensions and location so as not to
participate in removal. A feature, as discussed herein, may be located closer to a central axis of the
cartridge than any structure associated with a removal function.

For example, an activator may be effective for activation when a space (e.g., a head space)
between the activator and the cartridge is less than a maximum distance (e.g., compatible
interaction 109). The activator may be ineffective (e.g., unable to reliably activate the cartridge)
when a physical interference (e.g., abutment of feature surfaces) causes more than the maximum
distance to exist (e.g., excess head space). Interference may result from abutment between one or
more features of the cartridge and one or more features of the activator. Interference may result
from incompatibility between one or more features of the activator and one or more features of the
cartridge. Incompatibility may exist when a feature (e.g., a protrusion) does not nest within a
complementary feature (e.g., a recess). Failure to nest may result from the absence of a
complementary feature opposite a particular feature and/or misalignment of a complementary
feature with the particular feature.

For example, cartridge 110 may include a wireless electrified projectile 112, a percussion
fired pyrotechnic propellant for propelling the projectile, a base to receive a firing pin for
percussion fired activation 108 wherein the base includes a protrusion feature 114 that causes
excess head space (e.g., incompatible interaction 109) if an attempt is made to use the cartridge
110 with an incompatible activator 102 that does not include a suitable recess feature 106 to nest
the protrusion.

As another example, cartridge 110 may include a wire-tethered projectile 112, an
electrically fired pyrotechnic propellant in combination with a compressed gas propellant, an
enclosure with contacts to receive a current signal 108 for activation, and a flat (omission of a
sufficient recess) feature 114 that causes excess head space (e.g., incompatible interaction 109) if
an attempt is made to use the cartridge 110 with an incompatible activator 102 that has a protrusion
feature 106.

Combining a cartridge and a station may be accomplished with manual, automatic, or
combinations of manual and automatic operations. For example, system 200 of FIG. 2 includes
activator 102, feature 106, station 104, cartridge 110, and feature 114 as discussed above. Further,
system 200 includes coupler 202, guide 204, positioning mechanism 206, and removing
mechanism 208. Weapon system 200 emits projectile 112 from cartridge 110 and through guide
204 to deploy a force against a target.
A guide guides at least one projectile from the cartridge in a manner that improves the accuracy of hitting the target with a projectile. A guide may have an axis on which the projectile is guided. A guide may control propulsion of one or more projectiles and/or direct one or more moving projectiles from the cartridge toward the target. For example, guide 202 guides projectile 112 of cartridge 110 when projectile 112 is being propelled away from system 200.

A coupler couples an activator and a compatible cartridge (e.g., by mechanical, electrical, magnetic, and/or electromagnetic cooperation) so that operation of the activator activates the cartridge. A coupler may cooperate with a positioning mechanism and a station to initiate the holding function of the station in response to completing the positioning function of the positioning mechanism. A coupler may cooperate with a removing mechanism after a cartridge combined with a station to prepare the removing mechanism for operation. A coupler may be manually operated as to any or all of its functions. A coupler may be automatically operated as to any or all of its functions. A coupler may detect an incompatibility between a cartridge and an activator. In response to detecting an incompatibility, a coupler may inhibit activation in any manner as discussed above. A coupler may cooperate with a removing mechanism (e.g., by mechanical, electrical, magnetic, and/or electromagnetic cooperation) to initiate removing in response to detecting an incompatibility between the cartridge and the activator.

For example, coupler 202 may enclose (e.g., by mechanism or signal 212) a compatible cartridge 110 in station 104 at a suitable distance from activator 110 in preparation for activation. If the cartridge in the station and/or coupler is not compatible, coupler 202 may inhibit activation (e.g., by mechanism or signal 210), as discussed above, for example, by blocking operation of a trigger and/or blocking enclosing the cartridge. The station may have a first position for receiving a cartridge and a second position for enclosing the cartridge. The coupler may block (e.g., by introducing a mechanical interference) the station from attaining the second (e.g., closed) position.

A positioning mechanism places a compatible cartridge in a position suitable for activation. Positioning may include placing and orienting the cartridge with respect to the station. A positioning mechanism may place a cartridge in a station of a guide, as discussed above. A positioning mechanism may be manually operated as to any or all of its functions. A positioning mechanism may be automatically operated as to any or all of its functions. A positioning mechanism may detect an incompatibility between the cartridge being positioned and an activator. In response to detecting an incompatibility, a positioning mechanism may inhibit activation in any manner as discussed above. A positioning system may cooperate with a removing mechanism (e.g., by mechanical, electrical, magnetic, and/or electromagnetic cooperation 222) to initiate removal in response to detecting an incompatibility between the cartridge being positioned and an activator. For example, positioning mechanism 206 opens, via mechanism or signal 216, station 104 for an operator to manually place a compatible cartridge 110 in station 104. Positioning
mechanism then moves the cartridge into a suitable position, via mechanism or signal 214. If the cartridge placed by the operator is not compatible (e.g., as detected by mechanism or signal 216 and/or 214), positioning mechanism 206 inhibits activation by activator 102. Inhibiting activation may be as discussed above. Inhibiting may include blocking operation of coupler 202 via mechanism or signal 210 and/or 212. Inhibiting may include blocking operation of a trigger of activator 102 and/or blocking enclosing cartridge 110 in station 104.

A removing mechanism removes a cartridge from a station. A removing mechanism may decouple a compatible cartridge from an activator prior to or in combination with removing. A removing mechanism may remove an incompatible cartridge from a station. A removing mechanism may include one or more extractors. An extractor may cooperate with a structure (e.g., lip, tang, ridge, flange) of a cartridge to perform the holding function discussed with reference to the station. The structure may be on an external surface of the cartridge or internal (e.g., within a cavity of an external surface of the cartridge). An extractor may cooperate with a structure of a cartridge to throw the cartridge away from the station. A removing mechanism may be manually operated as to any or all of its functions. A removing mechanism may be automatically operated as to any or all of its functions. For example, removing mechanism 208 may open an enclosure of station 104 and remove (e.g., by operation of extractors) a compatible cartridge 110 from station 104. Opening and or removing may utilize mechanism and/or signal 218 and/or 220. Removing may be initiated (e.g., by the system user and/or by positioning mechanism 206) whether or not the cartridge 110 was activated. Further, removing mechanism 208 in response to returning station 104 to an open position may remove an incompatible cartridge 110 from station 104.

For propulsion by expanding gas, a guide may include a barrel. An activator, station, coupler, positioning mechanism, and removing mechanism may be implemented at a breech end of the barrel with a breech block, a bolt, a receiver, a chamber, a trigger, and one or more extractors. At a muzzle end of the barrel, one or more projectiles from the cartridge are emitted.

Guide 204 may be omitted from another implementation of weapon 200 (not shown). For example, a cartridge may include sufficient structure to guide a projectile away from the cartridge, eliminating the need for a guide 204.

Positioning mechanism 206 and/or removing mechanism 208 may be omitted for another implementation of weapon 200 (not shown). For example, positioning and/or removing may be accomplished by operator action and the cooperation of surfaces of a cartridge (not shown) and a station (not shown), eliminating the need for a positioning mechanism 206 and/or a removing mechanism 208.

As discussed above, a condition of compatibility between feature 106 and 114 may be detected by one or more of activator 102, coupler 202, positioning mechanism 206, and/or one or more extractors. Actions taken in response to detecting an incompatibility, according to various
aspects of the present invention, include inhibiting activation and/or removing the cartridge from the weapon (e.g., from the station if already received by the station). Attempting repositioning of the cartridge by positioning mechanism 206 may be warranted where the time to attempt repositioning represents a reasonable cost over the cost of the cartridge in view of the likelihood of success for the attempt.

Systems 100 and/or 200 may perform a method for conditionally activating a cartridge. Inhibiting activating a cartridge may attain any one or more of the results discussed above. For example, method 300 of FIG. 3 may be performed for each of several cartridges (or portions of a magazine) handled manually or automatically (e.g., fed automatically, automatically advanced).

Method 300 begins with preparing (302) the station (e.g., 104) and/or the activator (e.g., 102). Preparation may instate or reinstate any suitable initial condition of activation of a next cartridge (e.g., 110). For example, preparation may include opening a receiver to admit the cartridge. Preparation may include retracting a bolt and/or a breech block. Preparation may include recharging an energy storage mechanism and/or circuit so that sufficient energy is available for activation and/or current through target tissue.

The cartridge (e.g., 110) is combined (304) with the station (e.g., 104). Combining may include accepting, receiving, positioning, supporting, holding, orienting (e.g., to achieve indexing and/or alignment), and/or enclosing. Combining may be incomplete for an incompatible cartridge.

As a result of an attempt to combine (304), compatibility of features of the activator (e.g., one or more features 106) with features of the cartridge (e.g., one or more features 114) may be detected (306). For example, opposing features may nest (compatible) or abut (incompatible). Excess head space may be detected. If these features are incompatible, the method continues with inhibiting (312). Otherwise the method continues with coupling (308).

The cartridge is coupled (308) to the activator (e.g., by coupler 202). Coupling may include moving the cartridge with respect to the station and/or the activator. Movement may be in any linear direction. Movement may be along any arc. Coupling may include indexing (e.g., moving to align an index structure of a cartridge with an index structure of a station and/or of an activator). Coupling may include providing for operator safety as a prerequisite to activating. Coupling may include closing a chamber around the cartridge. Attempting coupling may result in achieving a suitable head space or in failing to achieve a suitable head space (e.g., detecting excess head space). Coupling may be incomplete for an incompatible cartridge.

As a result of an attempt to couple (308), compatibility of features of the activator (e.g., one or more features 106) with features of the cartridge (e.g., one or more features 114) may be detected (310). For example, opposing features may nest (compatible) or abut (incompatible). Excess head space may be detected. If these features are incompatible, the method continues with inhibiting (312). Otherwise, the method continues with activating (314).
If incompatible features are detected, activation is inhibited in any manner as discussed herein.

If compatible features are detected, the cartridge is activated (314). Activation is permitted because a condition of compatibility has been met (e.g., incompatibility has not been detected, sufficient compatibility has been detected, and/or insufficient incompatibility has been detected).

Activation may include propelling the projectile from the cartridge. Activating may include initiating and/or repeating provision of a current through target tissue.

The cartridge is removed (316) from the station. Removing may include releasing, ceasing holding, and/or extracting.

If the weapon and cartridge are designed for multi-threaded operation of method 300, another performance of method 300 may be performed with respect to a second cartridge at any time, whether or not a first cartridge is removed.

The conditional activation, described above for systems 100 and 200 and method 300, may be implemented with mechanical structures. For example, a cylindrical cartridge may be placed for activation against a breech block having a firing pin. If excess head space does not arise from incompatible features in a region of a portion of the breech block and a portion of the cartridge, activation by percussion of a center firing pin against the cartridge may be accomplished. Otherwise, excess head space may inhibit activation by exceeding the operating range of the firing pin. For example, a portion of weapon system 400 is shown in cross-section in FIG. 4. Weapon system 400 generally includes circularly symmetric structures that are symmetric about an axis 402, the axis of projection of the projectile. Weapon system 400 includes receiver 404 that has an open position and a closed position (shown in the closed position). Weapon system 404 further includes extractor 406, bolt 408, firing pin 410, and cartridge 412.

Receiver 404 includes radial surfaces 420 and 421. When receiver 406 is in the open position, surfaces 420 and 421 are located a considerable distance along axis 402 away from bolt 408. When receiver 406 transitions from the open position to the closed position (as shown), ejector 406 is urged toward cartridge 412 and the distance between bolt 408 and cartridge 412 is reduced. To achieve the closed position, surface 418 of extractor 406 must grasp lip 416 of cartridge 412; and extractor 406 surface 430 must avoid abutting surface 421. In the presence of excess head space, extractor 406 cannot grasp lip 416 in a manner that also avoids extractor 406 from abutting surface 421. Consequently, the closed position cannot be attained. Extractor 406 may abut surface 421 if an attempt to put receiver 404 into the closed position fails. Such an attempt may fail because excess head space prevents location of extractor 406 as shown.

When transitioning into the closed position, bolt 408 and cartridge 412 may move together to oppose each other and may be held against each other at least in part by operation of extractor 406. Consequently, firing pin 410 is aligned on axis 402 through a center fired axis of cartridge.
Further, a distance between firing pin 410 and a base 414 of the cartridge is brought within an operating distance for reliable activation. As shown, opposing features in region 422 are nested, indicating compatibility of features and an absence of excess head space.

Bolt 408 provides a bore for firing pin 410. Bolt 408 further includes chamfer 426 and recess 424 in region 422. Chamfer 426 cooperates with extractor 406 to throw cartridge 412 out of receiver 404 when receiver 404 transitions from the closed position to the open position. Because recess 424 is aligned to nest with protrusion 428 of cartridge 412, excess head space does not exist. By abutting base 414 of cartridge 412, bolt 408 may detect excess head space and may inhibit activation as discussed above.

Cartridge 412 includes base 414 which is generally flat except for features in region 422. Region 422 includes a protrusion feature 428 that inhibits activation of cartridge 412 in the absence of a corresponding recess feature 424 of bolt 408. Both protrusion feature 428 and recess feature 424 may have circular symmetry about axis 402 (e.g., formed on a circle, formed as a half annulus).

Extractor 406 is one of two extractors that are located diametrically opposite each other across axis 402. Extractors pivot away from bolt 408 to receive a cartridge and pivot toward bolt 408 to grasp a cartridge. By grasping a cartridge, extractors may detect excess head space and may inhibit activation as discussed above. An extractor may perform any function of a positioning mechanism (e.g., moving a cartridge toward an activator), any function of a coupler (e.g., mechanically and/or electrically coupling a cartridge to an activator), any function of a station (e.g., holding a cartridge at a distance (zero or more) from an activator, and/or any function of a removing mechanism (e.g., throwing a cartridge away from an activator) as discussed herein.

Region 422 of FIG. 4 illustrates a feature 424 of an activator compatible with and nested with a feature 428 of a cartridge.

Combinations of incompatible features are illustrated in FIGs. 5A, 5B, and 5C. In all three illustrations, opposing surfaces define a distance D that is detectable, as discussed above, and indicates incompatibility (e.g., insufficient compatibility). Distance D may cause an activator, coupler, station, positioning mechanism, or ejector to inhibit activation directly (e.g., open a circuit intended for firing current, separate a firing pin from a cartridge) or indirectly (e.g., prevent closing of a breech, block operation of a trigger).

Opposing surfaces having features as discussed herein may be located at any convenient portion of an activator and a cartridge. As an alternative or in addition, opposing surfaces having alternative and/or additional features may be located at any desired portion of a cartridge and a station. For example, detecting incompatibility and inhibiting activation may be accomplished by a station in response to incompatible features of opposing surfaces.
Compatibility and incompatibility may be implemented with any opposition of 2 surfaces each having one of 3 features: flat, recess, or protrusion. The combinations are listed in Table 1. In Table 1, the features of the first and second surfaces are assumed to completely overlap. If overlap is not sufficient, some combinations indicated as compatible may be incompatible.

<table>
<thead>
<tr>
<th>First Surface</th>
<th>Second Surface</th>
<th>Compatible (Yes/No)?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat</td>
<td>Flat</td>
<td>yes</td>
</tr>
<tr>
<td>Flat</td>
<td>Recess</td>
<td>yes</td>
</tr>
<tr>
<td>Flat</td>
<td>Protrusion</td>
<td>no (e.g., FIG. 5A)</td>
</tr>
<tr>
<td>Recess</td>
<td>Flat</td>
<td>yes</td>
</tr>
<tr>
<td>Recess</td>
<td>Recess</td>
<td>yes</td>
</tr>
<tr>
<td>Recess</td>
<td>Protrusion</td>
<td>yes</td>
</tr>
<tr>
<td>Protrusion</td>
<td>Flat</td>
<td>no (e.g., FIG. 5B)</td>
</tr>
<tr>
<td>Protrusion</td>
<td>Recess</td>
<td>yes</td>
</tr>
<tr>
<td>Protrusion</td>
<td>Protrusion</td>
<td>no (e.g., FIG. 5C)</td>
</tr>
</tbody>
</table>

In FIG. 5A, surface 504 opposes surface 503 in region 501. At point 502, a flat of surface 503 abuts a protrusion of surface 504.

In FIG. 5B, surface 514 opposes surface 513 in region 511. At point 512, a protrusion of surface 513 abuts a flat of surface 514.

In FIG. 5C, surface 524 opposes surface 523 in region 521. At point 522, a protrusion of surface 523 abuts a protrusion of surface 524.

Features to be opposed for detecting compatibility may be located on a surface without regard to symmetry. The surface may otherwise be substantially flat or may have any convenient topography. As an addition or alternative, features to be opposed for detecting compatibility may be located in circular tracks about a center of circular symmetry on a substantially flat surface. The region (e.g., 422) for features may also exhibit circular symmetry. Circular symmetry and regions of substantially flat surfaces (e.g., portion of base of cartridge, portion of face of bolt and/or breech block) are conventional for activators and cartridges used in percussion fired weaponry. Because the angular orientation about a central axis of circular symmetry may be costly to control, a feature may be implemented on a circle as a protrusion from the flat surface of the region or as a recess into the flat surface of the region. Multiple features at circles of differing radii may be used in the same region (e.g., a circular band of several circular tracks).
For example, circularly symmetric features of a circularly symmetric region are shown in
cross-section in FIG. 6. Region 600 is circular about axis 602. Axis 602 may correspond to the
center of an axis of symmetry of an activator, a cartridge, or both and activator and a cartridge.
Region 600 includes surface 601 abutting surface 603. Region 600 includes compatible features at
nested tracks 604 and nested tracks 606. Each track is circular about axis 602. All radii discussed
below are measured from axis 602.

Surface 601 includes a recess feature 615 that includes zone 1 centered at radius 610, zone
2 centered at radius 612 (greater than radius 610), and zone 3 centered at radius 614 (greater than
radius 612). Zone 2 includes a protrusion feature 613 from surface 603 that abuts recess feature
615. Width boundary zones 1 and 3 may serve one or more purposes including: (a) to provide
space for foreign substances that could otherwise interfere with nesting of protrusion feature 613 in
recess feature 615; (b) to provide for tolerances in forming features and for wear of the type of
features that may be deformed by exposure to incompatibilities; (3) to provide for tolerances in
positioning and holding the cartridge in the station, as discussed above; (4) to provide for
tolerances in alignment of the cartridge and/or station and the activator; and/or (5) to avoid
interfering with extracting the cartridge from the station.

Surface 601 includes a protrusion feature 609 at radius 616 (greater than radius 614) that
nests in recess feature 607 of surface 603. Width 620 of protrusion feature 609 is smaller than
width 618 of recess feature 607 by an amount sufficient for boundary zones (not shown, but
analogous to zones 1 and 3). Feature 609 height 626 and feature 607 depth 628 may be measured
at the intended central radius 616 of the overlap of the features. Due to irregularities in surface
flatness and forming of surfaces and features, some portions of some features may not abut when
nested. Proper activation should allow for spaces 624 between substantially (e.g., imperfectly) flat
surfaces and the effects (e.g., rocking) of spaces 622 between features that are nested. These
spaces may contribute to a head space that, though not zero, still indicates compatibility.

Widths of features may be measured where the feature height or depth differs from the
surface by 10%. Widths of features may be selected to effect reliable detection without interfering
with removal (e.g., extraction). When features are used to define several types of compatibility,
feature width may be adjusted to assure each type of compatibility is distinguishable from each
other type.

Feature height for a protrusion may be determined by a distance at which a positioning
mechanism will inhibit normal operation of the weapon (e.g., fail to permit a breech to close, fail to
permit a trigger to effect activation). Feature height for a protrusion may be determined by a
distance at which an activator cannot reliably activate (e.g., beyond the distance a firing pin will
reliably strike a primer, beyond the distance an electric circuit can be formed through the
cartridge). Feature height for a protrusion may be reduced from the determinations just mentioned to assure the protrusion will not interfere with removal of the cartridge from the station.

Recess depth, when greater than corresponding protrusion height may create free volume as a depth boundary zone (or height boundary zone) to serve the same purposes as width boundary zones so that width boundary zones may be reduced in volume.

Any feature discussed herein may include a width boundary zone and/or a depth (or height) boundary zone. Indexing structures, alignment structures, and/or removal structures may include analogous zones for analogous purposes.

For a cartridge to be used in a breech loaded weapon (e.g., a 12 ga. shotgun), the base of the cartridge that faces the breech block of the weapon may have a protrusion toward the breech block and/or a recess away from the breech block. The protrusion may have a height in the range from 0.030 inch to 0.100 inch. The recess may have a depth in the range from 0.030 inch to 0.100 inch. Similarly, a breech loaded weapon (e.g., a 12 ga. shotgun) to be used with such cartridges may have a breech block with a recess and/or a protrusion respectively to nest the feature of the cartridge. The protrusion of such a breech block may have a height in the range from 0.030 inch to 0.100 inch. The recess of such a breech block may have a depth in the range from 0.030 inch to 0.100 inch.

For cartridges and/or activators that include circular symmetry as discussed above, plural features may be arranged in concentric tracks each track at a different radius from a center of symmetry. For example, a first feature track at a first radius may include a continuous substantially uniform annular protrusion and a second feature track at a second radius may include a continuous substantially uniform annular recess at a second radius. Substantial uniformity assures circular symmetry. Each track may be used to create 6 compatible (e.g., interoperable) combinations and 3 incompatible (e.g., non-interoperable) combinations of activators and cartridges as described in Table 1. Multiple tracks may be used to create additional combinations as desired.

Variation along the circumference of a track may be used to create plural features (herein called serial coded features), for example, to create additional compatible and incompatible combinations of cartridges and activators. For example, plan 700 having overall radius of 716 and circumference 702 includes plural concentric tracks that may be applied to a cartridge and/or an activator. Plan 700 includes track 704 having radius 714, track 706 having radius 712, center 710 from which all radii are measured, and arc 723 between radial reference 722 and radial reference 724. In the example as shown, radius 712 is less than radius 714. Each track may be defined from a radius at its inner edge (as shown) or at its center or outer edge as desired. Track width may be determined so as to include suitable feature width and width boundary zones as discussed above.
Arc 723 may define a repeating unit of plural features arranged along the arc of a first track 704 (or 706). The remainder of the first track may repeat the unit for each successive arc of the same size as arc 723.

A second track 706 (or 704) may have one or more indexing structures designed to identify to the positioning mechanism, the station, and/or the activator an index from which to align a corresponding track for detecting compatibility. Alignment structures may be included to effect rotation of the cartridge (or the activator) about the center 710 when the cartridge and activator are brought together. The indexing structures and/or alignment structures of the second track 706 (or 704) may have height greater than the height of the compatibility enforcing features (e.g., 106, 114) of the first track 704 (or 706) so that registration (of the corresponding tracks having units of serial coded features) is completed before attempting detection of compatibility.

A cartridge may include a base and a projectile. The base may include a propellant and one or more features as discussed herein. The base may remain with the weapon after activation and be removed away from the activator, as discussed above. The propellant may propel (e.g., launch) the projectile away from the weapon and toward the target. For propulsion by expanding gas through a barrel, a wad may seal the barrel to reduce gas escaping around the projectile while in the barrel. The wad may be free to fall away from the projectile during flight of the projectile (e.g., after the projectile leaves a barrel). Otherwise, the wad may be attached to the projectile and serve an additional function related to flight of the projectile or related to impact of the projectile at the target. Stabilized flight of the projectile may be accomplished by causing the projectile to spin after activation (e.g., launching) of the cartridge. The projectile may include fins for causing spin by aerodynamics. The projectile may omit fins if launched through a rifled barrel and the rifling causes sufficient spin. The projectile may include a power supply (e.g., battery or charged capacitor), a signal generator, and electrodes to generate a current to pass through the target, as discussed above. The electrodes may include adhesive or barbs to attach the projectile to the target. The projectile may also include a payload that remains with the projectile after impact with the target, is dispensed during flight, or dispensed on impact with the target. The payload may operate during flight and/or after impact with the target. The payload may use power from the power supply to enable one or more of its functions (e.g., begin dispersing, ignite pyrotechnics, conduct measurement and/or telemetry functions). The complement of structures and functions included in a particular cartridge may be tailored to different market segments. The features on the base of the projectile may assure use of particular cartridges with particular activators, as discussed above, by inhibiting activation of a particular projectile in an unsuitable weapon.

For example, cartridge 800 of FIG. 8 includes base 802 and one or more projectiles 820 (one shown). Base 802 includes propellant 804, wad 806, removal structures 808, and features as discussed above. Features include substantially uniform features 810 and/or serial coded features
The projectile 820 includes power supply 822, signal generator 824, electrodes 826, payload 828, fins 830, and wad 832. In operation, cartridge 800 may perform any and all of the cartridge functions discussed above. Cartridge 800 may be placed in a conventional weapon having no features (e.g., electronic control device, handgun, rifle, shot gun, grenade launcher, mortar) or in a weapon of the present invention (e.g., having an activator with one or more features) and, if conditions for activation are met (e.g., features of the cartridge do not interfere with features (if any) of the activator), the cartridge may be activated. When activated, the projectile may be launched away from the cartridge.

Base 802 may include a pyrotechnic propellant for operation in a chamber of a barrel. Propellant 804 may include a conventional percussion fired primer and powder that releases gas for propelling the projectile through a barrel. Propellant 804 may be formed in a separate assembly (e.g., brass) and pressed into base 802 (plastic). Wad 806 may seal the gas into the barrel and slide along the barrel as the gas expands to propel the projectile. Wad 806 may further include conventional pyrotechnics (e.g., report, tracer smoke, muzzle flash, tracer combustibles) for drawing attention to the use of the projectile (e.g., for crowd control purposes). Following activation of the cartridge, one or more removal structures 808 may provide one or more surfaces for removal of the cartridge from the weapon (e.g., grasping and/or throwing the spent cartridge 800 away from the activator).

One or more features 810, 812, as discussed above for conditional activation, may be included in base 802. Substantially uniform features 810 may include protrusions and/or recesses arranged about an axis of symmetry. One substantially uniform feature is substantially uniform in at least one dimension (e.g., width, height, depth, length) throughout a region sufficient for symmetry (e.g., a ring, circle, half annulus, line, perimeter). Multiple substantially uniform features of the same type (e.g., two circular protrusions of the same height), of mixed types (e.g., a circularly symmetric protrusion and a circularly symmetric recess), and/or of mixed dimensions (e.g., different heights, depths, widths, lengths) may be used. Serial coded features may be arranged about an axis of symmetry (e.g., on a circumference of a circle, on a perimeter of a polygon, a regularly distributed flat pencil of lines from a point). Serial coded features may be arranged with reference to one or more indexing structures. An indexing structure assures that one set of features (e.g., on a cartridge) is properly aligned with a second set of features (e.g., on an activator). In a simple symbol grammar, each feature of a code unit of serial coded features may include one of three features: a flat, a protrusion, or a recess. Other serial code unit symbol grammars may include features of different dimensions and/or different locations relative to the indexing structures.

Projectile 820 may include a wad 832 that performs one or more of the functions discussed above with reference to wad 806, except that wad 832 may remain with projectile 820 for some or
all of its flight toward the target. Wad functions may be performed by wads 806 and/or 832 with the omission of the other wad.

The flight of projectile 820 may be spin stabilized by fins 830 or by cooperation of projectile 820 with rifling of a barrel used to guide the initial portion of the flight.

A projectile may perform one or more lethal and non-lethal functions, as discussed above. For example, projectile 820 performs non-lethal functions including electric control of the target (via power supply 822, signal generator 824, and electrodes 826). When no other functions are desired, payload 828 may be omitted.

Particular synergies are realized, according to various aspects of the present invention, by combining a set of features of the cartridge (e.g., to define a cartridge type) with a selection of particular structural and/or functional aspects of the cartridge (e.g., propellant, wads, removal structures, electric control of the target, spin stabilization, and payloads). Additional particular synergies are realized according to various aspects of the present invention by defining a set of features of the activator (e.g., to define a weapon type) for compatibility with some cartridge types and for incompatibility with other cartridge types. Limited interoperability of cartridges and weapons results.

For instance, the combinations and purposes served by exemplary types of cartridges and exemplary types of weapons each type having no features, one feature, or two features are described in Tables 2 through 7. In this example, the first feature is implemented on a circular track at radius R1. The second circular feature is implemented on a second circular track at radius R2, concentric with the first track, (e.g., see also FIG. 6). R1, R2, the difference between R1 and R2 are all selected for reliable detecting of compatibility, inhibiting of activation, and/or noninterference with removal. Because non-lethal projectile muzzle velocities are desired to be significantly less than those of lethal projectiles, the propellant may have less thermal effect on the cartridge and the weapon. For example, the base of a cartridge may be formed of plastic (e.g., polystyrene, polyethylene, high density polymer) and the features, indexing structures, and/or removal structures may be formed by any conventional plastics manufacturing techniques (e.g., by injection molding).

Four types of cartridges are defined in Table 2. Because each cartridge is not compatible with some types of weapons defined in Table 2, different markets for lethal and non-lethal uses may be served with cartridges of different types. Cartridge type A is a conventional cartridge without features as taught herein. Each cartridge type B through D has a base with a unique set of features according to various aspects of the present invention.
TABLE 2

<table>
<thead>
<tr>
<th>Cartridge Features</th>
<th>Cartridge Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Flat</td>
<td>Lethal</td>
</tr>
<tr>
<td>B. Recess at radius R1</td>
<td>Non-lethal, consumer purposes</td>
</tr>
<tr>
<td>C. Recess at radius R1 and protrusion at radius R2, where R1&lt;R2</td>
<td>Non-lethal, law enforcement purposes</td>
</tr>
<tr>
<td>D. Protrusion at radius R2</td>
<td>Non-lethal, military purposes</td>
</tr>
</tbody>
</table>

Four types of weapons are defined in Table 3. Because each weapon is not compatible with some types of cartridges, different markets for lethal and non-lethal uses may be served with weapons of different types. Weapon type 1 is a conventional weapon without features as taught herein. Each weapon type 2 though 4 has an activator with a unique set of features according to various aspects of the present invention.

TABLE 3

<table>
<thead>
<tr>
<th>Activator Features</th>
<th>Weapon System Lethal Uses</th>
<th>Weapon System Non-Lethal Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Flat</td>
<td>All existing lethal cartridges</td>
<td>Cartridges for consumer use</td>
</tr>
<tr>
<td>2. Protrusion at radius R1</td>
<td>None</td>
<td>Cartridges for consumer use</td>
</tr>
<tr>
<td>3. Protrusion at radius R1 and recess at radius R2, where R1&lt;R2</td>
<td>None</td>
<td>Cartridges for consumer or law enforcement use</td>
</tr>
<tr>
<td>4. Recess at radius R2</td>
<td>Cartridges for military lethal use</td>
<td>Cartridges for military non-lethal use</td>
</tr>
</tbody>
</table>

As described in Table 4, only 9 of 16 weapon systems involve compatible cartridges as in Table 2 and activators as in Table 3. Seven weapon systems involve incompatible activators and cartridges. Cartridges of each types A, C, and D are interoperable among a respective limited number of weapon types. Weapon types 1, 2, and 3 are interoperable among a respective limited number of cartridge types.
TABLE 4

<table>
<thead>
<tr>
<th>Weapon Type</th>
<th>Cartridge Type and Compatibility with Weapon</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>1</td>
<td>yes</td>
</tr>
<tr>
<td>2</td>
<td>no</td>
</tr>
<tr>
<td>3</td>
<td>no</td>
</tr>
<tr>
<td>4</td>
<td>yes</td>
</tr>
</tbody>
</table>

For weapons described in Table 3 and with reference to FIG. 2 having a guide comprising a barrel, the barrel may be rifled or smooth for cooperation with various projectile spin stabilization techniques as described in Table 5.

TABLE 5

<table>
<thead>
<tr>
<th>Weapon Type</th>
<th>Weapon Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>steel barrel, smooth bore</td>
</tr>
<tr>
<td>2</td>
<td>aluminum barrel, smooth bore</td>
</tr>
<tr>
<td>3</td>
<td>aluminum barrel, rifled bore</td>
</tr>
<tr>
<td>4</td>
<td>steel barrel, rifled bore</td>
</tr>
</tbody>
</table>

As discussed above, a cartridge may include a projectile, herein called an electrified projectile, comprising a power supply and signal generator for conducting a current through tissue of a target. Three types of such cartridges may be marketed to three different markets as described in Table 6 due to the compatibility and lack of compatibility with various weapon types, discussed above.
As discussed above, a cartridge may include a projectile, herein called a non-electrified projectile, that does not include a power supply or signal generator for conducting a current through tissue of a target. Three types of such cartridges may be marketed to three different markets as described in Table 7 due to the compatibility and lack of compatibility with various weapons, discussed above. Payloads for law enforcement purposes may assist in crowd control, SWAT team missions, and general arrests.

<table>
<thead>
<tr>
<th>Function of a Cartridge Having a Non-lethal Electrified Projectile</th>
<th>Consumer Type</th>
<th>Law Enforcement Type</th>
<th>Military Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Features</td>
<td>B as in Table 2</td>
<td>C as in Table 2</td>
<td>D as in Table 2</td>
</tr>
<tr>
<td>Firing</td>
<td>Percussion center fired</td>
<td>Percussion center fired</td>
<td>Percussion center fired</td>
</tr>
<tr>
<td>Propellant</td>
<td>Short range</td>
<td>Medium range</td>
<td>Long range</td>
</tr>
<tr>
<td>Front of Projectile</td>
<td>Barbed electrodes</td>
<td>Barbed electrodes</td>
<td>Barbed electrodes</td>
</tr>
<tr>
<td>Rear of Projectile</td>
<td>No payload</td>
<td>Payload</td>
<td>Payload</td>
</tr>
<tr>
<td>Payload alternatives</td>
<td>None</td>
<td>no payload, pepper spray, flash, bang, flash and bang</td>
<td>no payload, pepper spray, flash, bang, flash and bang</td>
</tr>
<tr>
<td>Muzzle effect</td>
<td>None</td>
<td>Flash</td>
<td>None</td>
</tr>
<tr>
<td>Wad effect</td>
<td>None</td>
<td>Wad provides tracer glare</td>
<td>None</td>
</tr>
<tr>
<td>Spin stabilization</td>
<td>Fins</td>
<td>In barrel, no fins needed</td>
<td>In barrel, no fins needed</td>
</tr>
<tr>
<td>Stimulus</td>
<td>30-second halting of locomotion</td>
<td>retrigerable 30-second halting of locomotion</td>
<td>retrigerable 30-second halting of locomotion</td>
</tr>
<tr>
<td>Telemetry between weapon and projectile</td>
<td>None</td>
<td>retriggering; control measurement and/or receive biometrics measured by projectile</td>
<td>retriggering; control and/or receive audio sensed by projectile</td>
</tr>
</tbody>
</table>

TABLE 6

As discussed above, a cartridge may include a projectile, herein called a non-electrified projectile, that does not include a power supply or signal generator for conducting a current through tissue of a target. Three types of such cartridges may be marketed to three different markets as described in Table 7 due to the compatibility and lack of compatibility with various weapons, discussed above. Payloads for law enforcement purposes may assist in crowd control, SWAT team missions, and general arrests.
For the sake of clarity of description of the invention, features that define a type of weapon have been associated with an activator. In another weapon, according to various aspects of the present invention, features that define a type of weapon are formed on or in a station. In still another weapon, according to various aspects of the present invention, features that define a type of weapon are formed on or in a coupler. In still another weapon, according to various aspects of the present invention, features that define a type of weapon are formed on or in a positioning mechanism. In still another weapon, according to various aspects of the present invention, features that define a type of weapon are formed on or in a removing mechanism. In still another weapon, according to various aspects of the present invention, features that define a type of weapon are formed on or in one or more of an activator, a coupler, a station, a positioning mechanism, and/or a removing mechanism.

Related technologies (methods and apparatus) that may be adapted and/or used with technologies disclosed herein to implement the present invention in various forms include propellant systems, electronic control devices, and electrified projectiles described in US Patents 5078117, 5936183, 5955695, 6636412, 6898887, 7042696, 7057872, 7075770, 7102870, 7145762, 7280340, 7305787, 7409912; and US Published Patent applications 2006/0279898, 2007/0075261, 2007/0081292, 2007/0081293, 2007/0214993, and 2008/0259520.

<table>
<thead>
<tr>
<th>Function of a Cartridge Having a Non-lethal, Non-Electrified Projectile</th>
<th>Consumer Type</th>
<th>Law Enforcement Type</th>
<th>Military Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Features</td>
<td>B as in Table 2</td>
<td>C as in Table 2</td>
<td>D as in Table 2</td>
</tr>
<tr>
<td>Usage</td>
<td>Warning flare</td>
<td>Substitute for electrified projectile for low cost accuracy training and mission practice</td>
<td>Bean bag assault</td>
</tr>
<tr>
<td>Propellant</td>
<td>Short range</td>
<td>Medium range</td>
<td>Long range</td>
</tr>
<tr>
<td>Front of Projectile</td>
<td>No electrodes and no payload</td>
<td>No electrodes; includes payload</td>
<td>No electrodes; includes payload</td>
</tr>
<tr>
<td>Payload alternatives</td>
<td>None</td>
<td>no payload, marker, pepper spray, flash, bang, flash and bang</td>
<td>no payload, marker, pepper spray, flash, bang, flash and bang</td>
</tr>
<tr>
<td>Spin stabilization</td>
<td>Fins</td>
<td>In barrel, no fins needed</td>
<td>In barrel, no fins needed</td>
</tr>
</tbody>
</table>
The foregoing description discusses preferred embodiments of the present invention which may be changed or modified without departing from the scope of the present invention as defined in the claims. While for the sake of clarity of description, several specific embodiments of the invention have been described, the scope of the invention is intended to be measured by the claims as set forth below.
CLAIMS

What is claimed is:

1. A system for conditionally activating, the system comprising:
   a relatively unlimited use portion comprising a first feature; and
   a relatively limited use portion comprising a second feature; wherein
   the first feature and the second feature are combined; and
   activating the relatively limited use portion by the relatively unlimited use portion
   is inhibited when the first feature is not mechanically compatible with the second feature.

2. A system for conditionally activating a cartridge, the system comprising:
   a cartridge including a projectile and a first feature;
   an activator including a second feature; and
   a station that receives the cartridge; wherein:
   the first feature and the second feature do not participate in removal of the cartridge
   from the station;
   an interference of the first feature and the second feature positions the activator a
distance away from the cartridge thereby inhibiting the activator from activating the
   cartridge to launch the projectile; and
   in an absence of the interference, the activator activates the cartridge to launch the
   projectile away from the cartridge.

3. A system for conditionally activating a cartridge, the system comprising:
   a cartridge that includes a projectile, a removal structure, and a first feature;
   an activator that includes a second feature; wherein:
   the projectile has an axis of propulsion;
   the first feature is positioned closer to the axis than the removal structure is to the
   axis;
   an interference of the first feature and the second feature positions the activator a
distance away from the cartridge thereby inhibiting the activator from activating the
   cartridge; and
   in an absence of the interference, the activator activates the cartridge to launch the
   projectile away from the cartridge.
4. A system for conditionally activating a cartridge, wherein the cartridge includes a projectile, the system comprising:

   means for opposing a first feature of the cartridge with a second feature of an activator, wherein the first feature and the second feature are incompatible thereby resulting in an excess head space; and

   means for inhibiting the activating of the cartridge in accordance with the excess head space; wherein:

   activating the cartridge comprises launching the projectile from the cartridge; and

   the first feature and the second feature do not participate in removing the cartridge away from the activator.

5. A system for conditionally activating a cartridge, wherein the cartridge includes a projectile, the system comprising:

   means for opposing a first feature of the cartridge with a second feature of an activator, wherein the first feature and the second feature are incompatible thereby resulting in an excess head space; and

   means for inhibiting the activating of the cartridge in accordance with the head space; wherein:

   activating the cartridge comprises launching the projectile on an axis from the cartridge; and

   the first feature is positioned closer to the axis than a removal structure of the cartridge is to the axis.

6. A system for conditionally activating a cartridge, wherein a provided cartridge includes a projectile, the system comprising:

   means for nesting a first feature of the cartridge with a second feature of an activator thereby avoiding an excess head space; and

   means for activating the cartridge in accordance with the head space; wherein:

   activating the cartridge comprises launching the projectile from the cartridge; and

   the first feature and the second feature do not participate in removing the cartridge away from the activator.

7. A system for conditionally activating a cartridge, wherein a provided cartridge includes a projectile, the system comprising:

   means for nesting a first feature of the cartridge with a second feature of an activator thereby avoiding an excess head space; and
means for activating the cartridge in accordance with the head space; wherein:
activating the cartridge comprises launching the projectile on an axis from the
cartridge; and
the first feature is positioned closer to the axis than a removal structure of the
cartridge is to the axis.

8. A weapon for conditional operation with a provided cartridge, the weapon
comprising:
a breech that includes an activator and a first feature, the activating by the activator
being inhibited when the breech is not closed;
an extractor that detects whether the first feature when opposed by a second feature
of the cartridge is compatible with the second feature, and if not, blocking closing of the
breech.

9. A cartridge that is conditionally activated by a provided activator, the cartridge
comprising:
a projectile; and
a first feature; wherein:
the activator includes a second feature;
the first feature and the second feature do not participate in removal of the cartridge
away from the activator;
an interference of the first feature and the second feature positions the activator a
distance away from the cartridge thereby inhibiting the activator from activating the
cartridge; and
in an absence of the interference, the activator activates the cartridge to launch the
projectile away from the cartridge.

10. A cartridge comprising:
a wireless electrified projectile;
a percussion fired pyrotechnic propellant for propelling the projectile; and
a base to receive a firing pin of a provided activator for percussion fired activation;
wherein
the base includes a protrusion feature that causes excess head space if an attempt is
made to use the cartridge with the activator that does not include a suitable recess feature
to nest the protrusion.

11. A cartridge comprising:
a wire-tethered projectile that includes an electrode; an electrically fired pyrotechnic propellant in combination with a compressed gas propellant to propel the projectile; an enclosure with contacts to receive a current for activation of the propellant; and a flat feature comprising omission of a sufficient recess feature to cause failure of coupling when an attempt is made to couple the cartridge and an activator that has a protrusion feature.

12. A cartridge that is conditionally activated by a provided activator, the cartridge comprising:

a projectile; a removal structure; and a first feature; wherein:

the activator includes a second feature; the first feature is positioned closer to an axis than the removal structure is to the axis;
a interference of the first feature and the second feature positions the activator a distance away from the cartridge thereby inhibiting the activator from activating the cartridge; and

in an absence of the interference, the activator activates the cartridge to launch the projectile on the axis away from the cartridge.

13. A method performed by a system for conditioning activation of a cartridge on excess head space, wherein activation of the cartridge launches a projectile from the cartridge, the method comprising:

opposing a first feature of a cartridge with a second feature of an activator, wherein:

the first feature does not participate in removing the cartridge away from the activator; and

the first feature and the second feature are incompatible thereby resulting in excess head space; and

inhibiting activation of the cartridge.

14. A method performed by a system for conditioning activation of a cartridge on excess head space, wherein activation of the cartridge launches a projectile on an axis from the cartridge, the method comprising:
opposing a first feature of a cartridge with a second feature of an activator,
wherein:

the first feature is positioned closer to the axis than a removal structure of
the cartridge is to the axis; and

the features are incompatible thereby resulting in excess head space; and

inhibiting activation of the cartridge.

A method for conditional activation of a relatively limited use portion of a system,
the method performed by a relatively unlimited use portion of the system, the method
comprising:

attempting to combine the relatively limited use portion of the system with the
relatively unlimited use portion of the system;

detecting an incompatibility between respective features of the relatively limited
use portion of the system and the relatively unlimited use portion of the system; and

inhibiting activation of the relatively limited use portion of the system on condition
of incompatibility.

A method performed by an extractor of a breech loaded weapon with respect to a
cartridge loaded in the breech when the breech is open and activated when the breech is
closed, the method comprising:

detecting a failure of a first feature of the cartridge to nest with a second feature of
the bolt or breech block of the weapon; and

in response to detecting, blocking the breech from closing.

A method comprising:

manufacturing at least one of a relatively limited use portion of a system and a
relatively unlimited use portion of the system in accordance with at least one of a first
definition and a second definition, for limited interoperability; wherein

the first definition defines a multiplicity of first sets of features each set for a
respective type of relatively limited use portion of the system by associating each set with
a selection of particular structural and/or functional aspects of alternative relatively limited
use portions of the system;

the second definition defines a second set of features for a type of relatively
unlimited use portion of the system wherein operability of a particular relatively limited
use portion of the system with a particular relatively unlimited use portion of the system
depends on compatibility of a feature of the first set and a feature of the second set;
each feature of any first set and each feature of the second set comprises at least one of a protrusion, a recess, and an omission of a protrusion; and compatibility results from protrusion-recess nesting.

18. The invention of any preceding claim wherein the relatively limited use portion comprises a cartridge.

19. The invention of any preceding claim wherein the relatively limited use portion comprises a projectile.

20. The invention of any preceding claim wherein the relatively limited use portion comprises a signal generator.

21. The invention of any preceding claim wherein the relatively limited use portion comprises a wire-tethered electrode.

22. The invention of any preceding claim wherein the relatively unlimited use portion comprises a signal generator for electric control of the target.

23. The invention of any preceding claim wherein the relatively unlimited use portion comprises a weapon.

24. The invention of any preceding claim wherein the relatively unlimited use portion is operative for deploying non-lethal force.

25. The invention of any preceding claim wherein the projectile is operative for deploying non-lethal force.

26. The invention of any preceding claim wherein the first feature comprises at least one of:

   a flat;
   an omission of a protrusion;
   a recess;
   a protrusion;
   a flat that is symmetric about an axis of symmetry of the cartridge;
   an omission of a protrusion that is symmetric about an axis of symmetry of the cartridge;
   a recess that is symmetric about an axis of symmetry of the cartridge;
   a protrusion that is symmetric about an axis of symmetry of the cartridge;
   a serial code unit;
   a serial code unit arranged on a perimeter of a polygon;
   a serial code unit arranged on a circumference of a circle;
a serial code unit in accordance with a symbol grammar;
a serial code unit in accordance with a symbol grammar including at least two of a flat, a protrusion, and a recess; and
a first track and a second track that is concentric with the first track.

27. The invention of any preceding claim wherein the first feature further comprises at least one of:
a width boundary zone;
a depth boundary zone; and
a height boundary zone.

28. The invention of any preceding claim wherein a first feature for incompatibility detection is located on any one or more of the following:
a surface proximate to a percussion primer of the cartridge;
a surface proximate to a contact for a firing current that activates the cartridge;
a surface on a base of the cartridge;
a surface proximate to an axis of symmetry of the cartridge;
a surface of a hull of the cartridge;
the activator;
a bolt;
a breech block;
a chamber;
a receiver;
the station;
the positioning mechanism;
the coupler;
the removing mechanism; and
an ejector.

29. The invention of any preceding claim wherein the second feature comprises at least one of:
a flat;
an omission of a protrusion;
a recess;
a protrusion;
a flat that is symmetric about an axis of symmetry of the cartridge;
an omission of a protrusion that is symmetric about an axis of symmetry of the cartridge;

a recess that is symmetric about an axis of symmetry of the cartridge;
a protrusion that is symmetric about an axis of symmetry of the cartridge;
a serial code unit;
a serial code unit arranged on a perimeter of a polygon;
a serial code unit arranged on a circumference of a circle;
a serial code unit in accordance with a symbol grammar;
a serial code unit in accordance with a symbol grammar including at least two of a flat, a protrusion, and a recess; and

a first track and a second track that is concentric with the first track.

30. The invention of any preceding claim wherein the second feature further comprises at least one of:

a width boundary zone;
a depth boundary zone; and
a height boundary zone.

31. The invention of any preceding claim wherein a second feature for incompatibility detection is located on any one or more of the following:

a surface proximate to a percussion primer of the cartridge;
a surface proximate to a contact for a firing current that activates the cartridge;
a surface on a base of the cartridge;
a surface proximate to an axis of symmetry of the cartridge;
a surface of a hull of the cartridge;
the activator;
a bolt;
a breech block;
a chamber;
a receiver;
the station;
the positioning mechanism;
the coupler;
the removing mechanism; and
an ejector.
32. The invention of any preceding claim wherein activating is inhibited by at least one of:

- blocking an operation of an activator;
- decoupling a trigger from the activator;
- blocking operation of a trigger;
- blocking operation of a firing pin;
- shunting a current otherwise used for activation;
- blocking a current otherwise used for activation;
- decoupling the activator from the station;
- separating the station from the activator;
- blocking operation of a coupler;
- blocking movement between the cartridge and a breech block and/or bolt of the station that would otherwise locate such against the cartridge;
- blocking the cartridge from being enclosed;
- interrupting receiving by a station of the relatively limited use portion;
- blocking an operation of the station;
- introducing a mechanical interference such as an abutment or a friction that interferes with attaining a position of the station such as a closed position of the station;
- blocking closure of the station to enclose the cartridge;
- blocking closure of the station;
- assuring the presence of excess head space during an attempted activation;
- returning a station to an open position; and
- initiating removing of the relatively limited use portion from the relatively unlimited use portion.

33. The invention of any preceding claim wherein combining comprises at least one of:

- coupling the relatively limited use portion of the system to a station;
- positioning the relatively limited use portion of the system with respect to an activator;
- opposing the respective features;
- orienting the first pattern with respect to the second pattern;
- orienting the first pattern with respect to an indexing structure;
- orienting an indexing structure of an activator with an indexing structure of a cartridge;
orienting an indexing structure of a relatively unlimited use portion of the system
with an indexing structure of a relatively limited use portion of the system;
accepting a cartridge;
receiving a cartridge;
supporting a cartridge prior to positioning the cartridge with respect to an activator;
holding a cartridge for later activation;
aligning a cartridge with respect to an axis of symmetry that is common to the
activator and the cartridge; and
using an ejector to grasp the cartridge.

34. The invention of any preceding claim wherein the cartridge has a symmetry about
an axis of symmetry.
35. The invention of any preceding claim wherein each feature of a plurality of features
of the cartridge has a respective radius about the axis of symmetry.
36. The invention of any preceding claim wherein each feature of a plurality of features
of the activator has a respective radius about an axis of symmetry of the activator.
37. The invention of any preceding claim wherein a height of a protrusion feature is
less than a depth of an opposing recess feature.
38. The invention of any preceding claim wherein at least a first portion of a feature
has a first height or depth and a second portion of the feature has a second height or depth.
39. The invention of any preceding claim wherein a height of a protrusion feature is at
least 30/1000 of an inch.
40. The invention of any preceding claim wherein a height of a protrusion feature is at
most 100/1000 of an inch.
41. The invention of any preceding claim wherein a depth of a recess feature is at least
30/1000 of an inch.
42. The invention of any preceding claim wherein a depth of a recess feature is at most
100/1000 of an inch.
43. The invention of any preceding claim wherein at least one of a height, a width, and
a depth of a feature that is symmetric about an axis of symmetry of the cartridge varies
about the axis of symmetry.
44. The invention of any preceding claim wherein nesting comprises absence of an
interference or incompatibility.
45. The invention of any preceding claim wherein an interference or incompatibility of a first feature and a second feature comprises at least one of:
   an abutment of at least a portion of the first feature against at least a portion of the second feature;
   a misalignment of the first feature with the second feature;
   a misalignment causing failure of nesting;
   a misalignment causing failure of indexing;
   a failure to index the first feature with respect to the second feature; and
   a failure to sufficiently rotate the cartridge about an axis of symmetry.

46. The invention of any preceding claim wherein the activator comprises at least one of a firing pin and an electrical contact.

47. The invention of any preceding claim wherein the cartridge further comprises a removal structure.

48. The invention of any preceding claim wherein the cartridge further comprises an indexing structure.

49. The invention of any preceding claim wherein the indexing structure has a symmetry about an axis of the cartridge.

50. The invention of any preceding claim wherein the cartridge further comprises an alignment structure.

51. The invention of any preceding claim wherein the alignment structure has a symmetry about an axis of the cartridge.

52. The invention of any preceding claim wherein at least one of the first feature and the second feature has a circular symmetry.

53. The invention of any preceding claim wherein the nonlethal force comprises electric control of the target.

54. The invention of any preceding claim wherein the nonlethal force halts locomotion of the target.

55. The invention of any preceding claim wherein the projectile comprises a signal generator.

56. The invention of any preceding claim wherein the projectile comprises a wire-tethered electrode.

57. The invention of any preceding claim wherein the projectile comprises at least one electrode that provides a current through a target to inhibit locomotion of the target.
58. The invention of any preceding claim wherein the system further comprises a coupler that detects the activator is positioned the distance away from the cartridge and that inhibits activation responsive to detecting.

59. The invention of any preceding claim wherein the system further comprises a coupler that conditionally couples the activator to the cartridge.

60. The invention of any preceding claim wherein the system further comprises a coupler that detects the activator is positioned the distance away from the cartridge.

61. The invention of any preceding claim wherein the system further comprises a guide that guides the launched projectile along a trajectory away from the system.

62. The invention of any preceding claim wherein the system further comprises a positioning mechanism that detects the activator is positioned the distance away from the cartridge and that responsive to detecting, inhibits activating the cartridge.

63. The invention of any preceding claim wherein the system further comprises a positioning mechanism that positions the cartridge in the station.

64. The invention of any preceding claim wherein the system further comprises a positioning mechanism that detects the activator is positioned the distance away from the cartridge.

65. The invention of any preceding claim wherein the system further comprises a positioning mechanism that detects the activator is positioned the distance away from the cartridge; and responsive to detecting, the removing mechanism removes the cartridge.

66. The invention of any preceding claim wherein the system further comprises a removing mechanism and the cartridge further comprises a removal structure, wherein the removing mechanism cooperates with the removal structure and removes the cartridge from the station.

67. The invention of any preceding claim wherein detecting is performed by one or more of:

- the activator;
- the coupler;
- the station;
- the positioning mechanism;
- the removing mechanism; and
- the ejector.
68. The invention of any preceding claim wherein detecting comprises opposing the respective features.

69. The invention of any preceding claim wherein detecting interference or incompatibility comprises detecting excess head space.

70. The invention of any preceding claim wherein opposing comprises combining the cartridge with a station of the system.

71. The invention of any preceding claim wherein a particular first set of features of the multiplicity of first sets comprises at least one of:
   - a recess associated with deployment of non-lethal force;
   - a recess at a first radius and a protrusion at a second radius associated with deployment of a non-lethal force; and
   - an omitted protrusion at a first radius and a recess at a second radius associated with deployment of a non-lethal force.

72. The invention of any preceding claim wherein a particular first set of features of the multiplicity of first sets comprises a recess associated with deployment of non-lethal force in association with an electrified projectile and at least one of:
   - percussion center fired;
   - short range;
   - barded electrodes;
   - no muzzle effect;
   - no wad effect;
   - fins for spin stabilization;
   - about a 30 second duration of current for electric control of the target; and
   - no telemetry between the weapon and the cartridge.

73. The invention of any preceding claim wherein a particular first set of features of the multiplicity of first sets comprises a recess at a first radius and a protrusion at a second radius associated with deployment of non-lethal force in association with an electrified projectile and at least one of:
   - percussion center fired;
   - medium range;
   - barbed electrodes;
   - flash muzzle effect;
   - tracer glare wad effect;
spin stabilization without fins;
retriggerable about a 30 second duration of current for electric control of the target;
telemetry for retriggering;
telemetry for controlling measurement of biometrics of the target; and
telemetry for receiving measured biometrics of the target.

74. The invention of any preceding claim wherein a particular first set of features of
the multiplicity of first sets comprises an omitted protrusion at a first radius and a recess at
a second radius associated with deployment of non-lethal force in association with an
electrified projectile and at least one of:
percussion center fired;
long range;
barbed electrodes;
no muzzle effect;
no wad effect;
spin stabilization without fins;
retriggerable about a 30 second duration of current for electric control of the target;
telemetry for control of audio sensed at projectile; and
telemetry for receiving audio sensed at projectile.

75. The invention of any preceding claim wherein a particular first set of features of
the multiplicity of first sets comprises a recess associated with deployment of non-lethal
force in association with a non-electrified projectile and at least one of:
warning flare;
short range; and
fins for spin stabilization.

76. The invention of any preceding claim wherein a particular first set of features of
the multiplicity of first sets comprises an omitted protrusion at a first radius and a recess at
a second radius associated with deployment of non-lethal force in association with a non-
electrified projectile and at least one of:
adapted for accuracy training;
adapted for missing practice;
medium range;
payload selected from marker, pepper spray, flash, bang report, flash and bang
report; and
spin stabilization without fins.

77. The invention of any preceding claim wherein a particular first set of features of the multiplicity of first sets comprises an omitted protrusion at a first radius and a recess at a second radius associated with deployment of non-lethal force in association with a non-electrified projectile and at least one of:
   bean bag assault;
   long range;
   payload selected from marker, pepper spray, flash, bang report, flash and bang report; and
   spin stabilization without fins.

78. The invention of any preceding claim wherein the second set of features comprises at least one of:
   a protrusion at a first radius for deployment of a non-lethal force;
   a protrusion at a first radius for deployment of a non-lethal force and no interoperability with deployment of lethal force;
   a protrusion at a first radius and a recess at a second radius for deployment of a non-lethal force;
   a protrusion at a first radius and a recess at a second radius for deployment of a non-lethal force and no interoperability with deployment of lethal force; and
   a recess at a second radius for interoperable deployment of lethal force and non-lethal force.

79. A weapon for conditional activation of a provided cartridge, the cartridge having a projectile and a first mechanical feature, the weapon comprising:
   a. means for opposing the first feature with a second mechanical feature of the weapon wherein, during opposing, mechanical interference between the first feature and the second feature results in an excess head space;
   b. means for inhibiting activating of the cartridge in response to the excess head space and, in the absence of excess head space, for activating the cartridge to launch the projectile from the cartridge; and
   c. means for removing the cartridge from the means for opposing, wherein the first feature does not facilitate removing.

80. The weapon of claim 79 wherein:
   a. the projectile has an axis of propulsion;
b. the cartridge further has a structure that facilitates removing the cartridge from the weapon; and

c. during opposing, the second feature is closer to the axis than the structure is to the axis.

81. The weapon of claim 79 wherein the second feature inhibits activation of a conventional cartridge that deploys a lethal force.

82. A weapon for conditional activation of a provided cartridge, the cartridge having a projectile and a first mechanical feature, the weapon comprising:

a. means for nesting the first feature with a second mechanical feature of the weapon thereby avoiding an excess head space;

b. means for activating the cartridge in absence of the excess head space, wherein activating comprises launching the projectile from the cartridge; and

c. means for removing the cartridge from the means for nesting, wherein the first feature does not facilitate removing.

83. The weapon of claim 82 wherein:

a. the projectile has an axis of propulsion;

b. the cartridge further has a structure that facilitates removing the cartridge from the weapon; and

 c. during nesting, the second feature is closer to the axis than the structure is to the axis.

84. The weapon of claim 82 wherein the second feature inhibits activation of a conventional cartridge that deploys a lethal force.

85. A weapon for conditional activation of a provided cartridge, the cartridge having a projectile and a first mechanical feature, the weapon comprising:

a. an activator;

b. a second mechanical feature; and

c. a station that positions the cartridge so that the first feature opposes the second feature; wherein

d. on condition that the first feature does not mechanically interfere with the second feature, the activator activates the cartridge to launch the projectile from the cartridge;

e. on condition that the first feature mechanically interferes with the second feature resulting in an excess head space, the activator, in response to the excess head space, is inhibited from activating the cartridge; and
f. the first feature and the second feature do not participate in removal of the
cartridge from the station.

86. The weapon of claim 85 wherein:
   a. the projectile has an axis of propulsion;
   b. the cartridge further has a structure that facilitates removing the cartridge from
      the weapon; and
   c. when the first feature opposes the second feature, the second feature is closer to
      the axis than the structure is to the axis.

87. The weapon of claim 85 wherein the second feature inhibits activation of a
    conventional cartridge that deploys a lethal force.

88. The weapon of claim 85 wherein the activator comprises a firing pin.

89. The weapon of claim 85 wherein the activator comprises an electrical contact for
    conducting a current through the cartridge.

90. The weapon of claim 85 wherein the activator comprises the second feature.

91. The weapon of claim 85 wherein the activator comprises a breech block comprising
    the second feature.

92. The weapon of claim 85 wherein the station comprises the second feature.

93. The weapon of claim 85 wherein the station comprises a breech block comprising the
    second feature.

94. The weapon of claim 85 wherein the station comprises a bolt comprising the second
    feature.

95. The weapon of claim 85 wherein the station comprises a chamber comprising the
    second feature.

96. The weapon of claim 85 further comprising a receiver that receives the cartridge for
    activation, the receiver comprising the second feature.

97. The weapon of claim 85 further comprising a positioning mechanism that positions the
    cartridge with respect to the activator, wherein the positioning mechanism comprises the
    second feature.

98. The weapon of claim 85 further comprising a removing mechanism that removes the
    cartridge from the weapon, wherein the removing mechanism comprises the second
    feature.

99. A weapon for conditional activation of a provided cartridge, the cartridge having a first
    mechanical feature, the weapon comprising:
a. an activator;
b. a second mechanical feature; and
c. a station for positioning the cartridge so that the first feature opposes the second feature; wherein

d. the station has an open position and a closed position;
e. on condition that the first feature does not mechanically interfere with the second feature, the activator activates the cartridge to launch the projectile from the cartridge; and
f. on condition that the first feature mechanically interferes with the second feature resulting in an excess head space, the station, in response to the excess head space, is blocked from attaining the closed position.

100. The weapon of claim 99 wherein the second feature inhibits activation of a conventional cartridge that deploys a lethal force.

101. The weapon of claim 99 further comprising an extractor that detects whether the first feature interferes with the second feature.

102. The weapon of claim 99 further comprising an ejector that detects whether the first feature interferes with the second feature.

103. The weapon of claim 99 wherein the second feature consists essentially of a protrusion having a height.

104. The weapon of claim 103 wherein the height is at least 30/1000 of an inch.

105. The weapon of claim 103 wherein the height is at most 100/1000 of an inch.

106. The weapon of claim 99 wherein the second feature consists essentially of a recess having a depth.

107. The weapon of claim 106 wherein the depth is at least 30/1000 of an inch.

108. The weapon of claim 106 wherein the depth is at most 100/1000 of an inch.

109. The weapon of claim 99 wherein the second feature is symmetric about an axis.

110. The weapon of claim 99 wherein the mechanical interference comprises at least one of an abutment of at least a portion of the second feature against at least a portion of the first feature, and a misalignment of the second feature with the first feature.

111. The weapon of claim 99 wherein the activator comprises a firing pin.

112. The weapon of claim 99 wherein the activator comprises an electrical contact for conducting a current through the cartridge.

113. A method performed by a weapon for conditional activation of a cartridge, the cartridge having a projectile and a first mechanical feature, the method comprising:
opposing the first feature with a second mechanical feature of an activator of the weapon wherein, during opposing, mechanical interference between the first feature and the second feature results in an excess head space;

inhibiting activating of the cartridge in response to the excess head space and, in the absence of excess head space, activating the cartridge to launch the projectile from the cartridge; and

removing the cartridge from the weapon, wherein removing does not involve the first feature.

114. The method of claim 113 wherein inhibiting comprises blocking an operation of an activator of the weapon.

115. The method of claim 113 wherein inhibiting comprises blocking an operation of a trigger of the weapon.

116. The method of claim 113 wherein inhibiting comprises blocking an operation of a firing pin of the weapon.

117. The method of claim 113 wherein inhibiting comprises blocking a current used for activation.

118. The method of claim 113 wherein inhibiting comprises blocking an operation of a coupler of the weapon.

119. The method of claim 113 wherein inhibiting comprises blocking an operation of a station of the weapon.

120. The method of claim 113 wherein inhibiting comprises blocking an operation of a bolt of the weapon.

121. The method of claim 113 wherein inhibiting comprises decoupling an activator of the weapon from a station of the weapon.

122. The method of claim 113 wherein inhibiting comprises removing the cartridge from the weapon.

123. A method performed by a weapon for conditional activation of a cartridge, the cartridge having a projectile and a first mechanical feature, the method comprising:

nesting the first feature with a second feature of an activator of the weapon thereby avoiding an excess head space;

activating the cartridge in accordance with the head space, wherein activating comprises launching the projectile from the cartridge; and
removing the cartridge from the weapon, wherein removing does not involve the first feature.

124. A method performed by a weapon for conditional activation of a cartridge, the cartridge having a projectile and a first mechanical feature, the method comprising:

- detecting whether the first feature and a second mechanical feature of the weapon cooperate to cause an excess head space;
- inhibiting activating of the cartridge on condition of detecting the excess head space;
- activating the cartridge to launch the projectile from the cartridge on condition of detecting an absence of excess head space; and
- removing the cartridge from the weapon, wherein removing does not involve the first feature.

125. The method of claim 124 wherein detecting comprises attaining, by a removing mechanism of the weapon, a first position in the absence of excess head space and attaining a second position as a result of excess head space, the removing mechanism for removing the cartridge from the weapon.

126. The method of claim 124 wherein detecting comprises attaining, by a coupler of the weapon, a first position in the absence of excess head space and attaining a second position as a result of excess head space, the coupler for coupling the cartridge to an activator of the weapon.

127. The method of claim 124 wherein detecting comprises attaining, by a positioning mechanism of the weapon, a first position in the absence of excess head space and attaining a second position as a result of excess head space, the positioning mechanism for positioning the cartridge with respect to an activator of the weapon.

128. The method of claim 124 wherein detecting comprises opposing the first feature and the second feature.

129. A cartridge for use with a first weapon, the first weapon comprising a first chamber, a first breech block having a protrusion into the first chamber, and a first firing pin that extends into the first chamber, and for use with a second weapon comprising a second chamber, a second breech block without protrusion, and a second firing pin that extends into the second chamber, the cartridge comprising:
a. a wireless electrified projectile for conducting a current through a human or animal
target, the current for interfering with locomotion by the target by causing contractions of
skeletal muscles of the target;
    b. a propellant for propelling the projectile; and
    c. a base for receiving the first firing pin when the cartridge is used with the first
weapon and for receiving the second firing pin when the cartridge is used with the second
weapon, receiving to activate the propellant; wherein
    d. the base includes a recess for nesting the protrusion before activation of the
propellant, the recess for avoiding an excess head space when the cartridge is used with the
first weapon.

130. A cartridge for use with a first weapon, the first weapon comprising a first chamber, a
first breech block having a recess, and a first firing pin that extends into the first chamber,
but not for use with a second weapon comprising a second chamber, a second breech block
without recess, and a second firing pin that extends into the second chamber, the cartridge
comprising:
    a. a wireless electrified projectile for conducting a current through a human or animal
target, the current for interfering with locomotion by the target by causing contractions of
skeletal muscles of the target;
    b. a propellant for propelling the projectile; and
    c. a base for receiving the first firing pin when the cartridge is used with the first
weapon, receiving to activate the propellant, and for avoiding the second firing pin when the
cartridge is used with the second weapon; wherein
    d. the base includes a protrusion for nesting the recess before activation of the
propellant, the protrusion for providing an excess head space when the cartridge is used with
the second weapon.

131. A cartridge for use with a weapon, the weapon comprising an activator for activating in
accordance with up to a maximum head space and comprising a first mechanical feature, the
cartridge comprising:
    a. a projectile;
    b. a base for cooperation with the activator to propel the projectile from the cartridge;
and
    c. a second mechanical feature that indicates a capability of the cartridge, wherein
d. the second feature, when opposed by an incompatible first feature, provides head space greater than the maximum head space thereby inhibiting activation;

e. the second feature, when opposed by a compatible first feature, does not provide head space equal to or greater than the maximum head space thereby permitting activation;

f. the second feature does not facilitate removal of the cartridge from the weapon.

132. The cartridge of claim 131 wherein:

a. the projectile has an axis of propulsion;

b. the cartridge further comprises a structure that facilitates removing the cartridge from the weapon; and

c. the second feature is closer to the axis than the structure for removing is from the axis.

133. The cartridge of claim 131 wherein the capability comprises deploying a non-lethal force.

134. The cartridge of claim 131 wherein the projectile comprises a signal generator for providing a current through tissue of a human or animal target.

135. The cartridge of claim 131 wherein the projectile comprises a wire-tethered electrode.

136. The cartridge of claim 131 wherein:

a. the cartridge further comprises a propellant for propelling the projectile; and

b. the base is responsive to a firing pin of the activator for activating the propellant.

137. The cartridge of claim 131 wherein:

a. the cartridge further comprises a propellant for propelling the projectile; and

b. the base is responsive to a current provided by the activator for activating the propellant.

138. The cartridge of claim 131 wherein the second feature consists essentially of a recess having a depth.

139. The cartridge of claim 138 wherein the depth is at least 30/1000 of an inch.

140. The cartridge of claim 138 wherein the depth is at most 100/1000 of an inch.

141. The cartridge of claim 131 wherein the second feature has a first portion and a second portion, wherein the first portion has a first dimension and wherein the second portion has a second dimension.

142. The cartridge of claim 131 wherein the second feature nests with the first feature when the second feature is compatible with the first feature.
143. The cartridge of claim 131 wherein the second feature the base comprises the second feature.

144. The cartridge of claim 131 wherein:
   a. the projectile has an axis of propulsion; and
   b. the second feature has a symmetry about the axis.

145. The cartridge of claim 144 wherein at least one of a height, a depth, or a width of the second feature varies about the axis.

146. The cartridge of claim 131 wherein the indicated cartridge capability describes a non-lethal force capability.

147. The cartridge of claim 131 wherein the indicated cartridge capability describes a range of deployment of the projectile.

148. The cartridge of claim 131 wherein the indicated cartridge capability describes a muzzle effect.

149. The cartridge of claim 131 wherein the indicated cartridge capability describes a wad effect.

150. The cartridge of claim 131 wherein the indicated cartridge capability describes a stabilization technique for the projectile.

151. The cartridge of claim 131 wherein the indicated cartridge capability describes an electrical function of the projectile.

152. The cartridge of claim 131 wherein the indicated cartridge capability describes an electrical control capability for controlling a target.

153. The cartridge of claim 131 wherein the indicated cartridge capability describes a telemetry capability of the projectile.

154. The cartridge of claim 131 wherein the indicated cartridge capability describes a projectile for accuracy training;

155. The cartridge of claim 131 wherein the indicated cartridge capability describes a payload of the projectile.
BEGIN

PREPARE THE STATION AND/OR THE ACTIVATOR

COMBINE THE CARTRIDGE WITH THE STATION

COMPATIBLE FEATURES?

Y

COUPLE THE CARTRIDGE TO THE ACTIVATOR

N

COMPATIBLE FEATURES?

N

INHIBIT ACTIVATION

Y

ACTIVATE THE CARTRIDGE

REMOVE THE CARTRIDGE FROM THE STATION

END

FIG. 3
FIG. 6
INTERNATIONAL SEARCH REPORT

International application No
PCT/US 08/83835

A CLASSIFICATION OF SUBJECT MATTER
IPC(8) - F42B 30/000 (2009.01)
USPC - 102/439

According to International Patent Classification (IPC) or to both national classification and IPC

B FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
USPC 102/439

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC 103/430, 431, 432, 439, 464, 501, 501, 86/19 5, 47 text limited

Electronic database consulted during the international search (name of data base and, where practicable, search terms used)
PUBWEST (PGPB.USPT.USOCEPAB.JPAB), Google Scholar
Search terms weapon, activating, cartridges, inhibiting, projectile

C DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
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<td>Y</td>
<td>US 2006/0207466 A1 (McNulty et al) 21 September 2006 (21 09 2006) Fig 1</td>
<td>10</td>
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<td>Y</td>
<td>US 4,193,335 A (Tassie) 18 March 1980 (18 03 1980), abstract and col 1, in 11-14 and 36-41</td>
<td>15</td>
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<td>US 2006/0185507 A1 (Trendall) 24 August 2006 (24 08 2006) Fig 2, para [0019]</td>
<td>129-130</td>
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<td>A</td>
<td>US 2006/0026884 A1 (Cerovic et al) 09 February 2006 (09 02 2006) Fig 1</td>
<td>1, 15, 17, 18</td>
</tr>
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<td>A</td>
<td>US 2006/0266209 A1 (Grabowski) 30 November 2006 (30 11 2006) Fig 3</td>
<td>1, 15, 17, 18</td>
</tr>
</tbody>
</table>

J Further documents are listed in the continuation of Box C

* Special categories of cited documents
  "A" document defining the general state of the art which is not considered to be of particular relevance
  "E" earlier application or patent but published on or after the international filing date
  "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  "O" document referring to an oral disclosure, use, exhibition or other means
  "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search 10 March 2009 (10 03 2009)

Date of mailing of the international search report 30 MAR 2009

Name and mailing address of the ISA/US
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Authorized officer Lee W Young
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PCT/GIP 571-272-7774

Form PCT/ISA/210 (second sheet) (April 2007)
INTERNATIONAL SEARCH REPORT

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [J] Claims Nos
   because they relate to subject matter not required to be searched by this Authority, namely

2. [J] Claims Nos
   because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically

3. [X] Claims Nos. Claims 19-78
   because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 64(a)

This International Searching Authority found multiple inventions in this international application, as follows:

Group I claims 1, 15, 17 and 18 directed to a system for conditional activating comprising activating a relatively limited use portion

Group II claims 2-5, 9, 12, 18, 79-81 directed to a system, cartridge and weapon for conditional activating a cartridge comprising an absence/inhabitance of interference and activating the cartridge

—Continued in Supplemental Sheet below—

1. [J] As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims

2. [ ] As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees

3. [X] As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos 1, 10-11, 15, 17, 18 and 129-130

4. [ ] No required additional search fees were timely paid by the applicant Consequently, this international search report is restricted to the invention first mentioned in the claims, it is covered by claims Nos

Remark on Protest

☐ The additional search fees were accompanied by the applicant’s protest and, where applicable, the payment of a protest fee

☒ The additional search fees were accompanied by the applicant’s protest but the applicable protest fee was not paid within the time limit specified in the invitation

☐ No protest accompanied the payment of additional search fees

Form PCT/ISA/210 (continuation of first sheet (2)) (April 2007)
Group III claims 6-7, 13, 18, 82-84 and 123 directed to a system and cartridge for conditional activating comprising means for nesting a first feature and second feature and activating the cartridge, thereby avoiding excess head space

Group IV claims 8 and 18 directed to a weapon for conditional operation with a cartridge comprising a breech and an extractor

Group V claims 10-11, 18 and 129-130 directed to a cartridge comprising an electrified projectile and propellant

Group VI claims 14, 18, 85-122, 124-128 and 131-155 directed to a method performed by a system for conditioning activation of a cartridge comprising opposing a first feature with a second feature where the features are incompatible resulting in excess head space

Group VII claims 16 and 18 directed to a method performed by an extractor of a breach loaded weapon with respect to a cartridge comprising detecting a failure of a first feature and blocking the breach from closing.

The inventions listed as Groups I-VII do not relate to a single general inventive concept under PCT Rule 13 1 because, under PCT Rule 13 2, they lack the same or corresponding special technical features for the following reasons:

Group I does not include the cartridge comprising an absence/inhabitance of interference and activating the cartridge as recited by Group II, nesting a first feature and second feature and activating the cartridge, thereby avoiding excess head space as recited by Group III, the breech and an extractor as recited by Group IV, the electrified projectile and propellant as recited by Group V, and the extractor of a breach loaded weapon with respect to a cartridge comprising detecting a failure of a first feature and blocking the breach from closing as recited by Group VII

Group II does not include conditional activating comprising activating a relatively limited use portion as recited by Group I, nesting a first feature and second feature and activating the cartridge, thereby avoiding excess head space as recited by Group III, the breech and an extractor as recited by Group IV, the electrified projectile and propellant as recited by Group V, the opposing a first feature with a second feature where the features are incompatible resulting in excess head space or Group VI or the extractor of a breach loaded weapon with respect to a cartridge comprising detecting a failure of a first feature and blocking the breach from closing as recited by Group VII

Group III does not include conditional activating a cartridge comprising an absence/inhabitance of interference and activating the cartridge as recited by Group I, the cartridge comprising an absence/inhabitance of interference and activating the cartridge as recited by Group II, the breech and an extractor as recited by Group IV, the electrified projectile and propellant as recited by Group V, the opposing a first feature with a second feature where the features are incompatible resulting in excess head space or Group VI or the extractor of a breach loaded weapon with respect to a cartridge comprising detecting a failure of a first feature and blocking the breach from closing as recited by Group VII

Group IV does not include conditional activating a cartridge comprising an absence/inhabitance of interference and activating the cartridge as recited by Group I, the cartridge comprising an absence/inhabitance of interference and activating the cartridge as recited by Group II, nesting a first feature and second feature and activating the cartridge, thereby avoiding excess head space as recited by Group III, the electrified projectile and propellant as recited by Group V, or the extractor of a breach loaded weapon with respect to a cartridge comprising detecting a failure of a first feature and blocking the breach from closing as recited by Group VII

Group V does not include conditional activating a cartridge comprising an absence/inhabitance of interference and activating the cartridge as recited by Group I, the cartridge comprising an absence/inhabitance of interference and activating the cartridge as recited by Group II, nesting a first feature and second feature and activating the cartridge, thereby avoiding excess head space as recited by Group III, the electrified projectile and propellant as recited by Group IV, or the extractor of a breach loaded weapon with respect to a cartridge comprising detecting a failure of a first feature and blocking the breach from closing as recited by Group VII

Group VI does not include the conditional activating a cartridge comprising an absence/inhabitance of interference and activating the cartridge as recited by Group I, the cartridge comprising an absence/inhabitance of interference and activating the cartridge as recited by Group II, nesting a first feature and second feature and activating the cartridge, thereby avoiding excess head space as recited by Group III, the breech and an extractor as recited by Group IV, the electrified projectile and propellant as recited by Group V or the extractor of a breach loaded weapon with respect to a cartridge comprising detecting a failure of a first feature and blocking the breach from closing as recited by Group VII

Group VII does not include the conditional activating a cartridge comprising an absence/inhabitance of interference and activating the cartridge as recited by Group I, the cartridge comprising an absence/inhabitance of interference and activating the cartridge as recited by Group II, nesting a first feature and second feature and activating the cartridge, thereby avoiding excess head space as recited by Group III, the breech and an extractor as recited by Group IV, the electrified projectile and propellant as recited by Group V or the opposing a first feature with a second feature where the features are incompatible resulting in excess head space or Group VI

Groups M-VII share the technical feature of a cartridge. However, this shared technical feature does not represent a contribution over the prior art of US 6,269726 B1 to McNulty, Sr (7 August 2001), which teaches a multi-shot cartridge system (Abstract). As the above cartridge was known at the time, as evidenced by the teaching of McNulty, Sr, this cannot be considered a special technical feature that would otherwise unify the groups.

Groups III and IV share the technical feature of a head space. However, this shared technical feature does not represent a contribution over the prior art of US 5,829,180 A to Leiter (3 November 1998), which teaches headspace in a chamber (col 3, In 14-18) As the above headspace was known at the time, as evidenced by the teaching of Leiter, this cannot be considered a special technical feature that would otherwise unify the groups.

Groups I-VII therefore lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.