



(19) **United States**

(12) **Patent Application Publication**
Robb et al.

(10) **Pub. No.: US 2011/0168009 A1**

(43) **Pub. Date:** **Jul. 14, 2011**

(54) SEMIAUTOMATIC RIFLE WITH
DOWNWARD EJECTION

Publication Classification

(76) Inventors: **Eric P. Robb**, Arlington, TX (US);
Ronald R. Royce, Woodinville, WA
(US)

(21) Appl. No.: 12/752,623

(22) Filed: **Apr. 1, 2010**

Related U.S. Application Data

(63) Continuation-in-part of application No. 11/943,385, filed on Nov. 20, 2007, now abandoned.

(51) **Int. Cl.**

F41A 3/54 (2006.01)

F41A 3/12 (2006.01)

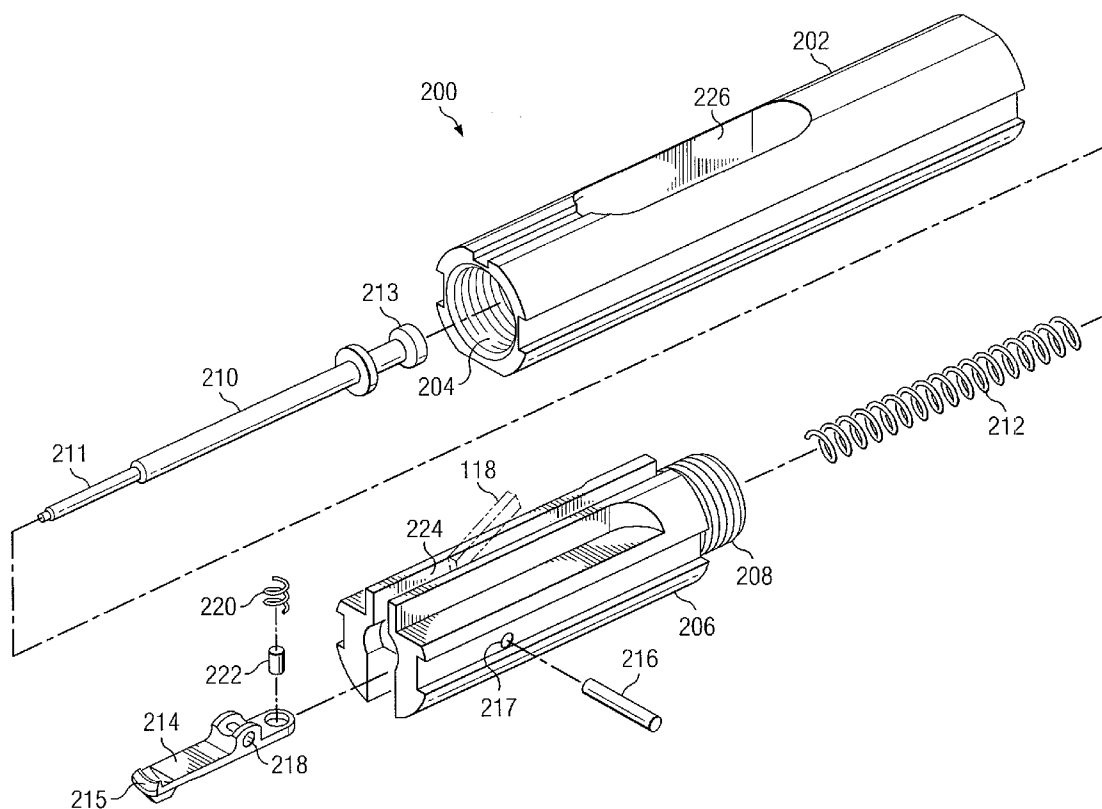
F41A 9/61 (2006.01)

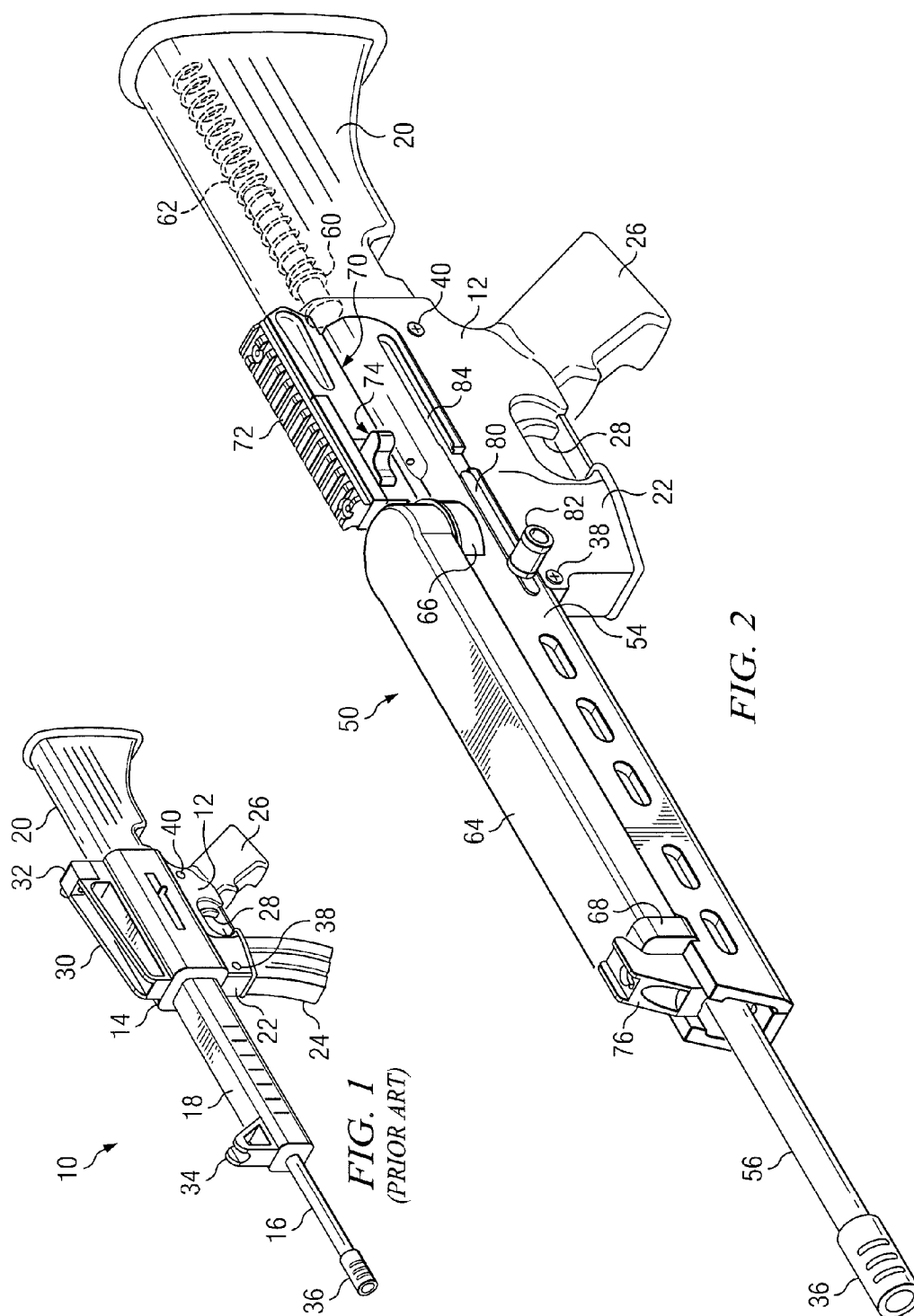
F41A 15/00 (2006.01)

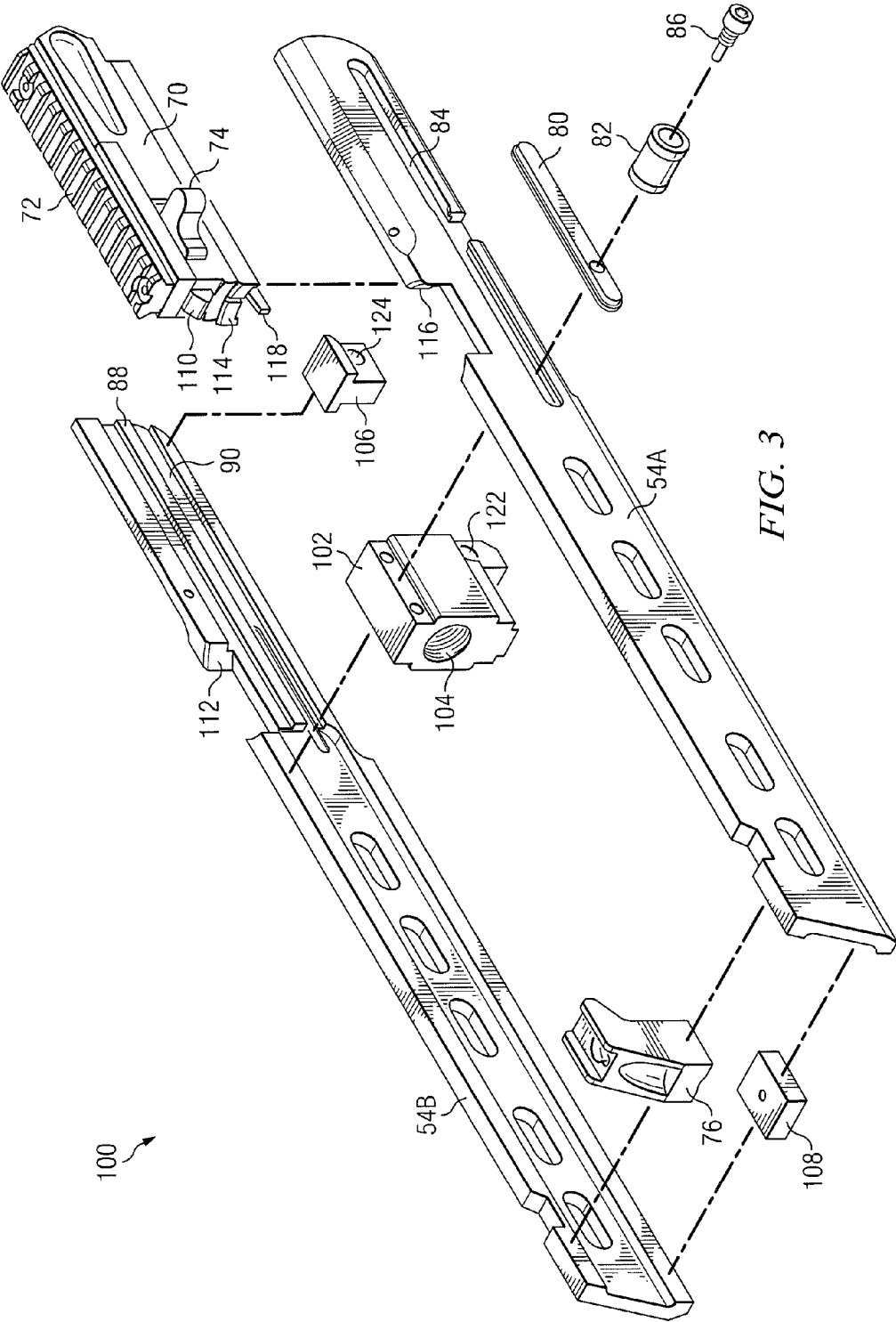
(52) **U.S. Cl.** **89/194; 89/125**

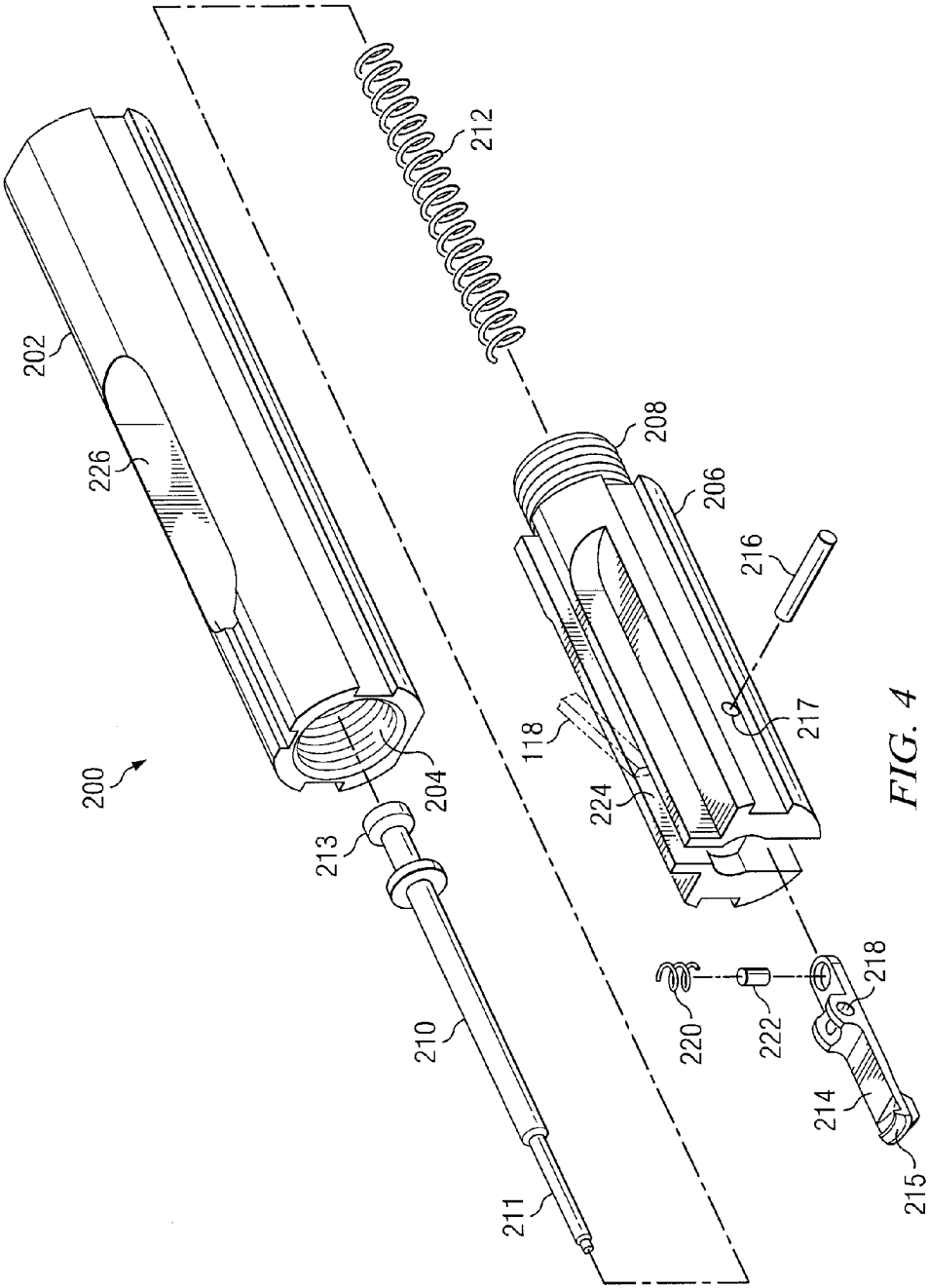
(57) **ABSTRACT**

A bolt assembly for a rifle is configured for recoil blowback operation and cooperation with a round of ammunition dispensed from a magazine into a firing chamber of the rifle. An extractor disposed in a lower, forward portion of the bolt assembly and an ejector disposed in an upper, forward portion of the bolt assembly further cooperate with the round of ammunition to extract a spent cartridge of the round of ammunition from the firing chamber and eject the spent cartridge downward from the firing chamber.









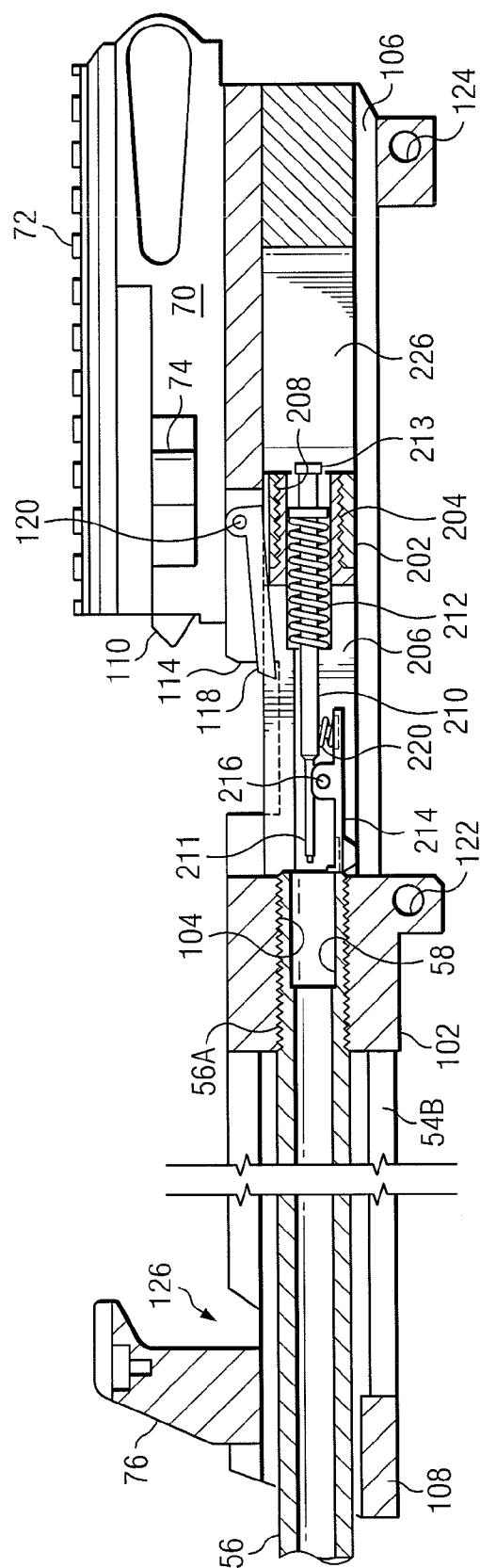
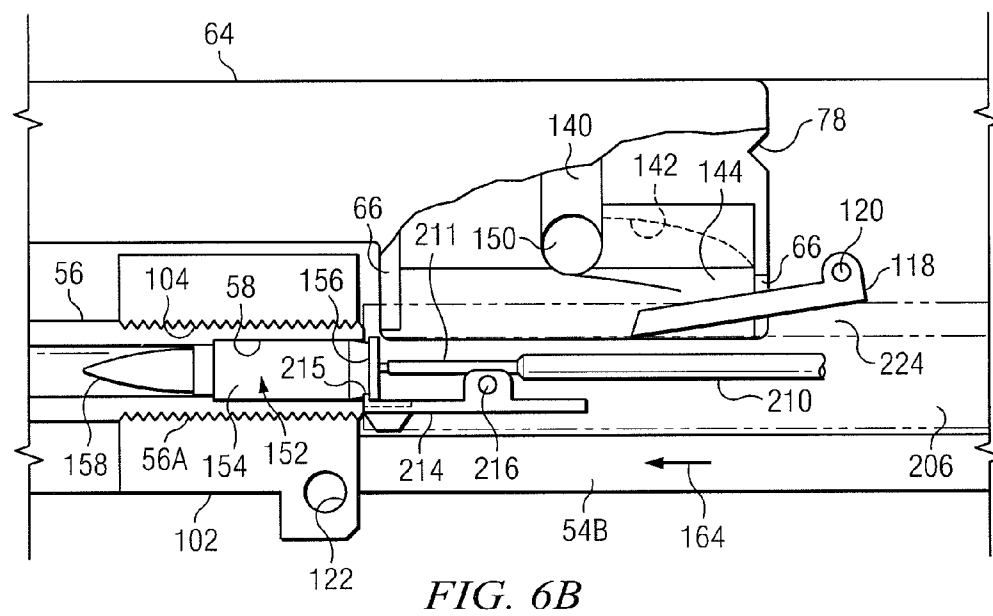
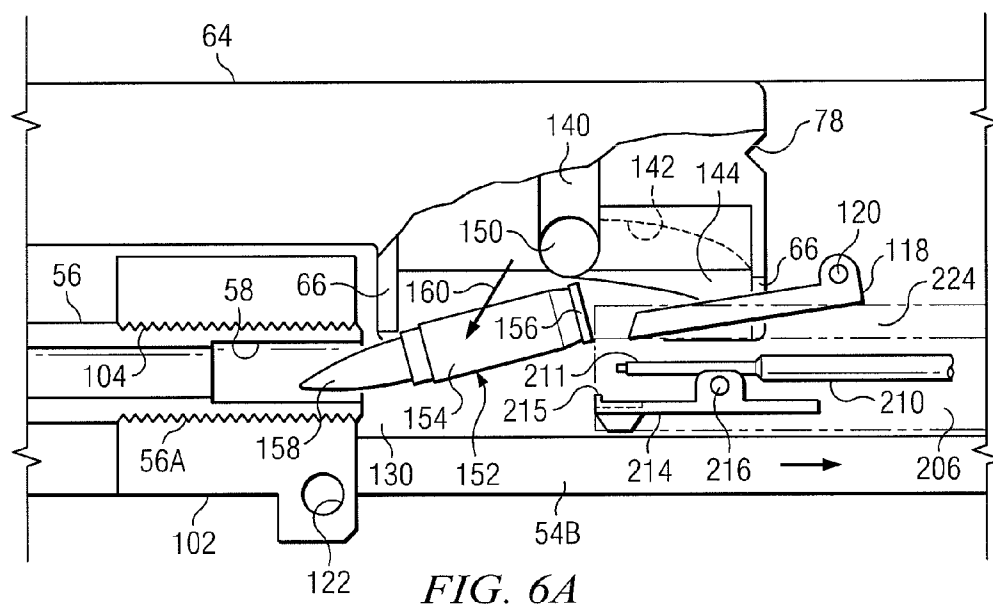


FIG. 5



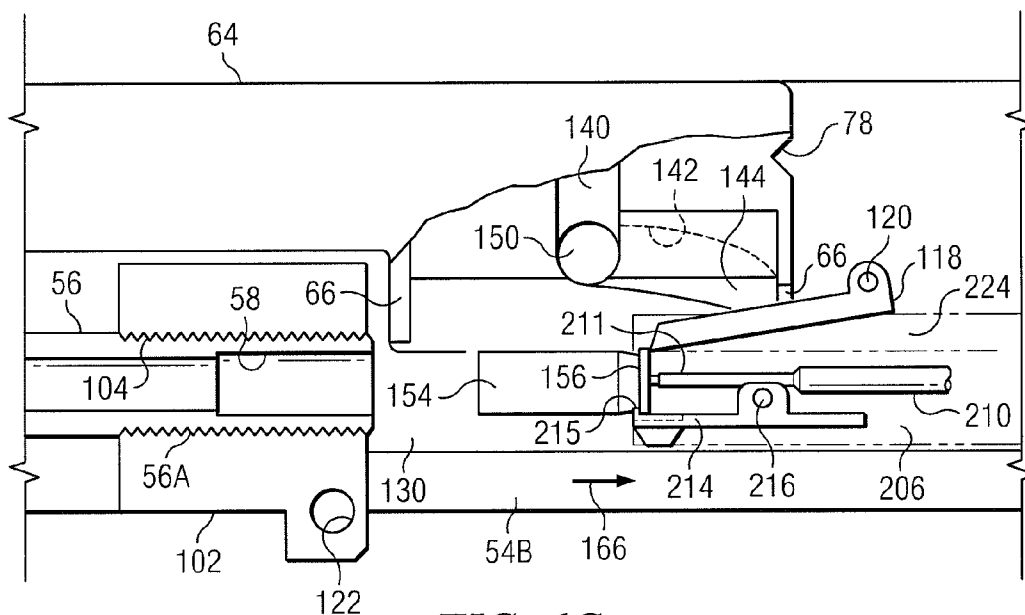


FIG. 6C

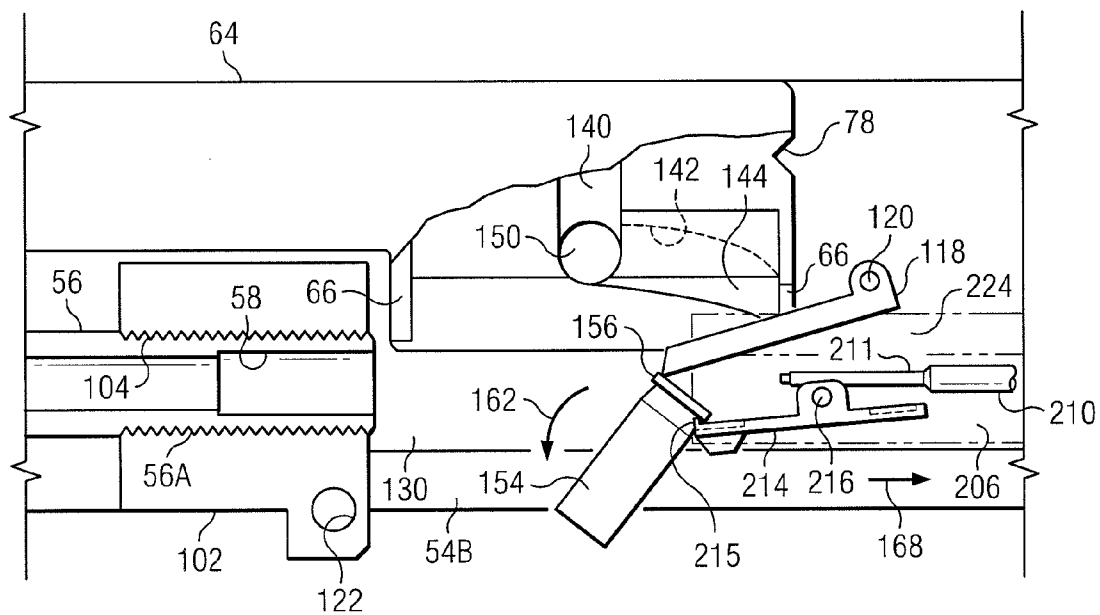
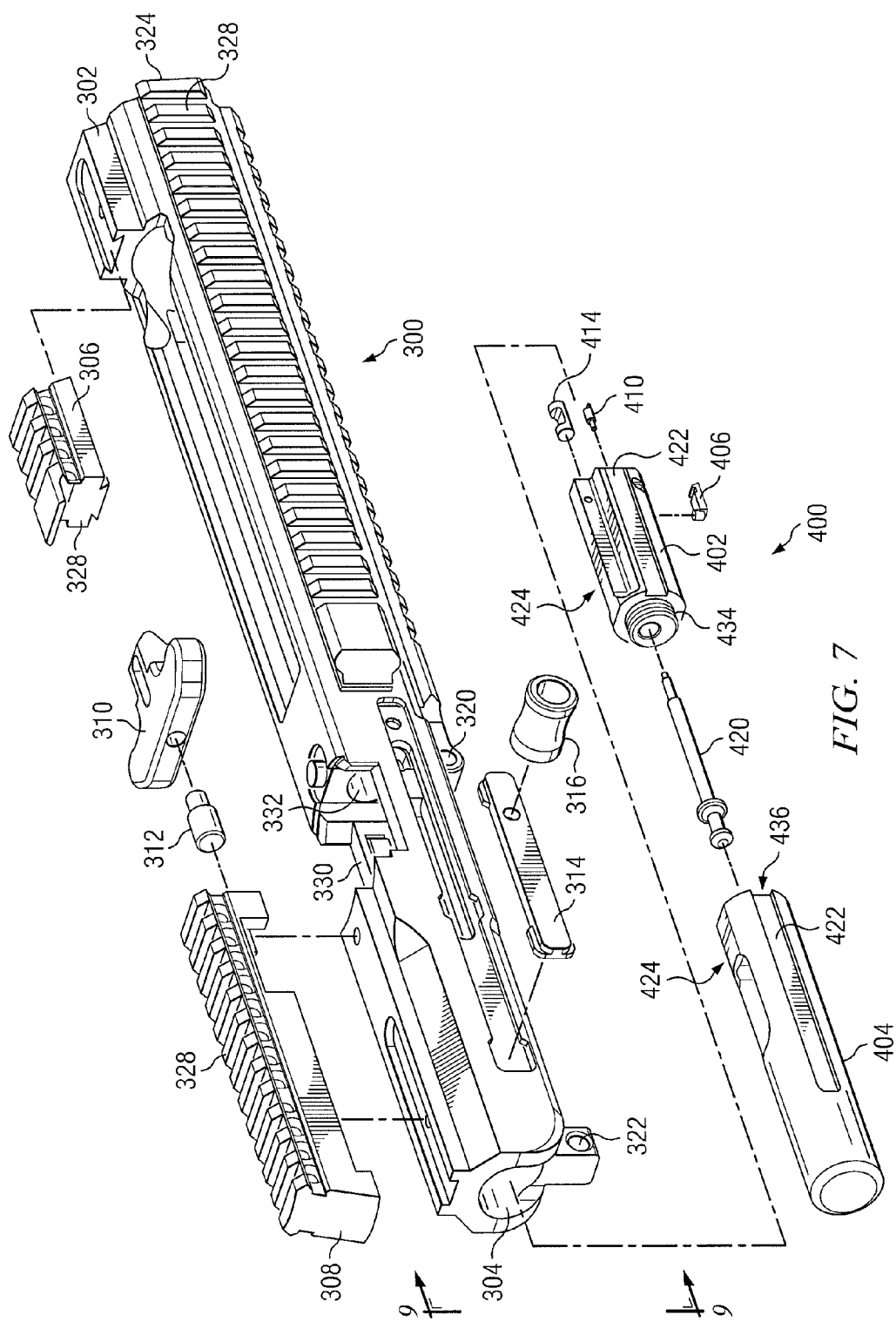


FIG. 6D



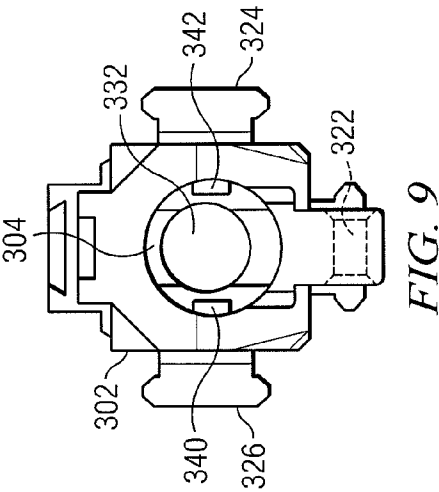
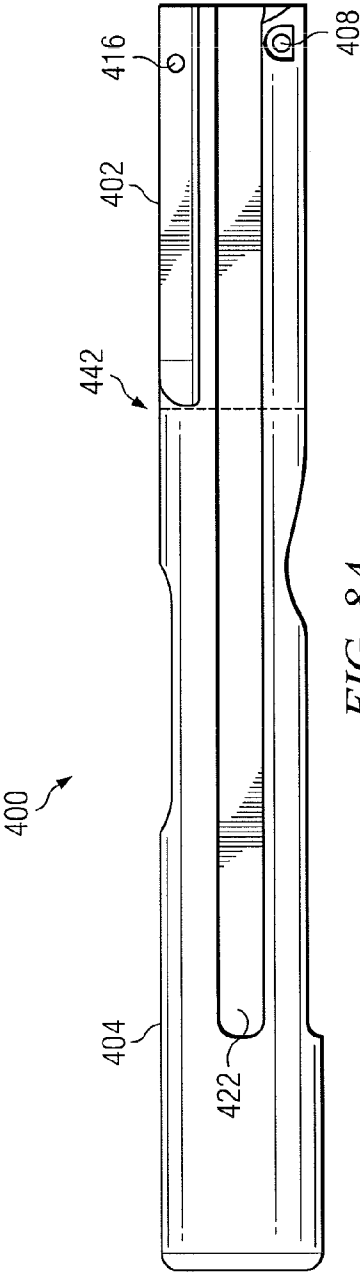


FIG. 8B

SEMI-AUTOMATIC RIFLE WITH DOWNWARD EJECTION

CROSS REFERENCE TO RELATED APPLICATION

[0001] The present U.S. patent application is a Continuation-In-Part of U.S. patent application Ser. No. 11/943,385 entitled "MAGAZINE CONVERSION FOR A SEMI-AUTOMATIC RIFLE," filed Nov. 20, 2007.

BACKGROUND OF THE INVENTION

[0002] The present invention generally relates to semiautomatic firearms and more particularly to apparatus and methods for converting an existing semiautomatic rifle such as an AR-15/M16 type firearm, for use with a horizontal, top-mounted cartridge magazine and from a direct gas impingement to straight blowback mechanism.

Background of the Invention and Description of the Prior Art

[0003] A well known example of a conventional semiautomatic rifle is the AR-15, also known by its military designation as the M16. The AR-15/M16 is characterized by its modular design and thus is susceptible to modifications for specific uses or with particular features to enhance some operational attribute. The AR-15 modules include a lower receiver and an upper receiver assemblies. The lower receiver generally includes a housing that contains such basic components as a trigger and hammer mechanisms, a magazine well for receiving a detachable transverse magazine from below the lower receiver, and a rearward extension that houses a recoil buffer assembly. The recoil buffer assembly is in turn contained within a buttstock that is typically attached to the lower receiver. The lower receiver housing also includes a pivot pin near its forward end and a takedown pin near its rearward end for attaching the upper receiver assembly thereto and securing it in a way that the two receiver assemblies may be detached from one another rapidly and without the use of tools. To disassemble them, one merely removes the pivot and takedown pins by pressing them from the holes in the lower receiver. The upper receiver generally includes a housing that encloses such basic components as the firing chamber, bolt assembly, an extractor mechanism to extract a spent shell, a charging handle, and a mechanism for attaching the barrel assembly to the upper receiver. The upper receiver housing also includes respective holes for the pivot pin and the takedown pin. For further details of the construction of an AR-15, the reader is referred to an exploded view entitled "AR-15-Type Rifle Exploded Diagram" available at www.fulton-armory.com, which drawing is incorporated herein by reference.

[0004] There are two types of operating mechanisms typically used in rifles, the direct gas impingement mechanism and the recoil or straight blowback mechanism. In the gas impingement type, the expanding gases released as the cartridge is fired are routed rearward through a tube disposed above the barrel into the bolt carrier to unlock the bolt by rotating it and forcing it rearward. This action also causes the ejection of the spent cartridge shell from the side of the rifle. In the recoil type, the expanding gases push rearward directly on the bolt, causing it to move rearward and enable the ejection of the spent cartridge shell. The AR-15/M16 employs the direct gas impingement mechanism. In both types, a spring-

loaded recoil buffer absorbs the recoil and then forces the bolt forward toward the chamber to secure the next round into the chamber after the round has been fed into the chamber.

[0005] In an AR-15/M16 type of semiautomatic rifle, the magazine is inserted from beneath the rifle into the magazine well that extends downward from the lower receiver portion of the rifle. When thus inserted, most of the magazine extends transversely to the longitudinal axis of the rifle, downward and outside of the well. Thus, if the magazine has a capacity of more than a dozen or so rounds, this transverse extension diminishes the compactness of the rifle making it unwieldy during use because it changes the center of gravity (i.e., the balance of the firearm) as the number of cartridges in the magazine varies, and because the magazine protrudes substantially below the rifle. An associated disadvantage of this design is that ejection of spent cartridges is out the side of the lower receiver, which increases the risk that an ejected cartridge may be ejected into an area where it could lead to injury of a person or a malfunction of nearby equipment. All three of these problems, the variable center of gravity, the compactness of the rifle, and the sideways ejection of cartridges, if solved, could substantially improve the utility and efficiency of the rifle.

[0006] In a search of the prior art, several patents disclose various ways to dispense rounds of ammunition from locations above or alongside the body of the firearm. U.S. Pat. No. 2,345,003 shows an early firearm having a tube disposed along the upper side of the barrel that allows extra cartridges to be readily available for hand loading into the breech of the firearm. This early design is not a true magazine because it does not participate in reloading a next round. U.S. Pat. No. 2,624,241 discloses a magazine assembly disposed alongside the barrel of a rifle that feeds a rotating transfer disk. The disk rotates under the action of an actuator when the bolt is moved rearward to receive a round from the magazine. As the bolt is moved forward when the trigger is released, the disk rotates again to align the round with the axis of the bolt and barrel and inject the round into position to be fired. U.S. Pat. No. 2,773,325 illustrates a horizontal magazine assembly mounted on the top of a rifle that feeds a fresh round into the breech by the same mechanism as disclosed in the '241 patent described previously. A disadvantage of these two patents is that the rotating transfer disk mechanism is relatively complex and therefore susceptible to malfunctions such as jamming of the mechanism during operation, particularly as the parts wear or become contaminated through use, thus possibly rendering the firearm inoperable or leading to injury to persons.

[0007] One patent that attempts to solve the drawbacks of the '325 and '241 patents is U.S. Pat. No. 4,336,742, which discloses a loader that dispenses cartridges from a port positioned midway between the ends of the loader to maintain the center of gravity as rounds are dispensed, and also balance the forces that move the rounds into position for insertion into the breech. However, the rounds are not dispensed in alignment with the barrel of the firearm. Another patent that addresses the jamming issue with the '241 and '325 patents is U.S. Pat. No. 4,905,394 for a top mounted horizontal magazine that eliminates the rotating mechanism by providing a helical transfer ramp leading from a storage area within the magazine into the breech that dispenses a next round under spring pressure when the spent cartridge is ejected from the breech. U.S. Pat. No. 5,239,911 discloses a grenade launcher having a top mounted magazine that also employs a rotating mechanism to align the next round with the barrel preparatory to

launching it. However, it is also relatively complex and suffers the same disadvantage as the '325 and '241 patents.

[0008] There is thus a need to solve the problems of a stable center of gravity, compactness, sideways ejection of cartridges, and reliability of operation of the AR-15/M16 type of semiautomatic rifle. Other problems to overcome would be to provide an affordable solution that is also simple to implement.

SUMMARY OF THE INVENTION

[0009] Accordingly, these and other problems are solved by a low cost conversion apparatus that exploits the modularity of the AR-15/M16 (hereinafter "AR-15") type of semiautomatic rifle to adapt an ammunition magazine to the AR-15 that arranges the rounds of ammunition along an axis that is essentially parallel to the longitudinal axis of the rifle instead of transverse to it thus providing a more compact, better balanced, and more maneuverable rifle. The conversion is made without altering the lower receiver module or its trigger mechanism. The resulting conversion ejects the spent cartridges downward instead of sideways for safer operation. Moreover, the conversion uses straight blowback operation instead of the direct gas impingement operation, a change that improves the reliability of the rifle.

[0010] In one embodiment an apparatus is disclosed for converting an AR-15/M16 type or other semiautomatic rifle from use of a transverse ammunition magazine to use of a longitudinal ammunition magazine, comprising: a bolt assembly configured for recoil blowback operation; an upper receiver having a first end and an opposed second end, said upper receiver having a firing chamber along its longitudinal axis, for receiving the rifle barrel in said first end therein and said bolt assembly in said second end therein, wherein said upper receiver is configured to attach to the lower receiver and buttstock assembly of said AR-15/M16 type rifle; and a longitudinal ammunition magazine having a transfer ramp disposed at a first end thereof, said longitudinal ammunition magazine attached along said upper receiver such that rounds of ammunition are dispensed into the firing chamber from above the firing chamber.

[0011] In another embodiment a method is disclosed for converting an AR-15/M16 type semiautomatic rifle from use of a transverse ammunition magazine to a longitudinal ammunition magazine, comprising the steps of: providing a modified bolt assembly configured for blowback operation; providing a modified upper receiver for receiving a rifle barrel in a first end therein and said modified bolt assembly in a second end therein, wherein the barrel and said bolt assembly are aligned on a common longitudinal axis; removing said upper receiver assembly, said transverse magazine, and an existing bolt assembly from the lower receiver assembly; installing a rifle barrel and said modified bolt assembly in said modified upper receiver; attaching said modified upper receiver with the rifle barrel and said modified bolt assembly to the lower receiver assembly of said AR-15/M16 type rifle; and attaching a longitudinal magazine having a transfer ramp disposed at a first end thereof to said modified upper receiver such that said longitudinal ammunition magazine is disposed to dispense rounds of ammunition into the firing chamber.

[0012] In another embodiment a semiautomatic rifle is disclosed, comprising: a standard AR-15/M16 lower receiver assembly having its standard transverse ammunition magazine removed from a magazine well of the lower receiver assembly; an upper receiver assembly adapted for attaching

to the lower receiver assembly via a takedown pin and a pivot pin, the upper receiver assembly further configured for straight blowback operation and ejection of spent cartridges downward through said magazine well; and a longitudinal ammunition magazine, mounted along the upper receiver assembly and configured to dispense cartridges via a transfer ramp into a firing chamber in the upper receiver.

[0013] A bolt assembly for a rifle configured for recoil blowback operation is disclosed, comprising a body having a first section for cooperating with a round of ammunition dispensed into a firing chamber of the rifle from a magazine; an extractor disposed in a lower, forward portion of the first section; and an ejector disposed in an upper, forward portion of the first section. The extractor and ejector cooperate with the round of ammunition to extract a spent cartridge of the round of ammunition from the firing chamber and eject the spent cartridge downward from the firing chamber.

[0014] In another aspect of the present invention, a bolt assembly for an upper receiver of an AR-15 type rifle configured for ejecting spent cartridges downward through a magazine well of the rifle is disclosed, comprising a bolt assembly having first and second guide rail tracks formed along respective first and second sides of the bolt assembly; an extractor disposed at least partially within a lower, forward end of the bolt assembly; and an ejector disposed at least partially within an upper, forward end of the bolt assembly and operative in cooperation with the extractor to eject the spent cartridge downward through the magazine well of said AR-15 type rifle when the rifle is fired.

[0015] In yet another aspect of the present invention, a semiautomatic rifle is disclosed, comprising a lower receiver assembly for a standard AR-15—type rifle having a magazine well disposed in its underside; an upper receiver assembly adapted for attaching to the lower receiver assembly and configured for ejection of spent cartridges downward through the magazine well of the lower receiver assembly; and an ammunition magazine detachably mounted upon the upper receiver assembly and configured to dispense cartridges into a firing chamber of the upper receiver.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] FIG. 1 illustrates a prior art semiautomatic rifle of the AR-15/M16 type;

[0017] FIG. 2 illustrates one embodiment of a semiautomatic rifle modified according to the present invention;

[0018] FIG. 3 illustrates an exploded view of a portion of an AR-57 upper receiver assembly according to the embodiment illustrated in FIG. 2;

[0019] FIG. 4 illustrates an exploded view of a bolt assembly for use in the embodiment illustrated in FIG. 3;

[0020] FIG. 5 illustrates a side elevation of a section along the centerline of the assembled upper receiver and bolt assembly for the embodiment of FIGS. 2, 3, and 4 according to the present invention;

[0021] FIG. 6A illustrates a side elevation of a portion of the section of FIG. 5 surrounding the firing chamber, showing a fresh round of ammunition entering the firing chamber;

[0022] FIG. 6B illustrates a side elevation of a portion of the section of FIG. 5 surrounding the firing chamber, showing the fresh round of ammunition in position for firing;

[0023] FIG. 6C illustrates a side elevation of a portion of the section of FIG. 5 surrounding the firing chamber, prior to ejection of a spent round of ammunition; and

[0024] FIG. 6D illustrates a side elevation of a portion of the section of FIG. 5 surrounding the firing chamber, as the spent cartridge is ejected downward.

[0025] FIG. 7 illustrates an exploded view of an alternative embodiment of an upper receiver and bolt assembly for an AR-15 type semiautomatic rifle according to the present invention;

[0026] FIG. 8A illustrates a side elevation view of an assembled bolt for use in the embodiment of FIG. 7;

[0027] FIG. 8B illustrates an enlarged view of a vertical cross section of a portion of the bolt assembly of FIG. 8A; and

[0028] FIG. 9 illustrates a cross section view of a rear portion of the upper receiver shown in FIG. 7.

DETAILED DESCRIPTION OF THE INVENTION

[0029] In the following description, many of the structural components appear in more than one of the figures and are assigned the same reference numbers for convenience. Further, the embodiment described is just one alternative that illustrates the concept of the invention that combines several standard structures with several new structures to enhance the utility of the combination and advance the state of the art as compared with the prior art apparatus. In developing the structures to implement the present invention, the following problems had to be solved. (1) Redesign the upper receiver and the bolt assembly for straight blowback operation instead of gas impingement operation. (2) Creating a firing chamber in the upper receiver that would utilize a revised bolt assembly but the existing trigger and hammer mechanism, firing pin, etc., and would also adapt to the top-mounted longitudinal cartridge. (3) Revise the ejection mechanism to eject spent shells downward instead of out the side of the rifle. (4) Revise the position and operation of the charging handle of the standard AR-15/M16. (5) Configure the upper receiver to accept and lock to the top-mounted longitudinal magazine. (6) Revise the structure for supporting and securing the barrel to the upper receiver. (7) Coordinate the solutions to these problems to work together reliably and smoothly to realize all of the benefits of the invention.

[0030] The solution to all of these problems involved changing the upper receiver and its internal parts, including the bolt assembly. The result is a novel and unobvious combination heretofore unavailable, despite the existence of a type of longitudinal ammunition magazine that could be utilized, until the insight by the present inventor, who conceived the new combination and the solutions to the above problems. As a conversion applied to one of the most popular firearms in present use, which provide a number of operational advantages, the invention is expected to meet a substantial need. While the illustrative example is described for converting an AR-15/M16 type rifle for use with the longitudinal ammunition magazine, it is readily susceptible to use on other semiautomatic or automatic firearm platforms.

[0031] FIG. 1 illustrates a prior art semiautomatic rifle 10 of the AR-15/M16 type before being disassembled to modify it according to the present invention. A lower receiver assembly 12 ("lower receiver 12," or "lower receiver section 12" herein) includes a buttstock 20, a magazine well 22, a pistol grip 26, and a trigger mechanism 28. A conventional magazine 24 is inserted in the magazine well 22 and extends downward therefrom. An upper receiver assembly 14 ("upper receiver 14," or upper receiver section 14" or "upper receiver section 54" herein) includes a barrel 16, a hand guard 18 that surrounds the barrel 16, and a handle portion 30 along the top

portion of the upper receiver 14. A rear sight assembly 32 is mounted at the rearward portion of the handle 30. A front sight assembly 34 is mounted atop the forward end of the hand guard 18. A flash suppressor 36 may be attached to the muzzle of the barrel 16. The upper receiver 14 is attached to the lower receiver 12 by a pivot pin 38 and a takedown pin 40, which are installed in corresponding holes through the body portions of the lower 12 and upper 14 receivers when they are assembled into position.

[0032] The modularity of the AR-15/M16 is exploited in the present invention to enable replacing the upper receiver with a different configuration that improves the functionality of the converted rifle. Use of the lower receiver of the AR-15/M16 without modification allows the use of its existing trigger and hammer mechanisms. As will be described, the upper receiver is redesigned to be compatible with the lower receiver as well as adapt anew way to dispense ammunition into the firing chamber of the rifle and a new way to eject spent cartridges from the firing chamber.

[0033] FIG. 2 illustrates one embodiment of a semiautomatic rifle modified according to the present invention. In brief, the modification replaces the upper receiver, barrel, bolt assembly, and magazine of the standard AR-15 with a conversion adapter called an AR-57 in which a new rifle barrel and a modified bolt assembly are installed. More importantly, the AR-57 upper receiver is configured to receive a standard longitudinal magazine along the top portion of the AR-57. The result is a more compact, well balanced, and more maneuverable semiautomatic rifle that improves recoil performance and ejects spent cartridges downward instead of sideways. The top-mounted, longitudinal magazine employed for illustration purposes herein is a standard type manufactured by Fabrique Nationale de Herstal of Belgium. This magazine is available from authorized distributors and retailers. The magazine accommodates 5.7×28 mm rounds, and is fully described in U.S. Pat. No. 4,905,394 issued to Predazzer, incorporated herein by reference in its entirety.

[0034] It will be appreciated that other implementations of a longitudinal magazine structure that stores the rounds of ammunition in an elongated container intended to be disposed on top of or alongside an upper receiver portion (or equivalent structure) of a semiautomatic rifle, or an automatic firearm in jurisdictions where such firearms are legal, may be used with the present invention. The rounds of ammunition may be stored transversely or longitudinally or in some other arrangement, as long as the rounds can be reliably introduced into the firing chamber in correct alignment as will be described. Moreover, the present invention is not limited to the use of the 5.7×28 mm ammunition, but may utilize any size or configuration or caliber ammunition consistent with the design and uses of the particular firearm that is subject to the type of conversion described and claimed herein.

[0035] Continuing with FIG. 2, the new combination, designated rifle 50, includes the original lower receiver section 12 and a new upper receiver section 54, secured together with a pivot pin 38 and a takedown pin 40. Thus, the upper receiver section 54 (or, "upper receiver 54" herein) includes a pivot pin hole and a takedown pin hole, both disposed transversely through the upper receiver (see the holes 122, 124 in FIG. 5) for securing the upper receiver 54 to the lower receiver 12 with a respective pivot pin 38 and a respective takedown pin 40. The pivot pin hole 122 and the takedown hole 124 are respectively disposed in the locations of the pivot pin 38 and the takedown pin 40. The pivot 38 and takedown 40 pins

shown in FIG. 2 are typically threadless pins that include features to retain them in position except when punched out from their respective bores with a simple tool such as a drift pin of a bullet of an unspent round of ammunition. The conversion is completed by installing the barrel 56 (perhaps with flash suppressor 36 attached) in the upper receiver 54 and by attaching the top-mounted, longitudinal magazine 64 to the upper portion of the upper receiver 54. The lower receiver includes the buttstock 20, magazine well 22, pistol grip 26, and the trigger mechanism 28. The trigger mechanism 28 includes a hammer (not shown for clarity) disposed within the lower receiver 12. Shown in phantom within the buttstock 20 is a buffer unit that includes a buffer assembly 60 and an action spring 62. The buffer unit is the same as used in a standard AR-15 in the illustrative example, but may be modified in certain other embodiments of the invention. The buffer assembly 60 is disposed in the buttstock 20 along the longitudinal axis thereof. The buffer assembly 60, 62 is preferably matched to the mass of the bolt assembly 200 (see FIG. 4) and the powder charge disposed in a round of ammunition, for acting in cooperation with the bolt assembly 200 during recoil to absorb recoil forces, thus providing a more stable, comfortable weapon in use. This matching or balancing of forces may be accomplished, for example, by adjusting the mass of the buffer assembly 60 or the tension in the buffer spring 62.

[0036] The upper receiver section 54 further includes a top rear main block 70 upon which is mounted an upper scope rail 72. The top rear main block 70 encloses a release mechanism (not shown) operated by a release lever 74. The release mechanism and lever 74 enable quick removal of the longitudinal ammunition magazine 64 (or, “magazine 64” herein) as will be explained. At the forward end of the upper receiver 54 is mounted a top front magazine block 76, which may also function as a support for a scope (not shown) or a front sight (not shown). The magazine 64 includes a cylindrical transfer case 66 disposed at the rearward end (or, a “first” end) of the magazine 64 that encloses the helical, ramp-like transfer passages to guide the rounds of ammunition 152 from the magazine 64 into the firing chamber of the rifle 50, as will be described. At the forward end (or, a “second” end) of the magazine 64 is an endbell 68 for enclosing the end of the magazine 64 and providing a structure for retaining the forward end of the magazine 64 in a fixed position upon the upper receiver 54, as will be described.

[0037] FIG. 3 illustrates an exploded view of a portion of an AR-57 upper receiver assembly according to the embodiment illustrated in FIG. 2. The AR-57 upper receiver assembly 100 replaces the original upper receiver 14 shown in FIG. 1. The AR-57 upper receiver assembly 100 is completely compatible with the original lower receiver 12, and it embodies the same features as the receiver 54 shown in FIG. 2 but in an exploded view to illustrate its component parts. The upper receiver 54 (upper receiver assembly 100 in FIG. 3) includes a left side plate 54A and a right side plate 54B. Assembled together, with several intermediate parts, they form the body of the upper receiver 54. The intermediate parts include a barrel mount block 102 that may have a threaded bore 104 for receiving a threaded male end of the barrel 56 therein, a lower rear mount block 106, and a lower front rail block 108. These intermediate parts may be captured between the left 54A and right 54B side plates of the receiver 54 upon assembly in the relative positions shown in FIG. 3. The components may be secured with pins, screws, or other fasteners, including adhesives. The barrel mount block 102 is positioned centrally, just

ahead of the firing chamber portion (to be described) of the upper receiver 54. The barrel mount block 102 also includes a transverse hole 122 in a lower portion thereof for the passage of the pivot pin 38 used to secure the upper receiver 54 to the lower receiver 12. Similarly, the lower rear mount block 106 also includes a transverse hole 124 in a lower portion thereof for the passage of the takedown pin 40 used to secure the upper receiver 54 to the lower receiver 12. The several component parts of the upper receiver assembly 100 may be fabricated (cast, with secondary machining operations) from an aluminum alloy such as A356. In some embodiments, light-weight synthetic materials may be used.

[0038] Another portion of the upper receiver assembly 100 shown in FIG. 3 is the top rear main block assembly formed of the top rear main block 70, an upper scope rail 72, and a release mechanism (not shown) operated by a release lever 74. The release lever 74 operates a spring-loaded magazine catch 110 that protrudes from the forward end of the block 70. The release mechanism for operating the magazine catch 110 operates the same as a door latch assembly. The magazine catch 110, instead of engaging a striker plate, engages a recess 78 (see FIGS. 6A through 6D) in the rear portion of the cylindrical transfer case 66 of the magazine 64. The installation of the magazine 64 in the upper receiver 54 will be described further in the description for FIG. 5.

[0039] Suspended from a pivot pin 120 (see FIG. 5) within a machined slot cut into the underside of the forward portion of the top rear main block 70 is an ejector 118. The ejector 118 is a lever that swings downward behind the upper rim of the cartridge portion of a round of ammunition 152 (see FIG. 6B) when the round 152 is present in the firing chamber 130 (see FIG. 6A-6D). The ejector 118, which may be spring loaded in some embodiments, is also shown in FIGS. 4, 5, and 6A-6D.

[0040] Two other features of the upper receiver assembly 100 appear in FIG. 3. In the upper edges of the left 54A and right 54B side plates, just rearward of the barrel mount block 102, the side plates are cut-out to make room for the cylindrical transfer case 66 of the longitudinal ammunition magazine 64 because the diameter of the transfer case is greater than the lateral width of the magazine 64. Thus, the surface 112 in the left side plate 54A and the surface 116 in the right side plate 54B, and the surface 114 in the forward end of the top rear main block 70 are provided, all of them cut to a radius slightly larger than the outer diameter of the cylindrical transfer case 66 of the magazine 64. Also shown in FIG. 3 is a cocking handle slide 80 and cocking handle 82, secured to the cocking handle slide 80 with a screw 84. This cocking handle assembly, which slides back and forth in the elongated opening 84 cut into the side of the left side plate 54A, replaces the conventional charging handle on an AR-15/M16 type semi-automatic rifle. The cocking handle 82 is coupled to the bolt assembly 200 to enable manually moving it rearward and then forward to set a fresh round of ammunition 152 into firing position in the firing chamber 130 (see FIG. 6A).

[0041] FIG. 4 illustrates an exploded view of a bolt assembly for use in the embodiment illustrated in FIG. 3. The bolt assembly 200 includes a rear section 202 and a front section 206, which connect together using the threaded female end 204 and the threaded male end 208. The two-section configuration permits the firing pin 210 and the firing pin spring 212 to be inserted and enclosed within a longitudinal bore formed through the bolt assembly 200. The firing pin 210 includes a reduced diameter forward end 211 that contacts the primer of the cartridge 154 (shown in FIG. 6B) when the trigger 28

(shown in FIG. 2) of the rifle is squeezed. The firing pin 210 also includes a head 213 against which the hammer portion of the trigger mechanism within the lower receiver 12 strikes the firing pin 210, causing the firing pin 210 to move forward to strike the primer to fire the rifle.

[0042] Suspended in a groove machined into the underside of the front section 206 of the bolt assembly 200 is an extractor 214. The extractor 214 is a spring-loaded lever having a forward end and a rearward end, and an upward-extending catch lip 215 formed at its forward end. The extractor pivots about a pivot pin 216 inserted through a transverse, horizontal hole 217 in the front section 206 of the bolt assembly 200. An extractor bias spring 220, and a damper 222 disposed within the spring 220, are positioned at the rearward end of the extractor 214 and just above it. The action of the bias spring 220 maintains the forward end of the extractor 214 in an upper position except when the bolt assembly 200 is in a forward-most position just after inserting a fresh round into the barrel (see the barrel 56 in FIG. 6B) of the rifle 50. When a fresh round of ammunition 152 is dispensed into the firing chamber 130 (see FIG. 6A), the lower rim of the cartridge bears downward on the forward end of the extractor 214 and engages the lip 215. After firing the rifle 50, the bolt assembly 200 moves rearward, pulling the extractor 214 and the spent cartridge 154 with it.

[0043] Several other features of the bolt assembly are shown in FIG. 4. In the topside of the front section 206 of the bolt assembly 200 is a machined groove 224 that allows the ejector 118 (see FIG. 3) to hang downward within the space traversed by the bolt assembly 200 as it moves forward and rearward respectively into and away from the firing chamber 130 (see FIG. 6A). The groove 224 is positioned so that the ejector 118 is in position to catch the upper edge of the rim 156 of an empty (spent) cartridge (shell) 154 as it and the bolt assembly 200 move rearward during the recoil motion that occurs after firing the rifle 50. This action tilts the open end of the cartridge 154 downward, rotating the cartridge 154 down and out through the empty magazine well 22 of the lower receiver 12. Another feature of the bolt assembly 200 is the opening 226 in the rear section 202 of the bolt assembly 200 that is provided so that the hammer, which pivots within the lower receiver 12 when the trigger 28 is squeezed, can move freely upward and forward toward the head 213 of the firing pin 210.

[0044] FIG. 5 illustrates a side elevation of a section along the longitudinal centerline of the assembled upper receiver and bolt assembly for the embodiment of FIGS. 2, 3, and 4 according to the present invention. In this view along the longitudinal centerline, which is common to the barrel 56, the bolt assembly 200, the firing chamber 130, and the buffer assembly 60, the right side plate 54B of the upper receiver 54 is shown, as are sectional views of the barrel 56, top rear main block 70, upper scope rail 72, top front magazine block 76, barrel mount block 102, lower rear mount block 106, lower front rail block 108, magazine catch 110, and the rear section 202 and front section 206 of the bolt assembly 200.

[0045] Other portions of the bolt assembly 200 are shown in FIG. 5 as a conventional side view to be described. The bolt assembly 200, with its component parts described in FIG. 4, is shown within the upper receiver 54 and in its forward-most position but without a round of ammunition 152 in place for clarity of the structures. The firing pin 210 and the firing pin spring 212 are shown in the position they would be in just before the head 213 of the firing pin 210 would be contacted

by the hammer portion of the trigger mechanism (not shown in FIG. 5, but see FIG. 2). The extractor 214 is shown suspended on its pivot pin 216 from the underside of the front section 206 of the bolt assembly 200. The extractor 214 is biased in the position shown, substantially parallel to the longitudinal axis of the upper receiver 54, by the action of the extractor bias spring 220. Also shown in FIG. 5 is the ejector 118, suspended from its pivot pin 120, with the forward end of the ejector 118 disposed into the groove 224 in the upper side of the front section 206 of the bolt assembly 200. As mentioned herein above, the ejector 118 is a lever that swings downward behind the upper rim 156 of the cartridge portion 154 of a round of ammunition 152 (see FIG. 6B) when the round of ammunition 152 is present in the firing chamber.

[0046] FIGS. 6A through 6D form a sequence of “snapshots” of the movement of a round of ammunition 152 from the longitudinal ammunition magazine 64 into the firing chamber 130 before firing the rifle (FIGS. 6A and 6B), and the movement of the spent cartridge 154 as it is extracted and ejected downward from the firing chamber 130 (6C and 6D) after firing. Many of the structural features appearing in FIGS. 6A through 6D have been described in conjunction with FIG. 5 and will not be repeated because the FIGS. 6A through 6D are likewise side views along the longitudinal centerline of the upper receiver 54 and firing chamber 130. In each of the “snapshots,” the bolt assembly 206 is shown in phantom to enable showing more clearly the active structures during movement of the round of ammunition 152 and the cartridge 154. Further, details of the structure and operation of the exemplary longitudinal ammunition magazine 64 are fully described and illustrated in the aforementioned U.S. Pat. No. 4,905,394, incorporated herein by reference in its entirety. In that reference, the path of the round of ammunition from its stored position in the magazine, which is transverse to the longitudinal axes of the magazine and the upper receiver, through its 90° rotation within the cylindrical transfer case (at the first end of the magazine) and into the firing chamber, is described. As viewed from the top side of the magazine, the rotation of the round of ammunition is clockwise (CW) into alignment with the firing chamber. The movement of the rounds within and from the magazine is caused by a spring (not shown herein, as it is clearly illustrated in the '394 patent) within the magazine.

[0047] FIG. 6A illustrates a side elevation of a portion of the section of FIG. 5 surrounding the firing chamber 130. The rearward portion of the longitudinal ammunition magazine 64 (also referred to herein as the “first end” of the longitudinal ammunition magazine 64) is shown cut away to illustrate the passage that the round of ammunition 152 traverses when moving from a stored position in the longitudinal ammunition magazine 64 into the firing chamber 130. The round 152, forced under the urging of a spring (not shown) within the longitudinal ammunition magazine 64 travels downward through the port 140 into the position 150, then proceeds to follow the ramp 142 toward the exit port 144, rotating into alignment with the longitudinal axis of the firing chamber 130, the barrel 56, and the upper receiver 54. FIG. 6A shows a fresh round of ammunition 152 exiting the exit port 144 of the cylindrical transfer case 66, and entering the firing chamber 130 as indicated by the arrow 160. The round of ammunition 152, shown as a cartridge 154 having a rim 156 and a bullet 158 is illustrated. Further, as shown in FIG. 4, the ejector 118 is in position within the groove 224, in preparation

to catch the upper part of the rim 156 of the cartridge 154 as it moves rearward after the round of ammunition 152 is fired.

[0048] FIG. 6B illustrates a side elevation of a portion of the section of FIG. 6A surrounding the firing chamber 130, showing the fresh round of ammunition 152 in position just after bolt assembly 206 has pushed the round of ammunition 152 into the barrel 56 in position to be fired. During this motion, the extractor 214 has engaged the lower part of the rim 156 of the cartridge 154. Further, the forward end 211 of the firing pin 210 is shown in position to strike the detonator or primer of the cartridge 152 when the trigger 28 is squeezed. The bolt assembly 206 is shown moving toward the forward end of its travel as indicated by the arrow 164.

[0049] FIG. 6C illustrates a side elevation of a portion of the section of FIG. 6B surrounding the firing chamber, after the round of ammunition 152 is fired and during the rearward movement 166 of the empty cartridge 154 as pulled by the extractor 214 with the bolt assembly 206, just as the upper part of the rim 156 of the cartridge 154 contacts the ejector 118. All other structures shown in FIG. 6C are as described in FIGS. 6A and 6B.

[0050] FIG. 6D illustrates a side elevation of a portion of the section of FIG. 6C surrounding the firing chamber 130, after the round of ammunition 152 is fired and during the downward rotation movement 162 of the empty cartridge 154 with the bolt assembly 206, just after the ejector 118 has caused the empty cartridge 154 to rotate as the lower part of the rim 156 of the empty cartridge 154 is pulled rearward by the extractor 214, and just before the momentum of the moving bolt assembly 206 that is imparted to the rotating empty cartridge 154 flings the empty cartridge 154 downward through the open magazine well 22. All other structures are as described for FIGS. 6A, 6B, and 6C.

[0051] The present invention is intended to be provided as a conversion assembly that includes the "AR-57" upper receiver assembly 54, the redesigned bolt assembly 200, and a redesigned barrel 56. Completing the conversion is the simple process of: (a) removing the pivot 38 and takedown 40 pins, by pressing them from the lower receiver 12 of the rifle to be converted; (b) removing the existing "transverse" magazine 24 from the rifle; (c) installing the new barrel 56 in the new upper receiver 54; (d) installing the new upper receiver 54 upon the lower receiver 12 using the pivot 38 and takedown 40 pins; and (e) installing the longitudinal ammunition magazine 64 to the top of the new upper receiver 54.

[0052] Accordingly there has been described an invention that provides a low cost conversion apparatus that exploits the modularity of the AR-15/M16 type of semiautomatic rifle to adapt a longitudinal ammunition magazine to the AR-15/M16 semiautomatic rifle that arranges the rounds of ammunition along an axis that is essentially parallel to the longitudinal axis of the rifle instead of transverse to it thus providing a more compact, better balanced, and more maneuverable rifle. As development of the conversion of the present invention proceeded, the natural synergy of the longitudinal ammunition magazine, the modified bolt assembly, ejector and extractor mechanisms, and the upper receiver assembly that enabled these components to work together reliably and smoothly, became apparent. This natural synergy was unexpected, and not only adapted the longitudinal ammunition magazine to a popular semiautomatic rifle to solve the problems discussed herein above, but produced a rifle in which the result exceeded the sum of the parts. Further, the conversion is made without altering the lower receiver module or its trigger and

hammer mechanism. The resulting conversion ejects the spent cartridges downward instead of sideways for safer operation. Moreover, the conversion uses straight blowback operation instead of the direct gas impingement operation, a change that improves the reliability of the rifle. Tests have shown the recoil forces are lighter and the action can be operated with less cycle time without sacrificing reliability or accuracy.

[0053] In an alternate embodiment of the present invention, a modified bolt assembly 400 is illustrated in FIGS. 7 and 8. The bolt assembly 400 is designed for use with an upper receiver 300 that is also revised from the embodiment shown in FIGS. 2, 3, and 5. FIG. 9 depicts a cross section of the rear portion of the upper receiver 300 to illustrate the first and second (left and right) alignment or guide rails 340, 342 (See FIG. 9) machined into the internal recoil bore 314 of the upper receiver body 302 to accommodate the bolt assembly 400. It will be appreciated that a comparison of FIGS. 4 and 7 reveals that the bolt assembly 200 and the modified bolt assembly 400 both slide along the left and right (or first and second, respectively) alignment or guide rails 340, 342 internal to the recoil bore 314 in the upper receiver 300 to prevent the bolt assembly 400 from rotating during its travel while the rifle is being fired. Similarly, in the upper receiver 100 of FIG. 3, one such guide rail 88 is shown in FIG. 3 along an inside, rearward surface 90 of the right side plate 54B. The inside of the left side plate 54A is not visible in FIG. 3 but may be a mirror image of the right side plate 54B. In the upper receiver body 302 of FIG. 9, both guide rails 340, 342 appear on either side of the recoil bore 314.

[0054] Referring to FIG. 7, there is illustrated an exploded view of an alternative embodiment of an upper receiver and bolt assembly for an AR-15 type semiautomatic rifle. Like the embodiment illustrated in FIGS. 2 through 6D, the embodiment of FIG. 7 adapts a top-mounted longitudinal magazine 64 to the rifle to provide a more linear, continuous path for the ammunition as it cycles through the rifle, and to eject spent cartridges downward through the magazine well formerly occupied by the standard AR-15 type magazine. The result is a safer, more compact, simpler, and smoother-operating rifle. The reduction in the number of parts facilitates maintenance and provides improved reliability. The embodiment of FIG. 7 includes the principal components that rely on the action of gravity to facilitate the movement of the ammunition through the weapon when assembled to a lower receiver of an AR-15 type semi-automatic rifle such as the lower receiver 12 shown in FIG. 2. Moreover, extractor and ejector mechanisms are incorporated into a low-mass bolt assembly to safely eject spent cartridges downward instead of sideways or upward, risking injury to the user or persons nearby.

[0055] Continuing with FIG. 7, the upper receiver body 302 includes a recoil bore 304, a pivot pin channel 320, a takedown pin channel 322, a rifle barrel bore 330, and a well 332 for a turret portion of longitudinal magazine 64 (not shown in FIG. 7, but see FIG. 2). Other components that attach to the upper receiver body 302 include a front scope rail 306, a rear scope rail 308, a magazine catch 310, a magazine catch plunger 312, a charging handle slide 314, and a charging handle 316. The upper receiver body 302 includes side rails 324, 326 (See also FIG. 9). The side rails 324, 326 are provided to facilitate attachment of aiming devices, flash lights, laser devices, hand grips or other accessories desired by the user. The front and rear scope rails 306, 308, and the side rails

324, 326 include a series of fins **328** formed along their outer surfaces to facilitate the dissipation of heat when the weapon is in use.

[0056] The bolt assembly **400** shown in part in the exploded view in FIG. 7 includes a first or forward end **402**, a second or rearward end **404** of the bolt assembly **400** and the following additional components. The forward end **402** includes a shallow recess **403** in the front of the forward end **402**. The recess **403** may be sized to receive the cartridge rim of a round of ammunition when it is dispensed into the firing chamber of the rifle. Further disposed in a lower, front portion **440** of the forward end **402** are included an extractor **406**, an extractor retaining pin **408**, an extractor plunger **410**, and a plunger spring **412**. The forward end **402** further includes disposed in an upper, front portion of the forward end **402** an ejector **414**, an ejector retaining pin **416**, and an ejector spring **418**. The ejector **414** functions as a spring loaded piston, as will be described. Near the longitudinal centerline of the forward end **402** of the bolt assembly **400** is a firing pin **420**. When the bolt assembly **400** is oriented as it is in the upper receiver **300**, the extractor **406**, ejector **414**, and the firing pin **420** are aligned vertically such that their respective centerlines are parallel and disposed in a vertical plane through the forward end **402** of the bolt assembly **400**. As described, the bolt assembly **400** includes the forward end **402** and the rearward end **404**, which are coupled together at the respective threaded portions **434** (male), and **436** (female). The bolt assembly **400** further includes a first guide rail track or groove **422** along one side of the assembled bolt **400** and a corresponding second guide rail track or groove **424** (not shown) along the opposite side of the assembled bolt **400**. The tracks **422, 424** may be machined or otherwise formed in the bolt assembly **400**. The grooves **422, 424** mate with and slide along the previously mentioned first and second guide rails **340, 342** that appear in FIG. 9.

[0057] Referring to FIG. 8A, there is illustrated a side elevation view of an assembled bolt assembly **400**. FIG. 8B illustrates an enlarged view of a vertical cross section through the centerline of the forward bolt end **402** showing the details of the mechanisms for actuating the extractor **406** and ejector **414** of the improved (modified) bolt assembly **400**. The bolt assembly **400** includes features that provide the downward ejection of a spent cartridge as a round of ammunition is fired, one of the principal features of the present invention. The assembled bolt **400** is shown in FIG. 8A, including the forward end **402** coupled to the rearward end **404** by the respective threads **434, 436** (See FIG. 7), before it is assembled into the upper receiver **300**. Other features of the bolt **400** include the extractor pin **408**, ejector pin **416**, and the first guide rail track **422** for guiding the bolt **400** within the bore **304** of the upper receiver **300** so that it does not rotate during its motion while firing the rifle.

[0058] The extractor and ejector mechanisms are illustrated in cross section in FIG. 8B. The extractor **406** resembles a spring-biased pawl that rocks about an extractor pin **408**. The extractor pin **408** acts as a fulcrum for the rocking motion imparted to the extractor **406** as the bolt assembly **400** moves forward into position within the firing chamber **130** of the rifle **50** to make contact with the cartridge **154** of the round of ammunition **152** loaded into the firing chamber **130**. See FIGS. 6A-6D. The extractor pin **408** also functions as a retaining pin to retain the extractor assembly in place within the lower portion of the forward end **402** of the bolt assembly **400**. As the tooth **409** of the extractor **406** contacts the rim of the cartridge **154**, the sloping end of the extractor tooth **409**

causes the extractor tooth **409** to slide first downward, then upward into position just catching the rim of the cartridge **154** in the gap **411**. The motion of the extractor **406** is controlled by the extractor spring **412**, which resists the downward motion of the extractor tooth **409** and then causes its upward motion when the rim of the cartridge **154** clears the tooth **409**, thus retaining the rim of the cartridge **154** against the recess **440** in the front of the forward end **402** of the bolt assembly **400** as the bolt assembly **400** moves backward within the upper receiver **300** due to the direct blowback forces released when the round of ammunition is fired. The bolt assembly **400** and the cartridge move together until the ejector mechanism to be described completes the ejection operation to eject the spent cartridge downward from the firing chamber through the magazine well **22** (See FIG. 2). Although the structure of the extractor **406** and ejector **414** mechanisms in the embodiment of FIGS. 7, 8A and 8B is different, the action of the spent cartridge being ejected is similar to the action shown in FIG. 6D.

[0059] Continuing with FIG. 8B, the ejector **414** is illustrated as it is installed in the upper portion of the forward end **402** of the bolt assembly **400**. The ejector **414** travels a short distance within a bore in the forward end **402** and further includes a relief **415** in its upper side. An ejector pin **416** passes through the relieved side **415** to retain the ejector **414** in position and also limit its travel forward and backward. An ejector spring **418** biases the ejector **414** in a forward position as shown in the figure. When the bolt assembly **400** moves forward into position against the rim of a cartridge **154**, the force of the bolt assembly **400** moving into position forces the ejector **414** backward within its bore against the tension in the spring **418**. Thus, just after the rifle is fired and the bolt travels rearward, pulling the cartridge with it and away from the firing chamber **130**, the free end (opposite the rim) of the cartridge **154** is forced downward by the tension in the compressed spring **418**. This action causes the cartridge **154** to rotate end-over-end and spin downward through the unoccupied magazine well **22** of the rifle.

[0060] Referring to FIG. 9, there is illustrated a cross section view of a rear portion of the upper receiver **300** shown in FIG. 7. The receiver body **302** includes the recoil bore **304** within which the bolt assembly **400** moves during firing of the rifle. The bolt assembly **400** slides along first (left) **340** and second (right) guide **342** rails along the interior sides of the bore **304**. The guide rails **340, 342** keep the bolt assembly in alignment—i.e., prevents its rotation—during its travel within the bore **304**. Also shown is an end view of the position of the barrel **332** of the rifle within the body **302** of the upper receiver **300**. Other details include the bore **322** for receiving the takedown pin **40** that secures the upper receiver **300** to the hole (or bore) **124** in the lower receiver **12** (See FIG. 2).

[0061] While the invention has been shown in only a few of its forms, it is not thus limited but is susceptible to various changes and modifications without departing from the spirit thereof. The embodiments described herein above include modifications to the upper receiver section of an AR-15—type semi-automatic rifle to adapt the upper receiver to accept the mounting of an ammunition magazine thereon, thus facilitating a more compact rifle and more efficient, reliable dispensing of rounds of ammunition into the firing chamber of the rifle. The modifications include redesign of the bolt assembly in the upper receiver to provide for direct, downward ejection of the cartridges through the existing magazine well after firing the rifle. The existing magazine well provides

an open channel for free passage of the spent cartridges downward toward the ground because the standard AR-15—type magazine is no longer used. It will also be appreciated by persons skilled in the art that several other structural components are no longer required, thus simplifying the maintenance and operation of the rifle and improving its reliability. These unnecessary components include the standard gas tube, charging handle and bolt carrier for the AR-15 type rifle. [0062] With regard to the magazine 64 illustrated in FIG. 2, it is but one example—although an excellent one—of a magazine adapted to mounting along or on an upper receiver or similar structure of a semi-automatic or other rifle.

What is claimed is:

1. A bolt assembly for a rifle configured for recoil blowback operation, comprising:

a body having a first section for cooperating with a round of ammunition dispensed into a firing chamber of said rifle from a magazine;

an extractor disposed in a lower, forward portion of said first section; and

an ejector disposed in an upper, forward portion of said first section.

2. The apparatus of claim 1, wherein:

said extractor and said ejector cooperate with said round of ammunition to extract a spent cartridge of said round of ammunition from said firing chamber and eject said spent cartridge downward from said firing chamber.

3. The apparatus of claim 1, wherein:

said body includes a second section attached to said first section at an end opposite said forward portion of said first section.

4. The apparatus of claim 3, wherein:

said first and second portions of said body of said bolt assembly include first and second guide rail tracks formed along respective first and second sides of said bolt assembly.

5. The apparatus of claim 4, wherein:

said first and second guide rail tracks of said bolt assembly slide along corresponding guide rails disposed on each internal side of a recoil bore aligned with a barrel of said rifle.

6. The apparatus of claim 1, wherein said extractor comprises:

a pivoting lever urged by a first spring to grasp a rim of said cartridge when said bolt assembly is in a forward-most position within said rifle.

7. The apparatus of claim 1, wherein said ejector comprises:

a piston urged by a second spring to force said cartridge downward when said cartridge is fully extracted from a barrel of said rifle.

8. A bolt assembly for an upper receiver of an AR-15 type rifle configured for ejecting spent cartridges downward through a magazine well of said rifle, comprising:

a bolt assembly having first and second guide rail tracks formed along respective first and second sides of said bolt assembly;

an extractor disposed at least partially within a lower, forward end of said bolt assembly; and

an ejector disposed at least partially within an upper, forward end of said bolt assembly and operative in cooperation with said extractor to eject said spent cartridge

downward through said magazine well of said AR-15 type rifle when said rifle is fired.

9. The apparatus of claim 8, wherein said bolt assembly comprises:

a bolt assembly configured for recoil blowback operation.

10. The apparatus of claim 9, said bolt assembly further comprising:

a forward section and a second section, coupled together and including first and second guide rail tracks formed along respective first and second sides of said bolt assembly.

11. The apparatus of claim 10, wherein:

said first and second guide rail tracks slide along corresponding first and second guide rails disposed on each internal side of a recoil bore aligned with a barrel of said rifle.

12. The apparatus of claim 8, wherein said extractor comprises:

a pivoting lever urged by a first spring to grasp a rim of said cartridge when said bolt assembly is in a forward-most position within said rifle.

13. The apparatus of claim 8, wherein said ejector comprises:

a piston urged by a second spring to force said cartridge downward when said cartridge is fully extracted from a barrel of said rifle.

14. A semiautomatic rifle, comprising:

a lower receiver assembly for a standard AR-15—type rifle having a magazine well disposed in its underside;

an upper receiver assembly adapted for attaching to said lower receiver assembly and configured for ejection of spent cartridges downward through said magazine well of said lower receiver assembly; and

an ammunition magazine detachably mounted upon said upper receiver assembly and configured to dispense cartridges into a firing chamber of said upper receiver.

15. The apparatus of claim 14, said upper receiver comprising:

a bolt assembly installed in said upper receiver assembly and configured for straight/recoil blowback operation and having an ejector for ejecting said spent cartridge downward through said magazine well.

16. The apparatus of claim 15, said bolt assembly further comprising:

an extractor for extracting a spent cartridge to a position to be ejected from said upper receiver assembly by said ejector as said bolt assembly moves rearward during recoil.

17. The apparatus of claim 15, said upper receiver comprising:

a rifle barrel installed in said upper receiver assembly; wherein said rifle barrel and said bolt assembly are aligned along a common longitudinal axis of said upper receiver assembly.

18. The apparatus of claim 14, wherein:

said ammunition magazine is mounted on top of said upper receiver assembly for dispensing said cartridges into said firing chamber.

19. The apparatus of claim 14, wherein further:

said upper receiver includes no bolt carrier, no charging handle, and no gas tube.