United States Patent

Ramsay

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[54] **IMPACT IGNITION SHOTGUN FOR FIRING CASELESS AMMUNITION**

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[73] Assignee: **Olin Corporation**

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[51] **Int. Cl.**.....**F41c 7/00**, F41c 17/08

[58] **Field of Search**.....42/10, 11, 16, 69 B; 89/161; 102/DIG. 1

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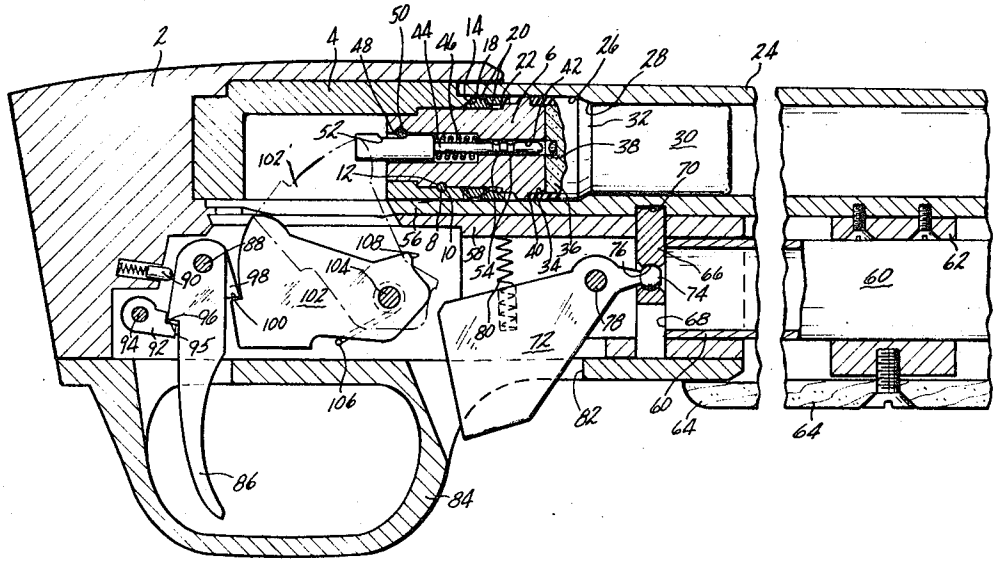
[57] **ABSTRACT**

A shotgun for firing caseless ammunition, the shotgun having a bolt member immovably mounted in the receiver. The barrel is slidably connected to the receiver with forward movement of the barrel being operative to open the breech to permit loading. Reciprocating locking means are mounted in the receiver for engagement with the barrel to lock the latter in a breech-closed position and a blocking member is operatively connected to the locking to block the hammer from contacting the firing pin when the barrel is not locked in its breech-closed position, thus the gun cannot be accidentally fired when the breech is not locked closed.

7 Claims, 4 Drawing Figures



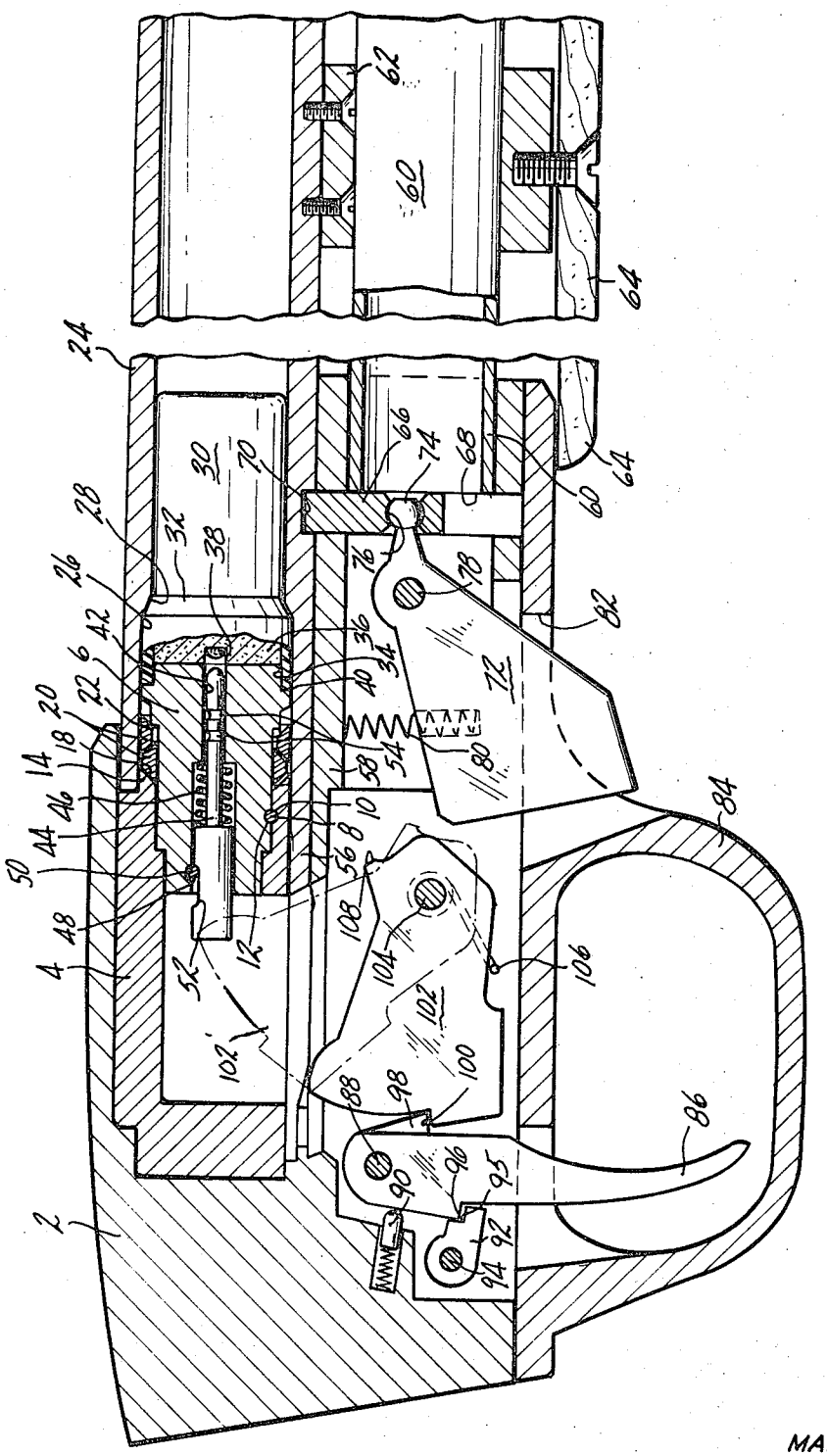


FIG-1

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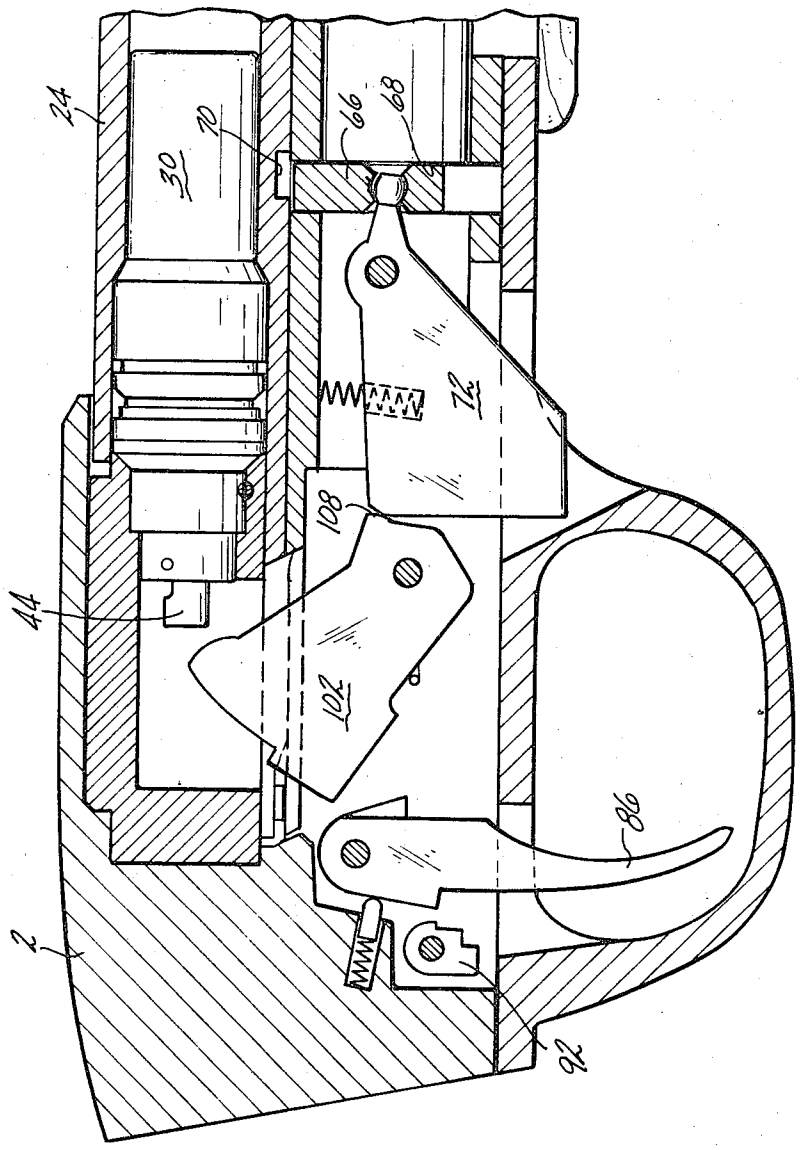

FIG - 2

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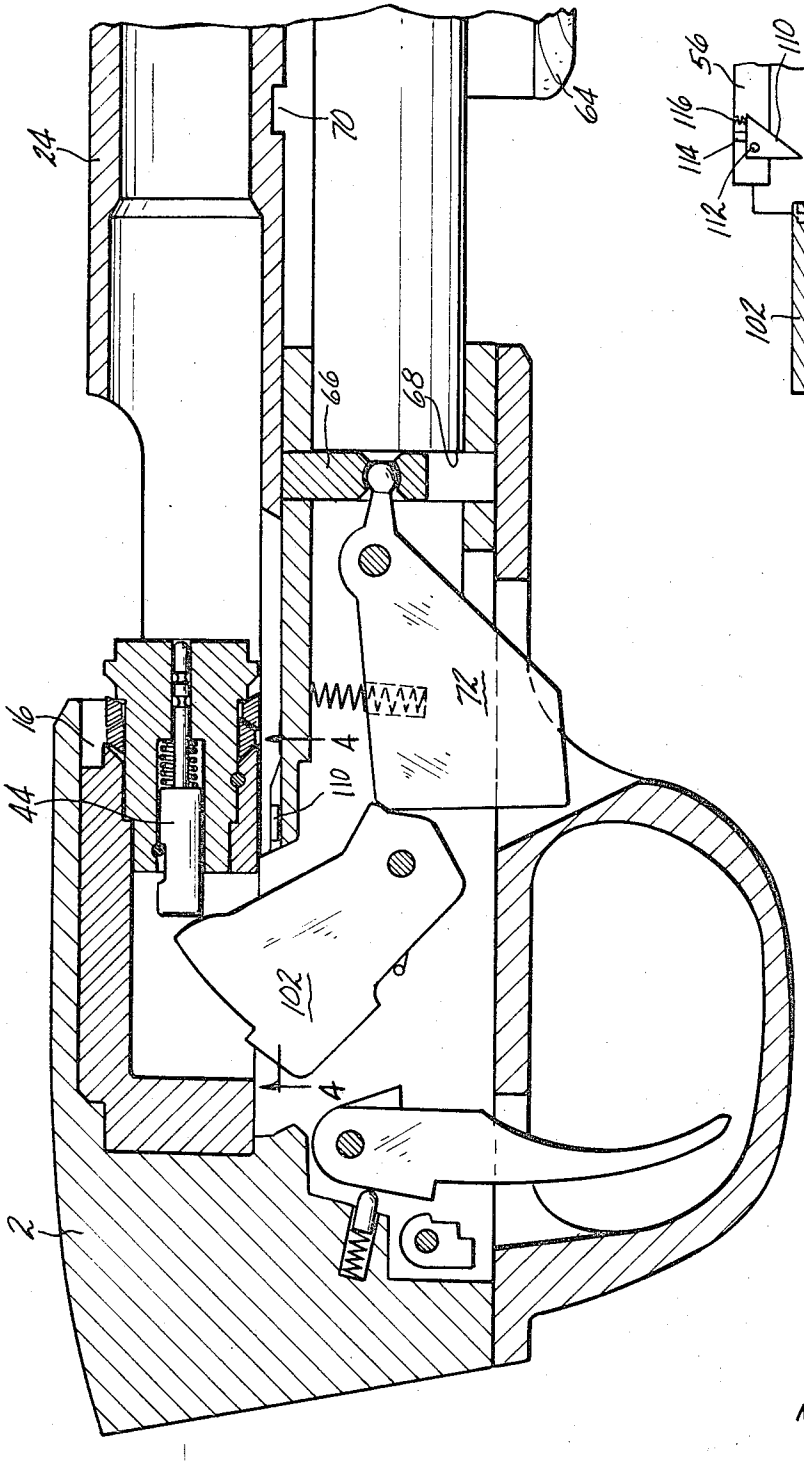

FIG-3

FIG-4

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IMPACT IGNITION SHOTGUN FOR FIRING CASELESS AMMUNITION

This invention relates to a shotgun of the impact ignition variety particularly adapted for firing caseless shotshells of the general type disclosed in application Ser. No. 727,164 to William B. Woodring, filed May 7, 1968.

The shotgun of this invention is designed for firing a shotshell preferably having a plastic casing which includes a forward pocket containing the shot pellets, or other projectiles, wads and the like, and which is closed by a thin-walled closure or crimp closure. The casing also includes a rearward pocket which contains a charge of propellant and a primer. A shoulder is formed on the exterior of the casing to resist initial forward movement of the shell when chambered and fired, the resistance continuing until a predetermined chamber pressure is achieved, at which time the shell is squeezed out of the firing chamber and propelled through the gun barrel substantially intact.

The gun includes a shoulder formed in the firing chamber which engages the shell shoulder and provides the surface against which the shell shoulder is forced to generate shot start, and past which the shell shoulder is squeezed after the predetermined chamber pressure is developed. The nose of the bolt mechanism is preferably reduced in size so as to be capable of snugly entering the rearward pocket on the shell when the breech is closed for firing. The snug engagement between the bolt nose and the rearward pocket of the shell permits the shell to be extracted easily from the firing chamber should the shooter desire to unload the gun without firing.

Since the shell does not have a metallic casing or a metallic head, and since the rearward pocket of the shell is open to the bolt nose, the bolt is preferably fixedly mounted in the receiver so as to aid in sealing the rearward end of the firing chamber against high pressure combustion gas leaks. In order to permit the breech to be opened and closed to permit loading and unloading the barrel of the gun is preferably slidably connected to the receiver so that the breech is opened by sliding the barrel forward from the receiver, and closed by sliding the barrel rearward toward the receiver. The firing chamber and shoulder are preferably located in the rearwardmost part of the barrel so that when the barrel is slid forward to open the breech, a shell can be inserted into the firing chamber and manually seated against the firing chamber shoulder. The barrel is then slid rearwardly toward the bolt mechanism until the reduced bolt nose enters the rearward pocket on the shell.

A locking block is preferably slidably mounted in the receiver and is positioned so as to be insertable into a cooperating notch, cut in the barrel, when the barrel is in its breech-closed position. Thus the barrel is locked in its breech-closed position and is prevented from sliding forward when the gun is fired. An actuating lever is pivotally mounted on the receiver and in driving engagement with the locking block. The actuating lever is accessible from the exterior of the gun so that the shooter can manually move the lever to unlock the barrel in order to load or unload the gun. The actuating lever is also preferably operable, when the locking block is downwardly offset from the barrel notch, such

as for example, when the block engages the bottom of the barrel when the barrel is not in its breech-closed position, to be in position to engage the hammer to prevent the latter from striking the firing pin if the trigger is pulled. Thus the gun cannot be accidently fired when the barrel is not locked in its breech-closed position. If the locking block is in its interlocking position in the barrel notch, the actuating lever will be offset so as not to be capable of engaging the hammer before the latter strikes the firing pin.

It is, therefore, an object of this invention to provide a shotgun particularly adapted to fire caseless shotshells which are completely expelled from the firing chamber when fired.

It is a further object of the invention to provide a shotgun of the character described having a bolt assembly with a nose portion of reduced diameter operative to telescopingly engage a rearward cup on the shotshell to permit extraction of an unfired round.

It is yet another object of the invention to provide a shotgun of the character described having a firing chamber with an inwardly extending shoulder operative to engage a complementary shoulder on the shotshell to initially resist forward movement of the shell after the latter is fired.

It is an additional object of the invention to provide a shotgun of the character described having a bolt assembly fixedly mounted in the receiver and having a barrel slidably connected to the receiver.

It is a still further object of the invention to provide a shotgun of the character described having a locking block selectively operable to lock the sliding barrel in a breech-closed position, and a block-actuating lever operable to prevent the hammer from striking the firing pin when the barrel is not locked in the breech-closed position.

These and other objects and advantages of this invention will become more readily apparent from the following detailed description of a preferred embodiment when read in conjunction with the accompanying drawings, in which:

FIG. 1 is a fragmentary side sectional view of a preferred embodiment of the shotgun of this invention as the latter appears when the hammer is cocked for firing, a caseless shell is in the firing chamber, and the barrel is locked in its breech-closed position;

FIG. 2 is a fragmentary side sectional view similar to FIG. 1, but showing the hammer being prevented from striking the firing pin when the barrel is not locked in its breech-closed position;

FIG. 3 is a fragmentary side sectional view of the shotgun of FIG. 1 showing the barrel as it appears when slid forward to a breech-open position for loading and unloading the gun; and

FIG. 4 is a plan view of the hammer-cocking portion connected to the barrel, as viewed along line 4—4 of FIG. 3, with parts omitted for clarity.

Referring now to FIG. 1, the receiver portion of the shotgun is shown along with the rearward portion of the barrel. The gun includes a receiver 2 in which is secured a bolt assembly housing 4. A bolt 6 is mounted in the housing 4, there being a pin 8 positioned within opposed notches 10 and 12 in the housing 4 and bolt 6 respectively to immovably fix the two together. It is noted that the pin 8 preferably extends through the side

walls of the receiver 2 to aid in securing the housing 4 and bolt 6 to the receiver 2. The forward end portion of the housing 4 is undercut as at 14 so as to form a pocket 16 with the receiver 2, the pocket 16 being most clearly shown in FIG. 3. The forward end face 18 of the housing is tapered inwardly and rearwardly and a pair of split metal rings 20 are positioned side-by-side around the bolt 6. The rings 20 are sandwiched between a shoulder 22 on the bolt 6 and the tapered face 18 of the housing 4. The side faces of the rings 20 are tapered in opposite directions so that when the rings are exposed to a longitudinally directed force resulting from combustion gases, the rings will move against each other and the tapered face 18, with the opposed tapered faces acting against each other to cause one ring to flex inwardly and the other ring to flex outwardly to help seal against high pressure gas leakage.

A barrel 24 is mounted for sliding movement with respect to the receiver 2. The barrel 24 is movable between a breech-closed position shown in FIG. 1 and a breech-open position shown in FIG. 3. A firing chamber 26 is disposed in the rearward portion of the barrel 24, the chamber 26 having an inwardly and forwardly tapering shoulder 28 positioned therein. A shell 30 is shown positioned in the chamber 26 in FIG. 1. The shell 30 includes an inwardly and forwardly tapered shoulder 32 which engages the chamber shoulder 28 when the shell 30 is seated for firing. The shell 30 includes a rearward pocket 34 in which is positioned a propellant charge 36 and a primer charge 38. The nose of the bolt 6 is undercut as at 40 so as to be of reduced diameter when compared to the diameter of the chamber 26. The undercut nose 40 of the bolt thus enters the rearward shell pocket 34 to frictionally engage the wall thereof when the shell 30 is seated for firing and the barrel 24 is in its breech-closed position. Thus, if the shooter desires to unload the gun without firing, he need merely slide the barrel 24 forward to the position shown in FIG. 3 and the shell 30 will remain in engagement with the bolt nose 40. The shooter can then manually remove the shell from the bolt nose.

The bolt 6 includes a central passage 42 in which is slidably mounted a firing pin 44. A spring 46 biases the firing pin 44 rearwardly in the bolt passage 42. A pin 48 is mounted in a notch 50 in the bolt 6 and in a slot 52 in the firing pin 44, the pin 48 preventing the firing pin 44 from moving rearwardly out of the bolt passage 42, and also acting as a positive stop with respect to the extend of forward movement that the firing pin 44 can experience. Gas-sealing grooves 54 are cut into the firing pin to seal the passage 42 against high pressure combustion gas leaks.

The barrel 24 includes a bottom portion forming a tray 56 which is slidably mounted on a cross web portion 58 of the receiver 2, the tray 56 of the barrel extending a substantial distance rearwardly into the receiver 2. A tube 60 is secured to the receiver 2 and extends forwardly therefrom beneath the barrel 24. A collar 62 is slidably mounted on the tube 60 and secured to the barrel 24 and to a forearm member 64. Thus, when the forearm 64 is pushed forward with respect to the receiver 2, the collar 62 causes the barrel 24 to slide forward along with the forearm 64.

A locking member 66 is slidably mounted in a slot 68 in the receiver 2, and a notch 70 is cut into the bottom of the barrel 24 and disposed so as to be aligned with the slot 68 when the barrel 24 is in its breech-closed position. When the locking member 66 is in its uppermost position it interlocks with the barrel notch 70 to lock the barrel 24 in the breech-closed position. An actuating lever 72, having a ball portion 74 mounted in a socket 76 in the locking member 66, is pivotally mounted on a pin 78 secured to the receiver 2. A spring 80 engages the receiver web 58 and the actuating lever 72 to bias the latter in a counter-clockwise direction about the pin 78. Thus the locking member 66 is urged upwardly in the receiver 2 toward the barrel notch 70. The actuating lever 72 also includes a portion which projects through a slot 82 in a trigger plate 84 mounted on the receiver 2 so that the actuating lever 72 is accessible to the shooter for actuation.

A trigger 86 is mounted for pivotal movement about a pin 88 secured to the trigger plate 84. A spring biased plunger 90 biases the trigger 86 in a counter-clockwise direction about the pin 88. A safety device 92 is pivotally mounted on a pin 94 which extends through the trigger plate 84. The safety 92 includes a notch 95 which engages a complementary shoulder 96 formed on the trigger 86 when the safety is rotated in a counter-clockwise direction as shown in FIG. 1, thus preventing the trigger 86 from being pulled. The safety 92 is rotated in a clockwise direction to the position shown in FIG. 2 in order to permit the trigger to be pulled.

The trigger 86 includes a projecting tang 98 which engages a shoulder 100 formed on a hammer 102 which is pivotally mounted on a pin 104 secured to the trigger plate 84. The trigger tang 98 thus restrains the hammer 102 in the cocked position as shown in FIG. 1. When the trigger 86 is pulled, the hammer 102 is pivoted about the pin 104 by a spring 106 to the position 102′ shown in phantom in FIG. 1. In this position the hammer 102 strikes the firing pin 44 and drives the latter forward against the bias of the spring 46 to strike the primer charge 38 and ignite the latter and the propellant charge 36. The spring 106 is preferably designed so that by the time the hammer reaches the position 102′, the spring 106 is exerting very little force on the hammer. Thus the momentum of the hammer 102 is the primary force relied upon to move the firing pin 44.

The foot portion of the hammer 102 is formed with a protruding boss 108 which operates in the following manner in conjunction with the actuating lever 72 to prevent the gun from being fired when the barrel is not locked in its breech-closed position. When the locking block 66 is in interlocking engagement with the barrel notch 70, the actuating lever 72 is pivoted sufficiently in the counter-clockwise direction so as to permit the hammer 102 to pivot to the firing pin-striking position 102′, as shown in FIG. 1. Assume that the shooter has loaded the gun with a fresh shell 30 and has moved the barrel 24 rearwardly toward the breech-closed position, but has failed to move the barrel 24 sufficiently to cause the locking block 66 to engage the notch 70, such as is shown in FIG. 2. To fire the gun in this condition would be dangerous, and to prevent this from occurring, the actuating lever 72 is positioned so that the hammer boss 108 will engage the lever 72 just before the hammer 102 strikes the firing pin 44. This position-

ing of the lever **72** results from the fact that the locking block **66** rides on the bottom of the barrel **24** until the notch **70** is aligned with the slot **68**. Thus the gun cannot be fired when the barrel is not locked in its breech-closed position. Furthermore, the lever **72** acts to absorb all of the momentum of the hammer **102** so that should the shooter subsequently move the barrel rearwardly so that it locks in its breech-closed position, the hammer **102** will not have enough energy to drive the firing pin **44** against the bias of the spring **46** to fire the shell.

Referring to FIG. **3**, the gun is shown as it appears after a shell has been fired and the barrel **24** has been moved forward sufficiently to permit a new shell to be inserted into the chamber. It is noted that once the momentum of the hammer **102** has been expended to move the firing pin **44** against the primer, the spring **46** forces the firing pin **44** and hammer **102** to move rearwardly. In order to unlock the barrel **24** the shooter manually depresses the protruding portion of the actuating lever **72** thus sliding the block **66** downwardly in the slot **68** and out of the notch **70**. The forearm **64** is then slid forward to move the barrel **24** to the position shown in FIG. **3**. When the barrel **24** moves forward to its breech-open position shown in FIG. **3**, a hammer-cocking plate **110** is deflected to one side. FIG. **4** shows the plate **110** in greater detail. The plate **110** is pivotally mounted on a pin **112** so to depend downwardly from the tray portion **56** of the barrel **24**. A stop lug **114** prevents the plate **110** from rotating in a counter-clockwise direction about the pin **112**, but does not interfere with clockwise rotation of the plate **110**. A spring **116** is connected to the plate **110** and to the barrel portion **56** to urge the plate **110** against the stop lug **114**. It is readily apparent that the plate **110** will pivot about the pin **112** from engagement with the hammer **102** when the barrel **24** is slid forward. Thus the plate **110** will clear the hammer **102** and then be returned to its original position by the spring **116**. When the barrel **24** is returned rearwardly, the plate **110** will be prevented from deflecting by the stop lug **114** and will engage the hammer **102** to rotate the latter back to its cocked position.

The firearm of this invention thus provides a mechanism for firing a specialized caseless ammunition, preferably in the form of a plastic shotshell, while providing a rearward sealing of the firing chamber against high pressure combustion gas leakage. The provision of a bolt nose of reduced diameter which enters and frictionally engages the rearward portion of the shell permits an unfired shell to be extracted from the firing chamber. In order to provide greater combustion gas sealing, the firearm includes a bolt assembly which is fixedly mounted in the receiver, and a barrel assembly which is slidably connected to the receiver for forward movement to a breech-open position for loading and unloading. A locking block pivotally connected to an actuating lever and slidably mounted in the receiver is operable to lock the barrel in its breech-closed position with the actuating lever being operable to engage the firearm hammer to prevent the latter from contacting the firing pin in the event that the barrel is not locked in its breech-closed position. Furthermore, the momentum of the hammer provides the force necessary to move the firing pin, so that once the hammer is intercepted by the actuating lever, the gun cannot be fired should the shooter subsequently lock the barrel in its breech-closed position.

Since many changes and variations of the disclosed embodiment of the invention may be made without departing from the inventive concept, it is not intended to limit the invention otherwise than as required by the appended claims.

What is claimed is:

1. A firearm comprising:

a. a receiver;

b. a barrel slidably connected to said receiver and movable between a breech-open position and a breech closed position, a rear portion of said barrel providing a firing chamber;

c. breech closure means mounted in said receiver rearward of said firing chamber to close the latter when said barrel is in said breech-closed position;

d. firing means mounted in said receiver for impacting a chambered round of ammunition to fire the latter;

e. trigger means mounted in said receiver and operably connected to said firing means to actuate the latter;

f. locking means mounted in said receiver and movable into an operative position in interlocking engagement with said barrel when the latter is in said breech-closed position; and

g. lever means connected to said locking means for actuating the latter, said lever means being movable between a first position wherein said locking means is in said operative position, and a second position wherein said locking means is displaced from said operative position, said lever means being operative, when in said second position, to contact said firing means to prevent the latter from impacting a chambered round of ammunition whereby the firearm cannot be fired when said barrel is not locked in said breech-closed position.

2. The firearm of claim **1**, wherein said breech closure means includes a projecting nose portion of reduced diameter operative to project into said firing chamber to telescopingly engage a rearward cup portion on a round of ammunition positioned in said firing chamber.

3. The firearm of claim **2**, wherein said breech closure means includes means for effecting a high pressure gas seal rearward of said firing chamber.

4. The firearm of claim **2**, wherein said firing chamber includes inwardly projecting means providing an inwardly and forwardly tapering shoulder for engagement with a complimentary shoulder on a chambered round of ammunition to position the latter in said firing chamber.

5. The firearm of claim **1**, wherein said firing means includes a firing pin mounted in said breech closure means and a spring-biased hammer pivotally mounted in said receiver for movement between a cocked position and a fired position, said lever means being operative, when in said second position, to contact said hammer to prevent the latter from moving to said fired position.

6. The firearm of claim **5**, wherein said hammer is spring-biased only when displaced a predetermined amount from said fired position.

7. The firearm of claim 1, further comprising spring means contacting said locking means to bias the latter toward said operable position.

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