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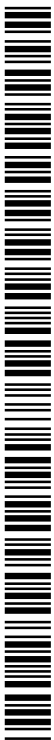
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(54) Title: MODULAR COMPACT SEMI-AUTOMATIC FIREARM

(57) Abstract: A firearm has a frame, a barrel assembly, a slide assembly which holds a recoil assembly, and a firing system with a trigger assembly and safety mechanism. The slide and recoil assemblies are located above the barrel so that the barrel is situated between the topmost part of the frame and the bottom of the slide assembly. The barrel assembly includes a housing which is covered by the slide assembly and secures one side of the recoil assembly. The barrel can be removably connected to the frame through front and rear mounts with removable pins and can modularly connect with the frame and slide assembly so that different caliber barrels can be interchanged. In addition to the trigger, the trigger assembly has a hammer, a sear, a lever arm that engages the trigger, sear and hammer, and springs that bias the trigger assembly components.

## MODULAR COMPACT SEMI-AUTOMATIC FIREARM

## BACKGROUND OF THE INVENTION

## CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority from U.S. Pat. App. Ser. Nos. 14/486,633 and 62/100,342 respectively filed on September 15, 2014 and January 6, 2015, hereby incorporated by reference.

## STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH

Not Applicable.

## APPENDIX

Not Applicable.

## FIELD OF THE INVENTION

[0001] The present invention relates to a semi-automatic pistol, and more particularly to modular compact semi-automatic pistols with quick-change barrels and corresponding inserts for different caliber barrels, an improved recoil mechanism having a shock absorbing system with a spring and dampener assembly that is held in place and stopped by a housing formed above the barrel, and a firing system with a trigger assembly and safety device having reduced complexity.

## RELATED ART

[0002] Known firearms generally experience kickback and muzzle climb due to discharge gases when the firearm is fired. Kickback is created by a forward momentum of the bullet and results in a rearward acting force upon the firearm and the marksman. Additionally, muzzle climb is caused by a torque which creates an upward movement of the barrel when the firearm is discharged. Recoil and muzzle climb typically increase with the size of the bullet or projectile. Moreover, there is typically an inverse relationship between the weight of the firearm and the kickback effects such that a lower weight firearm produces an increased kickback and muzzle climb transferred to the operator of the firearm. Kickback and muzzle climb may cause marksmen to flinch or hesitate when discharging the firearm, thereby resulting in less control of the firearm. Additionally, muzzle climb and recoil may lead to fatigue in the marksman and may inhibit the marksman's ability to repeatedly discharge the firearm. Kickback and muzzle climb can cause the marksman to move out of alignment with the target after each round is fired

requiring additional setup time for each subsequent shot. As such, kickback and muzzle climb can decrease the accuracy of the marksman.

**[0003]** Most prior art semi-automatic pistols either have recoil mechanisms beneath the barrel or, around the barrel in some cases, and there are a few instances in which the recoil mechanisms are above the barrel. However, pistols with the recoil mechanism beneath the barrel create a higher torque from the kickback or “recoil” upon discharging the firearm due to the offset of the barrel from the position of the operator’s hand. The larger the offset distance, the greater the counterforce that the operator of the firearm must exert to overcome the torque and maintain control after discharging the firearm, resulting in discomfort and increased fatigue to the operator of the firearm. In traditional semi-automatic pistols in which an ammunition magazine (or clip) slides into the butt handle of the firearm, the centerline of the barrel is offset by approximately an inch or higher than the top of the trigger and the top of the handle where the operator’s hand is located. Even with compact semi-automatic pistols, nearly an inch offset is typical. None of these traditional prior art pistols have the recoil mechanism secured over the barrel by a housing positioned over the barrel or firing chamber.

**[0004]** Furthermore, the gun barrels in many prior art firearms move during operation of the firearm, either sliding or rotating. This movement can negatively impact the accuracy of the firearms, since this creates a floating-type moment when firing the weapon. However, as indicated in US Pat. No. 747,585 it has generally been considered that the closer location of the barrel to the sighting line would result in increased accuracy. There has been a desire to replace barrels without the need for any tool, and although some barrels located above the recoil assembly have provided this ability, there has not been a firearm in which different caliber barrels could be interchanged in a modular manner so that they both work with the same frame, firing system, slide assembly and recoil mechanism.

**[0005]** In those firearms in which the barrel is situated below the recoil mechanism, it would be beneficial to permit the replacement of the barrel without the need for any tool. Additionally, there would be additional benefits to a barrel that is connected directly to the frame and does not move which can provide a stable, unmoving platform to hold the recoil mechanism to reduce the complexity of the firearm and minimize the moving parts in the firearm. There would also be benefits of an improved recoil mechanism with a shock absorbing system.

**[0006]** It would also be beneficial to provide a firing system with a trigger assembly that is compact and lightweight and that can operate with different caliber barrels. Additionally, it would be beneficial to provide a safety device for a trigger assembly that is both effective and reduces the complexity of the parts.

### SUMMARY OF THE INVENTION

[0007] Embodiments of the present invention comprise a firearm with a frame, a barrel assembly, a slide assembly with a recoil mechanism, and a firing system with a trigger assembly and safety device. The slide assembly and recoil mechanism are located above the barrel assembly so that the barrel is situated between the topmost part of the frame and the bottom of the slide assembly. The barrel assembly includes a housing situated above the firing chamber which is covered by the slide assembly and secures the side of the recoil assembly proximate to the breech plate.

[0008] The firearm of the present invention is also designed to have modular barrel assemblies that are interchangeable with each other so that different caliber gun barrels can use the same frame, firing system, recoil mechanism and possibly even the same slide assembly. The modular barrel assemblies are connected to the frame with takedown pins which permit quick removal and replacement without any tools apart from the cartridges used in the firearm. The removable connection of the barrel assembly to the frame are preferably through front and rear mounts that may be secured using the removable takedown pins.

[0009] The firing system has a trigger assembly that is compact and lightweight and that can operate with different caliber barrels. The trigger assembly includes a lever arm extending between the trigger pull and the sear; the lever arm has a ram that engages a tab on the sear and an extension that engages a cam surface on the hammer. The safety device for the trigger assembly reduces the complexity of the parts from traditional safeties, using a rotating shaft which engages the sear and forces the sear into its engaged position with the hammer catch surface in a safety-on configuration; a cutout section of the shaft allows the sear to rotate away from the hammer catch surface in the firing-ready configuration.

[0010] Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. The detailed description and specific examples of the invention in the specification and drawings are intended for purposes of illustration only and are not intended to limit the scope of the invention.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

[0012] Figure 1A is a cross-sectional view of a firearm of the present invention.

[0013] Figure 1B is a partial cross-sectional view of the firearm of the present invention.

[0014] Figure 1C is a front view of the firearm of the present invention.

[0015] Figure 1D is a cross-sectional view of the firearm of the present invention with a variation in the sear design.

[0016] Figure 2A is an exploded cross-sectional view of the firearm shown in Figure 1A.

[0017] Figure 2B is a front view of the frame of the firearm shown in Figure 2A.

[0018] Figure 2C is a front view of an interchangeable barrel assembly and breech plate insert for the firearm.

[0019] Figure 3A is an exploded isometric view of the firearm of the present invention.

[0020] Figure 3B is a detail isometric view of an alternative mount for barrel assemblies.

[0021] Figure 3C is an isometric view of the firing system with the trigger assembly and the linear striker mechanism.

[0022] Figure 3D is an isometric view of an alternative firing system.

[0023] Figures 4A-4H are a progression of views as the firearm discharges, cocks, and returns to its firing-ready position.

[0024] Figures 5A and 5B are cross-sectional detail views of the safety device in an engaged position and a disengaged position, respectively.

[0025] Figure 5C is an isometric view of the safety device shown in Figures 5A and 5B.

[0026] Figures 6A and 6B are cross-sectional detail views of an alternative safety device in an engaged position and a disengaged position, respectively.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0027] The following description of the preferred embodiment(s) is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses. Generally, as shown in Figure 1, the firearm 10 of the present invention includes a frame 12, a barrel assembly 14, a slide assembly 16 that contains a recoil mechanism 18, and a firing system 20. The slide assembly and recoil mechanism are located above the gun barrel 14a so that the barrel is situated between the topmost part of the frame and the bottom of the slide assembly. The barrel assembly 14 includes a housing 14b which is covered by the slide assembly 16 and secures one side of the recoil assembly 18. The firearm is operated by the firing system 20 which includes a trigger assembly 22 and linear striker mechanism 24. Details of the various features of the firearm are described below with reference to Figures 1-3, and the operation of the firearm is described below with reference to the drawings shown in Figures 4A-4H. A preferred embodiment of the firing system's safety mechanism 60 and its corresponding operation are shown in Figures 3C, 5A, and 5B, and an alternative safety mechanism 60' and its operation are shown in Figures 3D, 6A and 6B.

[0028] The barrel assembly can be removably connected to the frame through front and rear mounts 14c, 14d that may be secured using removable pins 26. The barrel assembly can modularly connect with the frame and slide assembly so that different caliber barrels 14', 14'' can be interchanged with each other using the same frame and slide assembly. When the same slide assembly is used for different caliber barrels, an insert 50 preferably mounts within a fitting 52 in the slide. It will also be appreciated that each different caliber barrel may have its own uniquely sized slide assembly to avoid the use of inserts. Additionally, it is also possible to form the barrel assembly with the frame so that they are permanently attached to each other.

[0029] The frame 12 has a handle portion 12a and a trigger portion 12b. The handle portion has a left side and a right side extending from the trigger portion to a butt end 12c of the frame. The sides each have a side aperture 32a proximate to the trigger portion and a lip 12d that is proximate to the top end of the handle portion and extends along the top end to the butt end of the handle portion. The trigger portion has an arm 12e extending from the handle portion and a cavity 34 recessed from a top face of the arm 12f. A pair of sides of the arm extends from the sides of the handle portion to form a pair of side walls on opposite sides of the cavity, and each of the side walls has a side wall aperture 36a.

[0030] The barrel assembly 14 is positioned adjacent to the top face of the arm. The barrel assembly includes a gun barrel 14a, a housing 14b, a front mount 14c, and a rear mount 14d and has a front portion 14e, a rear portion 14f, a top side 14g, and a bottom side 14h. The front and back mounts extend from the bottom side of the front and back portions, respectively. The housing 14b extends from the top side of the gun barrel and has inner and outer surfaces 38a, 38b and front and back surfaces 40a, 40b. The top side includes a pair of longitudinal ribs 42 extending between the front portion and the rear portion. The front mount is seated in the cavity and has a front aperture 36b aligned with the side wall aperture 36a in each of the side walls. The rear mount is seated between the first side and the second side and has a rear aperture 32b aligned with the side apertures 32a. As shown in Figure 3A, the mounts are preferably pinned. However, as particularly shown in Figure 3B, a latch mount 28 may be used in place of either one of the pin mounts. The latch mount would engage with a catch 30 on the frame and then the pin mount would be locked in place, preferably with a takedown pin.

[0031] The takedown pin locks the barrel assembly to the frame and can be dislodged from the pin aperture using a standard caliber cartridge 44. The user can then pull the pin out of the aperture to remove the barrel assembly 14 from the frame 12. The barrel assembly 14 can interchangeably connect with the frame 12 and the slide assembly 16 in a modular manner. For example, one barrel assembly 14' can be one caliber (.45) while another barrel assembly 14'' can be a different caliber (9 mm), as shown in Figures 2B and 2C, respectively. These barrel

assemblies 14 are interchangeable with each other, and the centerline 46 of each gun barrel aligns with the firing pin hole 16g in the breech plate 16b. As shown in Figures 2B and 2C, different breech plate inserts 50 may have the same outer size 50a to mount within the fitting 52 in the slide assembly and different sized interior spacing 50b', 50b'' to accommodate different caliber ammunition. For example, a thin-walled insert 50b' may be used to hold 45 caliber ammunition in alignment with the firing pin hole 16g while a thick-walled insert 50b'' corresponds with 9 mm ammunition. The centerline 46 of the gun barrels are aligned with the center of the firing pin hole in the breech plate. To lock the barrel assembly to the frame, a takedown pin 26a extends through the aperture in the front mount and the side wall aperture in each one of the side walls. Similarly, a takedown pin 26b extends through the aperture in the rear mount and the side apertures in the frame.

**[0032]** The slide assembly 16 includes a front casing 16a, a rear casing 16b, a breech plate 16c, a firing pin bore 16d, an internal recess 16e, and a conduit 16f between the internal recess and the rear casing. As indicated above, the breech plate has a firing pin hole 16g aligned with the firing pin bore 16d. The front casing extends from the internal recess to a distal end around the nose portion of the recoil rod. The front casing mates with the barrel and encloses the recoil assembly in an interior space between the front casing and the top side of the barrel. The front casing has a pair of apertures 48 at the distal end and a pair of inwardly-facing grooves 16g extending from the distal end to a location proximate to the internal recess. The pair of longitudinal ribs slide in the pair of inwardly-facing grooves. The rear casing has a pair of outwardly-facing grooves 16h, and the first lip and the second lip slide in the pair of outwardly-facing grooves. The back surface of the housing abuts the internal recess and the recoil assembly sleeve continues through the housing and is seated at the back wall of the internal recess.

**[0033]** The recoil assembly 18 includes a rod 18a, a helical spring 18b and a sleeve 18c. The recoil rod 18a has a nose portion 18d and an elongated rod 18e extending from the nose portion. The nose portion has a bore 18f. The sleeve 18c has a flange 18g around an open end at the front and an annular rib 18h at an opening at the back end. The elongated rod extends through an interior portion 18i of the sleeve and projects out the opening at the back end. The helical spring 18b surrounds the elongated rod 18a and is contained between the nose portion and the annular rib. An outer surface 18j of the sleeve is contained within the inner surface 38a of the housing 14b, and the flange 18g abuts the front surface 40a of the housing 14b. The recoil assembly also preferably includes a dampener device 18k which softens the impact of the slide as it is forced back following a discharged of a round. For example, a series of Belleville washers in a back-to-back arrangement can be situated around the rod between the spring and the

nose portion so that when the slide reaches its backmost travel, the washers are compressed between the nose portion and the sleeve's flange at a slide stop formed by the housing's front surface 40a. The recoil assembly 18 is preferably connected to the slide assembly by another takedown pin 26c. The pin extends through the pair of apertures in the front casing of the slide assembly and through the bore in the nose portion of the recoil assembly. It will be appreciated that any standard fastener can be used to connect the recoil assembly to the slide assembly.

**[0034]** The firing system 20 includes a trigger assembly 22 and a linear striker mechanism 24 as particularly illustrated in Figures 3C and 3D. The linear striker mechanism includes the firing pin 24a and the firing pin spring 24b which are seated in the firing pin bore 16d in the slide assembly 16. The linear striker mechanism may also include a bushing 54 as shown in Figures 2A and 3D and a tab 56 with a slot 58 to maintain the firing pin in its proper position in the firing pin bore. Different caliber rounds may have differently sized firing pins 24a, 24a' and the firing pin springs 24b, 24b' as shown in Figures 3C and 3D.

**[0035]** The trigger assembly 22 as shown in Figures 3C and 3D have many of the same components, including a hammer 22a, a sear 22b, a lever arm 22c, and a trigger pull 22d. The lever arm 22c extends from the trigger pull to its engagement with the sear and the hammer. The trigger assembly 22 also includes a safety mechanism 60 and several springs which are described below relative to the components of the trigger assembly that the springs bias in various positions and orientations. One trigger assembly with a preferred safety mechanism 60 is shown in Figure 3C, and another trigger assembly with an alternative safety mechanism 60' is shown in Figure 3D. Both versions of the trigger assembly use the same hammer design and also use a very similar sear design. The lever arm has some of the same features in both versions of the trigger assembly, but the lever arm used for the alternative safety mechanism 60' has additional parts that are not in the preferred safety mechanism 60.

**[0036]** The hammer 22a is pivotally mounted to the frame so that it rotates between its cocked orientation and its discharge orientation. The hammer has a catch surface 62a and a cam surface 62b which interact with the sear and lever arm as described in detail below and has a striking surface 62c that impacts the backside 24c of the striker mechanism 24. Generally, the sear engages the hammer's catch surface to hold the hammer in its cocked position, and the hammer's cam surface engages the lever arm to disengage it from the sear when the hammer rotates from its cocked orientation to its discharge orientation. The hammer spring 62c biases the hammer to its discharge orientation, and the hammer disengages the lever arm from the sear to prevent fully-automatic firing of the firearm. After the lever arm is disengaged from the sear, the trigger pull must be released for the lever arm to reengage with the sear.

[0037] Both the preferred safety mechanism 60 and the alternative safety mechanism 60' have a safety toggle switch 60a that is located in a recess 12g in the exterior of the frame 12. The switch connects to a shaft 60b that extends through and is rotatable in a pair of holes 54 in the frame. Preferably, the safety mechanism is ambidextrous, having a safety switch on each end of the shaft. The switch may have a detent, such as a nub 60a' on its inner surface, which engages with a depression 12h in the recess to hold the switch in the safety-on position. A user must push the switch past the detent to rotate the switch and shaft into the safety-off position. In the preferred safety mechanism, a solid portion 60c of the shaft engages the sear and forces the sear into its engaged position with the hammer catch surface for the safety-on configuration. In this preferred version, a cutout section 60d of the shaft allows the sear to rotate away from the hammer catch surface for the safety-off, firing-ready configuration. It will be appreciated that the particular shape of the shaft in the region of the sear could be an oblong or other irregular shape that matches with a corresponding mating surface on the sear so that the shaft surface generally serves as a cam with an engaged (safety-on) position and a disengaged (safety-off) position relative to the sear. In the alternative safety mechanism which is described in detail below, the shaft 60b has a cam surface 60'c that engages the lever arm 22c to force it into a safety-on configuration with the sear, the cam surface disengages from the lever arm to allow it to move into a safety-off configuration with the sear.

[0038] As shown in Figure 3C, the sear 22b engages the hammer 22a with a latching position that holds the hammer in its cocked orientation. In particular, the sear has a latch 64a which engages the catch surface when the sear is in its latching position and the hammer is in its cocked position. When the safety is off and the trigger is squeezed, i.e. moved from its rest position to its pulled position, the lever arm is actuated so that it pushes the sear to its releasing position which is where the latch falls away from the catch surface. A trigger spring 66 biases the trigger in the rest position, and the sear's latch is biased toward the catch by a sear spring 68 (see also Figure 1D). The sear preferably includes a tab 64b which extends from the sear's side and is acted on by the lever arm; the sear spring biases the tab toward the lever arm. When the sear is at its releasing position, the catch surface is no longer held by the latch, and the hammer spring forces the hammer to rotate from its cocked orientation to its discharge orientation. The sear also preferably includes a notch 64c which is positioned on the back side of the sear on the opposite side from the latch 64a and adjacent to the shaft's cutout section 60d when the safety switch is rotated into the safety-off position. The alignment of the notch in the sear with the cutout section allows the sear to rotate from its latching position back to its releasing position.

[0039] As shown in Figure 3D, the trigger assembly with the alternative safety mechanism has a sear 22b component with slightly different features. In this embodiment, the

search also has the latch 64a and the tab 64b. However, instead of a notch on the back of the sear as in the embodiment shown in Figure 3C, the sear has a safety catch 64d that extends from the same side of the sear as the tab 64b to interact with the lever arm 22c when the safety is on.

[0040] As shown in Figures 3C and 3D, the lever arm 22c interacts with and directly contacts the trigger 22d, the sear 22b, and the hammer 22a. The lever arm is rotatably connected to the trigger through a pivot pin 82 and has a ram 72a and an extension 72b through which the lever arm engages the other components of the trigger assembly. In the lever arm's ready position, the ram engages the tab and the ram uses the tab to push the sear back so that the latch is pushed away from the hammer catch. The lever arm is biased up toward the hammer by the lever arm spring 74 so that the extension contacts the hammer's cam surface. In the lever arm's firing position, the hammer's cam surface engages the extension and forces the lever arm down as the hammer rotates from its cocked orientation to its discharge orientation, and this also causes the ram to disengage from the sear's tab. After the firearm discharges and the recoil mechanism begins cocking the hammer back, the cam surface rotates back with the hammer and allows the lever spring arm to bias the lever arm up back toward the tab on the sear. In the semi-automatic mode of operation, an interference between the tab and the ram prevents the tab and ram from reengaging while the trigger remains depressed, even when the hammer is latched and the slide returns to chamber another round. When the trigger is released, the trigger spring biases the trigger and lever arm forward which brings the ram past the interference, thereby allowing the lever arm to return to its fully upward position in which the ram engages the tab to permit another triggering sequence to discharge the cartridge.

[0041] According to the embodiment of the invention shown in Figure 3D, the lever arm can also have a hook 72c, a notch 72d and a projection 72e. When the hammer is in its discharge orientation, the hammer's cam surface 62b pushes the lever arm down so that the notch in the lever arm is forced onto a firing detent 70 which prevents the lever arm and trigger from resetting at the same time that the firearm is being discharged. In the firing ready operation, the hammer cocking action allows the lever arm up off of the firing detent. In the lever arm's safety position for this embodiment, the safety's cam pushes the lever arm down so that the safety notch is on the safety detent and the hook is around the safety catch. The safety notch/detent engagement prevents the trigger from moving from its rest position to its pulled position, and the hook/catch safety engagement prevents the sear from moving from its latching position to its releasing position. Due to weight and/or space limitations or to place the toggle bar in a quick release location on the handle, the cam may be offset from the top side of the lever arm. Accordingly, the lever arm may include the projection 72e to contact the safety's cam that adjusts for the offset.

[0042] While one of ordinary skill in the art would generally understand the semi-automatic firearm's cycle of operation, a general cycle and its constituent phases are described below, starting with a cartridge feeding phase after a round has been fired from the pistol. The cartridge feeding phase involves the upward movement of cartridges in a magazine 76 loaded into the pistol. This upward movement of cartridges is generally accomplished by a follower and a spring positioned within magazine. However, other methods of cartridge feeding may be used to move the rounds upward into the path of the pistol's slide by the magazine follower and spring assembly. The feeding phase may also include a ramping action that occurs as the pistol slide moves forward and starts to strip a cartridge forward from the magazine. It is important to note that, in many pistols, the barrel is not stationary with the frame of the pistol, but instead moves forward and backward during the entire cycle of operation, i.e., a floating barrel.

[0043] A cartridge chambering phase occurs next in the cycle of operation, where a cartridge is stripped from the magazine and placed into the chamber of the pistol. This stripping action occurs as the slide moves forward under compressed recoil spring pressure, which in turn pulls a cartridge from the magazine. The combined movement of the slide and the upward pressure of the follower/spring assembly in magazine push the cartridge up a frame/barrel ramp and into the chamber. In many prior art pistols, the front muzzle end of the barrel angles upward and the rearward firing chamber end of the barrel angles downward during this phase to effect the chambering of a cartridge. In the present invention, the barrel remains fixed with the frame and may even be integrally formed with the frame.

[0044] Next, the pistol enters a locking phase in which the cartridge is locked into place in the barrel with the firing mechanism at the rear of the cartridge. In the semi-automatic pistols in which the barrel rotates, the barrel and slide are held in place relative to the frame during this phase. As indicated above, according to one aspect of the present invention, the barrel remains fixed in place and does not move, and the slide is locked into position relative to both the barrel and the frame.

[0045] The cycle of operation then "suspends" at this stage, until an operator of the pistol pulls the pistol trigger, at which time the cycle of operation enters into a firing phase. A triggering mechanism releases a striker or another form of a hammer, whereby the striker transfers its energy to the firing pin, which, in turn, strikes the primer. The primer ignites the propellant charge in the chambered cartridge. The gas created by the ignited propellant charge expands behind the bullet, forcing the bullet away from the cartridge casing and down the barrel. Generally, the barrel and slide remain in position during this initial portion of the firing phase. In the final portion of the firing phase, the bullet exits the barrel through a muzzle and the gas pressure within the barrel drops. At this point, the inertial thrust of the exiting bullet imparts an

equal rearward force on the slide assembly. As a result, the slide assembly moves rearward as the recoil spring assembly absorbs this “recoil” energy. It should be noted that the prior art pistols position the recoil spring beneath their respective floating barrels, the significance of which is discussed below.

[0046] At this point, the pistol enters an unlock phase, where the slide “unlocks”, “unlinks” or otherwise disengages from the barrel and frame, such that the slide can move relative thereto. The next phase, the fired cartridge case extraction phase, often occurs during this phase due to the breaking of friction between the expended cartridge case and the chamber wall. During the fired cartridge case extraction phase, the slide continues moving rearward and the breech opens. The rim of the fired cartridge case remains firmly in place, such as by an extractor and the continued rearward motion of the slide extracts the cartridge casing from the barrel. Finally, during the fired cartridge case ejection phase, the fired cartridge case is ejected through an ejection port. During the ejection, the cartridge case may be pivot upward and to one side which can free the case from the extractor. Finally, the pistol enters a cocking phase, whereby the striker and firing mechanism are positioned to fire the next cartridge. Generally, this occurs during the continued rearward motion of the slide.

[0047] The operational sequence of firing the pistol and automatic reloading is shown in Figures 4A-4H. The firing-ready rest position is shown in Figure 4A. As indicated above, in this position, the cutout section 60d of the shaft is rotated towards the notch 64c in the sear. When the safety switch is rotated into the safety-off position, the notch is positioned adjacent to the cutout section which allows the sear to rotate away from the hammer catch surface. With the safety off, the sear can rotate from its latching position back to its releasing position.

[0048] The firing-ready cocked position is shown in Figure 4B. In this position, the sear is brought to its break point. The trigger pull is pressed inwardly, and the lever arm ram pushes the sear tab to the sear break point in which the sear latch is at the edge of the hammer catch. Also, at the sear break point, the lever arm extension engages the hammer cam. If the trigger pull is released, the trigger assembly returns to the rest position, with the trigger and lever arm being biased forward by the trigger spring, the lever arm remaining biased upward by the lever arm spring and the sear being biased forward by sear spring. Any further pull on the trigger causes the sear to release the hammer as shown in Figure 4C. With the trigger pressed fully inward, the lever arm ram pushes the sear tab over the sear break point so that the sear latch moves past the edge of the hammer catch. The hammer spring forces the hammer to rotate around its pivot. The hammer cam forces the lever arm extension down and disengages the lever arm ram from the sear tab. As shown in Figure 4D, the hammer rotates fully to hit the linear

striker which propels the firing pin into the primer of the cartridge, discharging the round and firing the bullet.

[0049] As shown in Figures 4E and 4F, the discharge of the cartridge results in a reaction force being applied through its base against the breach plate. The slide is forced back, and the hammer is cocked while the spent shell is ejected out of the cartridge firing chamber. The slide bearing surface pushes the hammer so that it rotates back around its pivot. As the hammer rotates back, the hammer cam also rotates and allows the lever arm extension up, and the lever arm spring biases the lever arm up. The lever arm spring pushes the lever arm up against the sear tab while the trigger remains pressed inward, but the ram may not fully engage the sear tab until the trigger pull is released. The slide fully cocks the hammer, and the next cartridge in the clip is auto-loaded into the firing chamber. As the slide bearing surface fully cocks the hammer, and the sear spring biases the sear to its forward most position so that the sear latch engages the hammer catch.

[0050] As shown in Figures 4G and 4H, the recoil spring biases the slide forward and returns the slide to the firing ready position. When the trigger pull is released, the trigger and lever arm are biased forward by the trigger spring. The lever arm spring pushes the lever arm up further to engage the sear tab. As the slide returns to the firing ready position, the auto-loaded round from the magazine is seated in the insert with the base of the cartridge abutting against the breech plate and the shell and bullet forced into the cartridge firing chamber. When there are no additional rounds in the magazine, the clip may hold the slide open. A loaded magazine can be inserted into the handle and the safety can be released to chamber the first round.

[0051] The preferred safety device in an engaged position and a disengaged position are respectively shown in Figures 5A and 5B. As explained above, in the safety-on configuration, a solid portion 60c of the shaft engages the sear and forces the sear into its engaged position with the hammer catch surface. In the safety-off, firing-ready configuration, a cutout section 60d of the shaft allows the sear to rotate away from the hammer catch surface. The shaft preferably extends between both sides of the frame, and the cutout section in the center portion of the shaft is bounded by the cylindrical shaft at both ends.

[0052] The alternative safety device in an engaged position and a disengaged position are respectively shown in Figures 6A and 6B. In Figure 6A, the safety lock is engaged so that the pistol's firing system is in a non-firing arrangement. In this arrangement, the safety switch cam rotates down and pushes the lever arm down, and the sear safety hook engages the sear safety catch. With the lever arm pushed down in its lowered position, the trigger safety notch on the lever arm engages the trigger safety detent in the side of the frame. Additionally, with the lever arm in its lowered position, the lever arm ram is disengaged from the sear tab. The firing-ready

rest position is shown in Figure 6B. In this position, the safety switch rotates the safety cam up so that the safety is off. With the safety off, the lever arm spring biases the lever arm up so that the sear safety hook is disengaged from the sear safety catch and the trigger safety notch is disengaged from the trigger safety detent. When the lever arm moves up, the lever arm ram engages the sear tab.

[0053] The position of the recoil assembly above the barrel assembly permits the barrel of the gun to be positioned closer to the trigger and thereby closer to the operator's hand that is holding the firearm at the handle grip. Generally, the offset distance 78 between barrel's centerline 46 and the top portion of the trigger 80 is less than a diameter of the barrel (D). The barrel's centerline 46 or the bottom of the barrel can be positioned at or less than approximately one-half inch ( $<1/2''$ ) from the trigger pull's topmost exposed portion 80 at the top of the trigger guard. The small offset is possible even with a barrel that handles 45 caliber ammunition, having a bullet diameter of approximately .452" and a base diameter of approximately .476".

[0054] The closer proximity of the barrel centerline to the trigger pull and the top of the handle reduces the moment arm between the location where the kickback force pushes against the firearm, i.e., within the barrel, and where the operator of the firearm must exert a force to stabilize the firearm, i.e., at the handle grip and trigger. A smaller moment arm can significantly reduce the torque that an operator must overcome in holding the firearm as it is discharged, thereby allowing for much more accuracy in successive shots that are then fired. For example, for a typical semi-automatic pistol that has a recoil energy of approximately 4,500 in-lb, a barrel-to-handgrip distance of an inch or more would result in over 4,500 in-lb in torque that the operator must overcome. Even for a compact semi-automatic pistol, a barrel-to-handgrip distance that is a little less than an inch or around  $7/8''$  would result in approximately 4,000 in-lb in torque. In comparison, with the top-mounted recoil mechanism of the present invention in a traditional semi-automatic pistol design, the barrel-to-handgrip offset can be brought to within approximately one-half inch ( $1/2''$ ) or less which would reduce the torque to less than 2,250 in-lb.

[0055] Modifications to the exemplary embodiments without departing from the scope of the invention, and all matter contained in the foregoing description and shown in the accompanying drawings are illustrative rather than limiting. For example, it is within the invention's scope to incorporate any known firing pin block which is directly connected to the trigger and prevents or otherwise stops the firing pin from extending into the cartridge firing chamber and contacting the cartridge primer except when the trigger is pulled, such as described in US Pat. No. 3,830,002 and which is incorporated by reference herein. Thus, the invention's scope is not limited by any of the above-described exemplary embodiments, and is defined only in accordance with the following claims appended hereto and their equivalents.

## CLAIMS

What is claimed is:

1. A firearm for discharging ammunition, comprising:
  - a frame comprising a handle portion and a trigger portion, wherein said handle portion is comprised of a first side and a second side extending from said trigger portion to a butt end of said frame;
  - a barrel assembly situated over said trigger portion, wherein said barrel assembly is comprised of a gun barrel and a housing extending from a top side of said gun barrel, and wherein said housing has an inner surface and a front surface;
  - a recoil assembly comprising a rod, a helical spring and a sleeve, wherein said recoil rod comprises a nose portion and an elongated rod extending from said nose portion, wherein said sleeve has a flange around a first open end and an annular rib at a second open end, wherein said elongated rod extends through an interior portion of said sleeve and projects out said second open end, wherein said helical spring surrounds said elongated rod and is contained between said nose portion and said annular rib, wherein an outer surface of said sleeve is contained within said inner surface of said housing, and wherein said flange abuts said front surface of said housing;
  - a slide assembly comprising a front casing, an internal recess, a breech plate, a rear casing, a firing pin bore, and a conduit between said internal recess and said rear casing, wherein said front casing extends from said internal recess to a distal end around said nose portion of said recoil rod, wherein said front casing mates with said barrel and encloses said recoil assembly in an interior space between said front casing and said top side of said barrel, wherein said distal end of said front casing is fixedly connected to said nose portion of said recoil assembly, wherein said breech plate has a firing pin hole aligned with said firing pin bore, wherein said front casing is slidably connected to said top side of said barrel, and wherein said rear casing is slidably connected to said first side and said second side of said handle portion proximate to said butt end of said frame.
2. The firearm of claim 1, wherein said barrel assembly is removably connected to said frame through at least one takedown pin.
3. The firearm of claim 2, further comprising a pair of takedown pins fixedly connecting said barrel assembly to said frame, wherein said takedown pins are removable for removing said barrel assembly from said frame, wherein said trigger portion is further comprised of an arm extending from said handle portion and a cavity recessed from a top face of said arm, wherein a pair of sides of said arm extend from said first side and said second side of said handle portion to form a pair of side walls on opposite sides of said cavity, wherein each of said side walls has a side wall aperture, wherein said barrel assembly is further comprised of a front mount and a rear

mount extending from a bottom side of said gun barrel at said front portion and said rear portion, respectively, wherein said front mount is seated in said cavity and has a front aperture aligned with said side wall aperture in each of said side walls, wherein a first takedown pin extends through said front aperture and said side wall aperture in each one of said side walls, wherein said rear mount is seated between said first side and said second side and has a rear aperture aligned with said first side aperture and said second side aperture, and wherein a second takedown pin extends through said rear aperture, said first side aperture and said second side aperture.

4. The firearm of claim 2, wherein said barrel assembly modularly connects with said frame and said slide assembly, wherein a first barrel assembly has a first caliber and a second barrel assembly has a second caliber, and wherein said first barrel assembly is interchangeable with said second barrel assembly.

5. The firearm of claim 2, wherein said barrel assembly is further comprised pin mount and a latch mount, and wherein said latch mount engages with a catch on said frame.

6. The firearm of claim 1, further comprising a pin fixedly locking said recoil assembly to said slide assembly, wherein said recoil assembly is further comprised of a dampener situated around said elongated rod proximate to said nose portion, wherein said front casing of said slide assembly further comprises a pair of apertures, wherein said nose portion of said recoil rod comprises a bore, and wherein said pin extends through said pair of apertures and said bore.

7. The firearm of claim 1, wherein said first side of said frame has a first lip proximate to a top end of said handle portion extending toward said butt end, wherein said second side has a second lip proximate to said top end extending toward said butt end, wherein said top side of said gun barrel is further comprised of a pair of longitudinal ribs extending along a length of said top side from a front portion of said gun barrel to a rear portion of said gun barrel, wherein said front casing of said slide assembly comprises a pair of inwardly-facing grooves extending from said distal end to a location proximate to said internal recess, wherein pair of longitudinal ribs slide in said pair of inwardly-facing grooves, wherein said rear casing comprises a pair of outwardly-facing grooves, and wherein said first lip and said second lip slide in said pair of outwardly-facing grooves.

8. The firearm of claim 1, further comprising a trigger assembly within said handle of said frame and a linear striker mechanism within said firing pin hole, wherein said trigger assembly comprises:

- a hammer pivotally mounted to said frame, wherein said hammer has a catch and a cam;
- a hammer spring biasing said hammer to a discharge orientation;

a trigger having a rest position and a pulled position, wherein said trigger has a top portion proximate to said trigger portion of said frame;

a sear comprising a latch on a front end and a tab on a side of said sear, wherein said sear has a holding position with said latch engaging said catch of said hammer and holding said hammer in a cocked orientation, wherein said sear has a releasing position with said latch disengaged from said catch, and wherein said hammer rotates from said cocked orientation to said discharge orientation when said sear moves from said holding position to said releasing position;

a lever arm connected to said trigger at a proximal end and comprising a ram and an extension at a distal end, wherein said lever arm has a ready position and a firing position, wherein said ram engages said tab of said sear when said lever arm is in said ready position, wherein said cam of said hammer engages said extension when said lever arm is in said firing position and said cam forces said ram to disengage from said tab as said hammer rotates from said cocked orientation to said discharge orientation.

9. The firearm of claim 8, further comprising a safety mechanism having a safety-on position and a safety-off position, wherein said safety mechanism comprises a switch, a shaft connected to said switch, and a cam connected to said shaft, wherein said switch rotates said cam on said shaft to engage a back end of said sear opposite from said latch in said safety-on position and wherein said switch rotates said cam on said shaft to disengage from said back end of said sear in said safety-off position.

10. The firearm of claim 1, wherein a centerline of said gun barrel is positioned at or less than one-half inch from a trigger pull at its topmost exposed portion.

11. The firearm of claim 1, wherein an offset distance between a centerline of said gun barrel and a topmost exposed portion of a trigger pull is less than a diameter of said gun barrel.

12. A firearm for discharging ammunition, comprising:

a frame comprising a handle portion and a trigger portion, wherein said handle portion is comprised of a first side and a second side extending from said trigger portion to a butt end of said frame;

a barrel assembly removably connected to said frame, wherein said barrel assembly is comprised of a gun barrel and a housing extending from a top side of said gun barrel, wherein said housing has an inner surface and a front surface, and wherein said barrel assembly modularly connects with said frame;

a recoil assembly comprising a rod, a helical spring and a sleeve situated above said barrel assembly, wherein said recoil rod comprises a nose portion and an elongated rod extending from said nose portion, wherein said sleeve has a flange around a first open end and

an annular rib at a second open end, wherein said elongated rod extends through an interior portion of said sleeve and projects out said second open end, wherein said helical spring surrounds said elongated rod and is contained between said nose portion and said annular rib, wherein an outer surface of said sleeve is contained within said inner surface of said housing, and wherein said flange abuts said front surface of said housing;

a slide assembly comprising a front casing, an internal recess, a breech plate, a rear casing, a firing pin bore, and a conduit between said internal recess and said rear casing, wherein said front casing extends from said internal recess to a distal end around said nose portion of said recoil rod, wherein said front casing mates with said barrel and encloses said recoil assembly in an interior space between said front casing and said top side of said barrel, wherein said distal end of said front casing is fixedly connected to said nose portion of said recoil assembly, wherein said breech plate has a firing pin hole aligned with said firing pin bore, wherein said front casing is slidably connected to said top side of said barrel, and wherein said rear casing is slidably connected to said first side and said second side of said handle portion proximate to said butt end of said frame.

13. The firearm of claim 12, wherein said trigger portion is further comprised of an arm extending from said handle portion and a cavity recessed from a top face of said arm, wherein a pair of sides of said arm extend from said first side and said second side of said handle portion to form a pair of side walls on opposite sides of said cavity, wherein each of said side walls has a side wall aperture, wherein said barrel assembly is further comprised of a front mount and a rear mount extending from a bottom side of said gun barrel at said front portion and said rear portion, respectively, wherein said front mount is seated in said cavity and has a front aperture aligned with said side wall aperture in each of said side walls, wherein a first takedown pin extends through said front aperture and said side wall aperture in each one of said side walls, wherein said rear mount is seated between said first side and said second side and has a rear aperture aligned with said first side aperture and said second side aperture, and wherein a second takedown pin extends through said rear aperture, said first side aperture and said second side aperture.

14. The firearm of claim 12, wherein said barrel assembly is selected from a group of modular barrel assemblies consisting of a first barrel assembly having a first caliber and a second barrel assembly having a second caliber, and wherein said first barrel assembly is interchangeable with said second barrel assembly.

15. The firearm of claim 12, wherein an offset distance between a centerline of said gun barrel and a topmost exposed portion of a trigger pull is less than a diameter of said gun barrel.

16. The firearm of claim 12, further comprising a pin fixedly locking said recoil assembly to said slide assembly, wherein said front casing of said slide assembly further comprises a pair of apertures, wherein said nose portion of said recoil rod comprises a bore, and wherein said pin extends through said pair of apertures and said bore, wherein said first side of said frame has a first lip proximate to a top end of said handle portion extending toward said butt end, wherein said second side has a second lip proximate to said top end extending toward said butt end, wherein said top side of said gun barrel is further comprised of a pair of longitudinal ribs extending along a length of said top side from a front portion of said gun barrel to a rear portion of said gun barrel, wherein said front casing of said slide assembly comprises a pair of inwardly-facing grooves extending from said distal end to a location proximate to said internal recess, wherein pair of longitudinal ribs slide in said pair of inwardly-facing grooves, wherein said rear casing comprises a pair of outwardly-facing grooves, and wherein said first lip and said second lip slide in said pair of outwardly-facing grooves.

17. The firearm of claim 12, further comprising a trigger assembly within said handle of said frame and a linear striker mechanism within said firing pin hole.

18. A firearm for discharging ammunition, comprising:

a frame comprising a handle portion and a trigger portion, wherein said handle portion is comprised of a first side and a second side extending from said trigger portion to a butt end of said frame, wherein said first side is further comprised of a first side aperture proximate to said trigger portion and a first lip proximate to a top end of said handle portion extending toward said butt end, wherein said second side is further comprised of a second side aperture proximate to said trigger portion and a second lip proximate to said top end extending toward said butt end, wherein said trigger portion is comprised of an arm extending from said handle portion and a cavity recessed from a top face of said arm, wherein a pair of sides of said arm extend from said first side and said second side of said handle portion to form a pair of side walls on opposite sides of said cavity, and wherein each of said side walls has a side wall aperture;

a barrel assembly positioned adjacent to said top face of said arm, wherein said barrel assembly is comprised of a gun barrel, a front mount, a rear mount and a housing, wherein said barrel assembly has a front portion, a rear portion, a top side, and a bottom side, wherein said front mount extends from said bottom side of said front portion, wherein said rear mount extends from said bottom side of said rear portion, wherein said housing extends from said top side of said gun barrel and has an inner surface and a front surface, wherein said top side is further comprised of a pair of longitudinal ribs extending between said front portion and said rear portion, wherein said front mount is seated in said cavity and has a front aperture aligned with said side wall aperture in each of said side walls, and wherein said rear mount is seated between

said first side and said second side and has a rear aperture aligned with said first side aperture and said second side aperture;

a pair of takedown pins locking said barrel assembly to said frame, wherein a first takedown pin extends through said front aperture and said side wall aperture in each one of said side walls, wherein a second takedown pin extends through said rear aperture, said first side aperture and said second side aperture;

a recoil assembly comprising a rod, a helical spring and a sleeve situated over said barrel assembly, wherein said recoil rod comprises a nose portion and an elongated rod extending from said nose portion, wherein said nose portion comprises a bore, wherein said sleeve has a flange around a first open end and an annular rib at a second open end, wherein said elongated rod extends through an interior portion of said sleeve and projects out said second open end, wherein said helical spring surrounds said elongated rod and is contained between said nose portion and said annular rib, wherein an outer surface of said sleeve is contained within said inner surface of said housing, and wherein said flange abuts said front surface of said housing;

a slide assembly comprising a front casing, an internal recess, a breech plate, a rear casing, a firing pin bore, and a conduit between said internal recess and said rear casing, wherein said breech plate has a firing pin hole aligned with said firing pin bore, wherein said front casing extends from said internal recess to a distal end around said nose portion of said recoil rod, wherein said front casing mates with said barrel and encloses said recoil assembly in an interior space between said front casing and said top side of said barrel, wherein said front casing comprises a pair of apertures at said distal end and a pair of inwardly-facing grooves extending from said distal end to a location proximate to said internal recess, wherein said pair of longitudinal ribs slide in said pair of inwardly-facing grooves, wherein said rear casing comprises a pair of outwardly-facing grooves, wherein said first lip and said second lip slide in said pair of outwardly-facing grooves; and

a pin extending through said pair of apertures in said front casing of said slide assembly and through said bore in said nose portion of said recoil assembly.

19. The firearm of claim 18, wherein said barrel assembly modularly connects with said frame and said slide assembly, wherein a first barrel assembly has a first caliber and a second barrel assembly has a second caliber, and wherein said first barrel assembly is interchangeable with said second barrel assembly.

20. The firearm of claim 18, wherein an offset distance between a centerline of said gun barrel and a topmost exposed portion of a trigger pull is less than a diameter of said gun barrel.

21. A firearm for discharging ammunition, comprising:

a frame comprising a handle;

a barrel assembly connected to said frame;

a hammer pivotally mounted to said frame, wherein said hammer comprises a catch surface and a cam surface;

a hammer spring biasing said hammer to a discharge orientation;

a trigger having a rest position and a pulled position;

a sear comprising a latch on a front end and a tab extending from a side surface, wherein said sear has a latching position with said latch engaging said catch of said hammer and holding said hammer in a cocked orientation, wherein said sear has a releasing position with said latch disengaged from said catch, and wherein said hammer rotates from said cocked orientation to said discharge orientation when said sear moves from said latching position to said releasing position; and

a lever arm connecting said trigger to said sear, said lever arm comprising a ram and an extension, wherein said lever arm has a ready position and a firing position, wherein said ram engages said tab when said lever arm is in said ready position, wherein said cam surface of said hammer engages said extension when said lever arm is in said firing position, and wherein said cam surface forces said ram to disengage from said tab as said hammer rotates from said cocked orientation to said discharge orientation.

22. The firearm of claim 21, further comprising a safety mechanism comprising a safety switch and a shaft extending through said frame proximal to said sear, wherein said safety switch is connected to said shaft and rotates said shaft in said frame between a safety-on position and a safety-off position, wherein said shaft comprises a cutout section, wherein said cutout section is adjacent to a portion of said sear when said shaft is in said safety-off position and wherein said portion of said sear fits within said cutout section in said safety-off position, and wherein said cutout section is rotated away from said sear in said safety-on position.

23. The firearm of claim 21, wherein said barrel assembly comprises a gun barrel, a front mount, a rear mount and a housing, wherein said barrel assembly has a front portion, a rear portion, a top side, and a bottom side, wherein said front mount extends from said bottom side of said front portion and connects to said frame, wherein said rear mount extends from said bottom side of said rear portion and connects to said frame, wherein said housing extends from said top side of said gun barrel and has an inner surface and a front surface, wherein said top side is further comprised of a pair of longitudinal ribs extending between said front portion and said rear portion.

24. The firearm of claim 23, further comprising a recoil assembly and a slide assembly, said recoil assembly comprising a rod, a helical spring and a sleeve, wherein said recoil rod comprises a nose portion and an elongated rod extending from said nose portion, wherein said

sleeve has a flange around a first open end and an annular rib at a second open end, wherein said elongated rod extends through an interior portion of said sleeve and projects out said second open end, wherein said helical spring surrounds said elongated rod and is contained between said nose portion and said annular rib, wherein an outer surface of said sleeve is contained within said inner surface of said housing, wherein said flange abuts said front surface of said housing, wherein said slide assembly comprises a front casing, an internal recess, a breech plate, a rear casing, a firing pin bore, and a conduit between said internal recess and said rear casing, wherein said front casing extends from said internal recess to a distal end around said nose portion of said recoil rod, wherein said front casing mates with said barrel and encloses said recoil assembly in an interior space between said front casing and said top side of said barrel, wherein said distal end of said front casing is fixedly connected to said nose portion of said recoil assembly, wherein said breech plate has a firing pin hole aligned with said firing pin bore, wherein said front casing is slidably connected to said top side of said barrel, and wherein said rear casing is slidably connected to said frame.

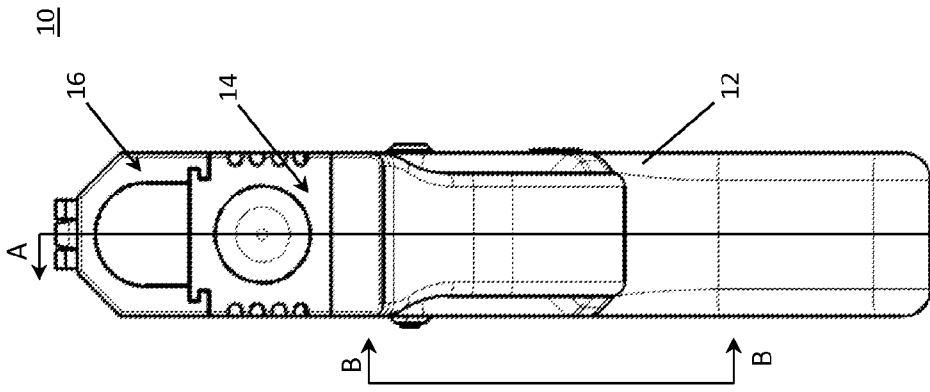


FIG. 1C

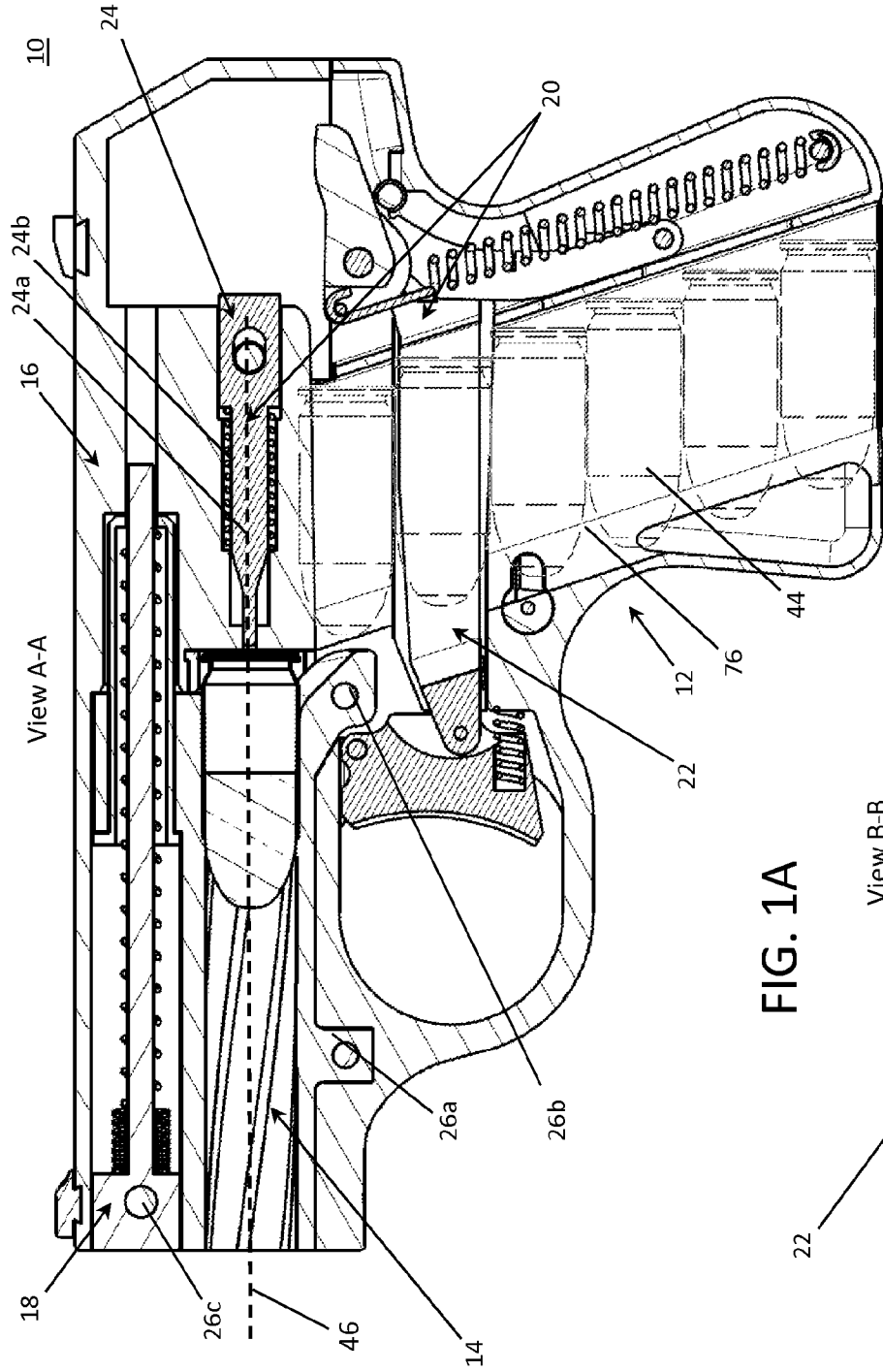


FIG. 1A

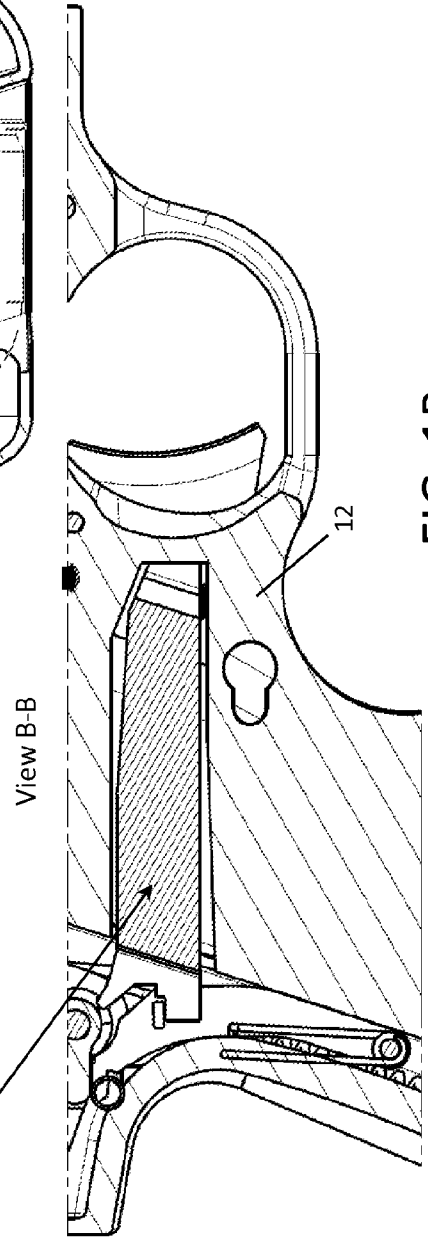


FIG. 1B

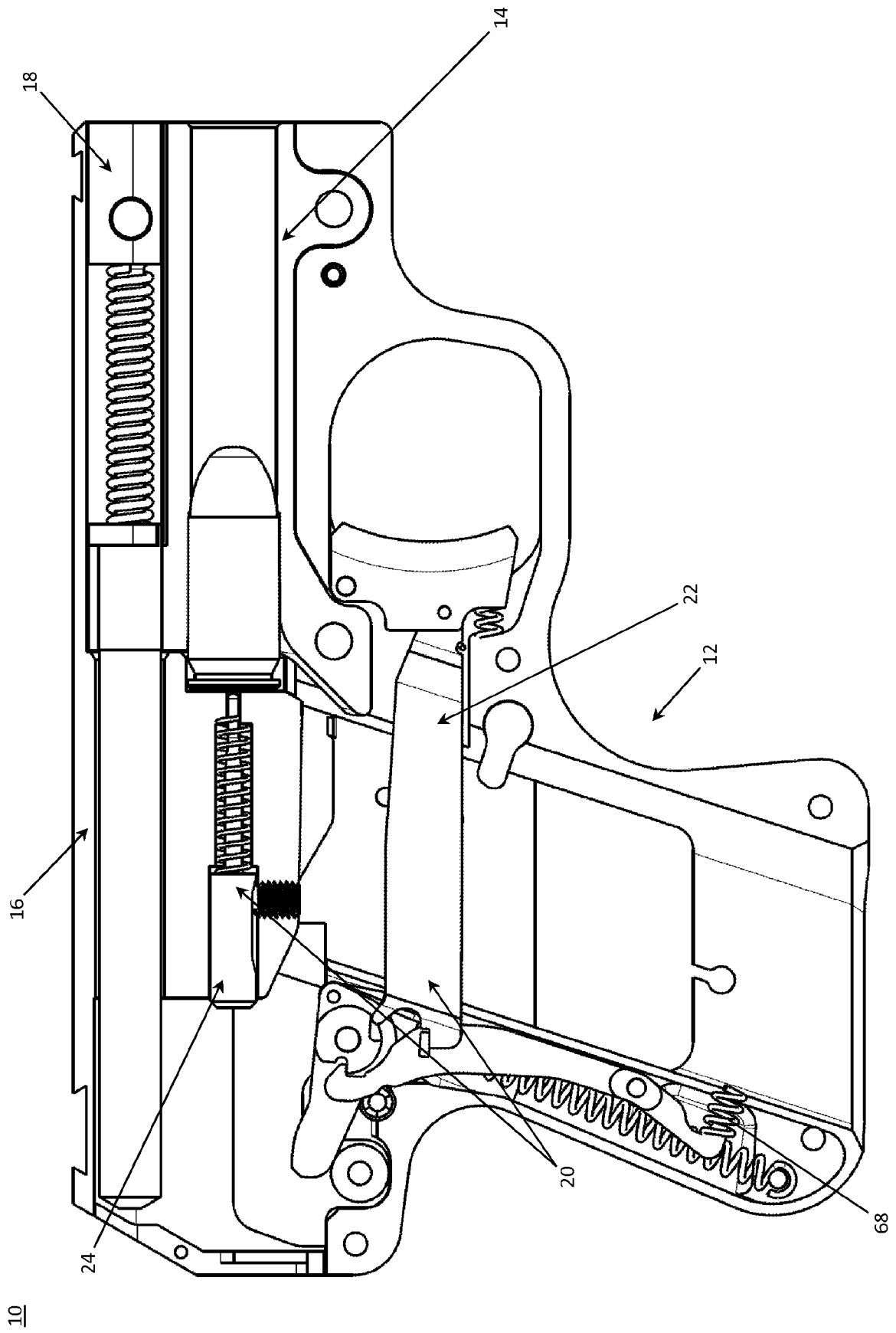


FIG. 1D

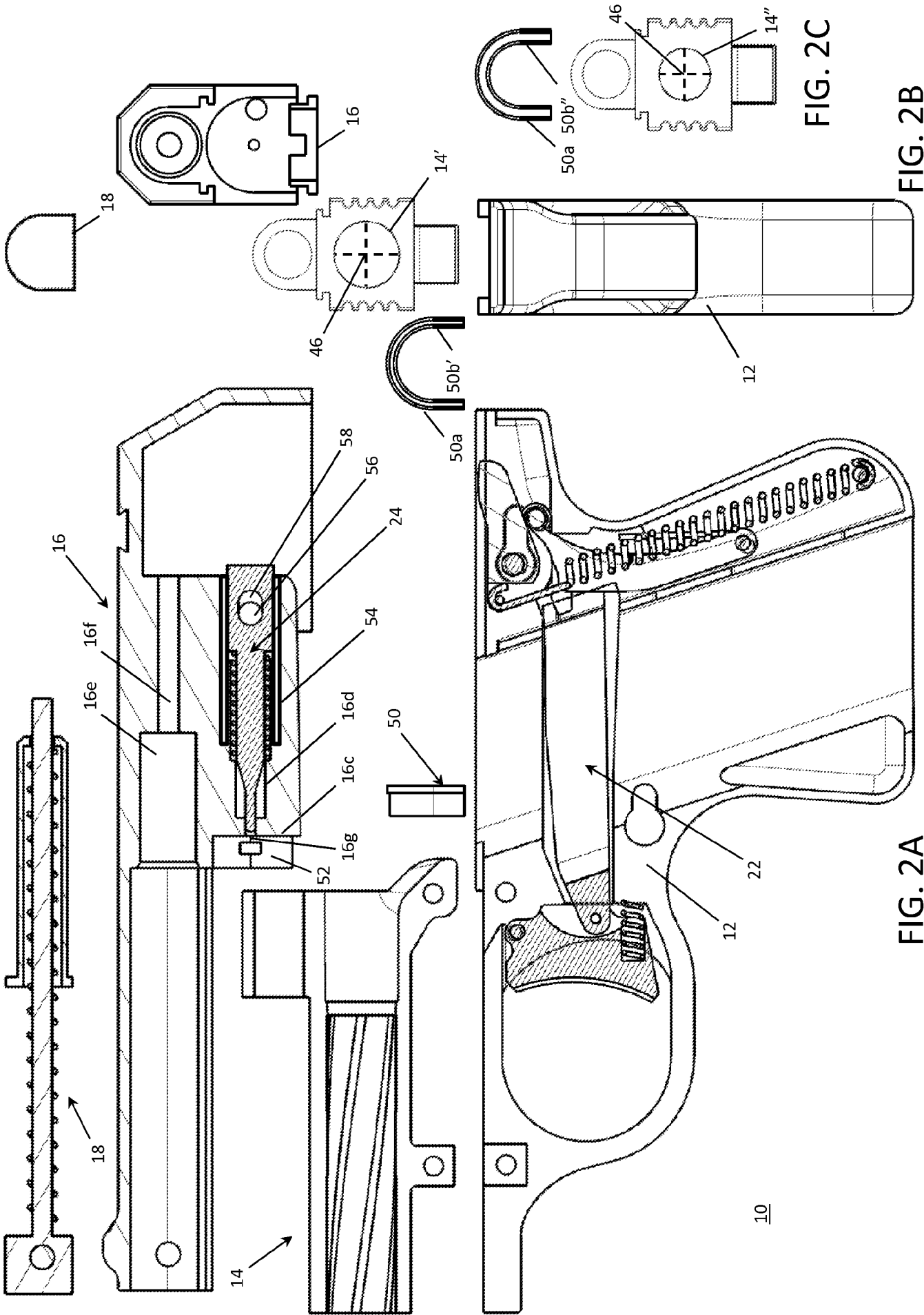


FIG. 2C

FIG. 2B

FIG. 2A



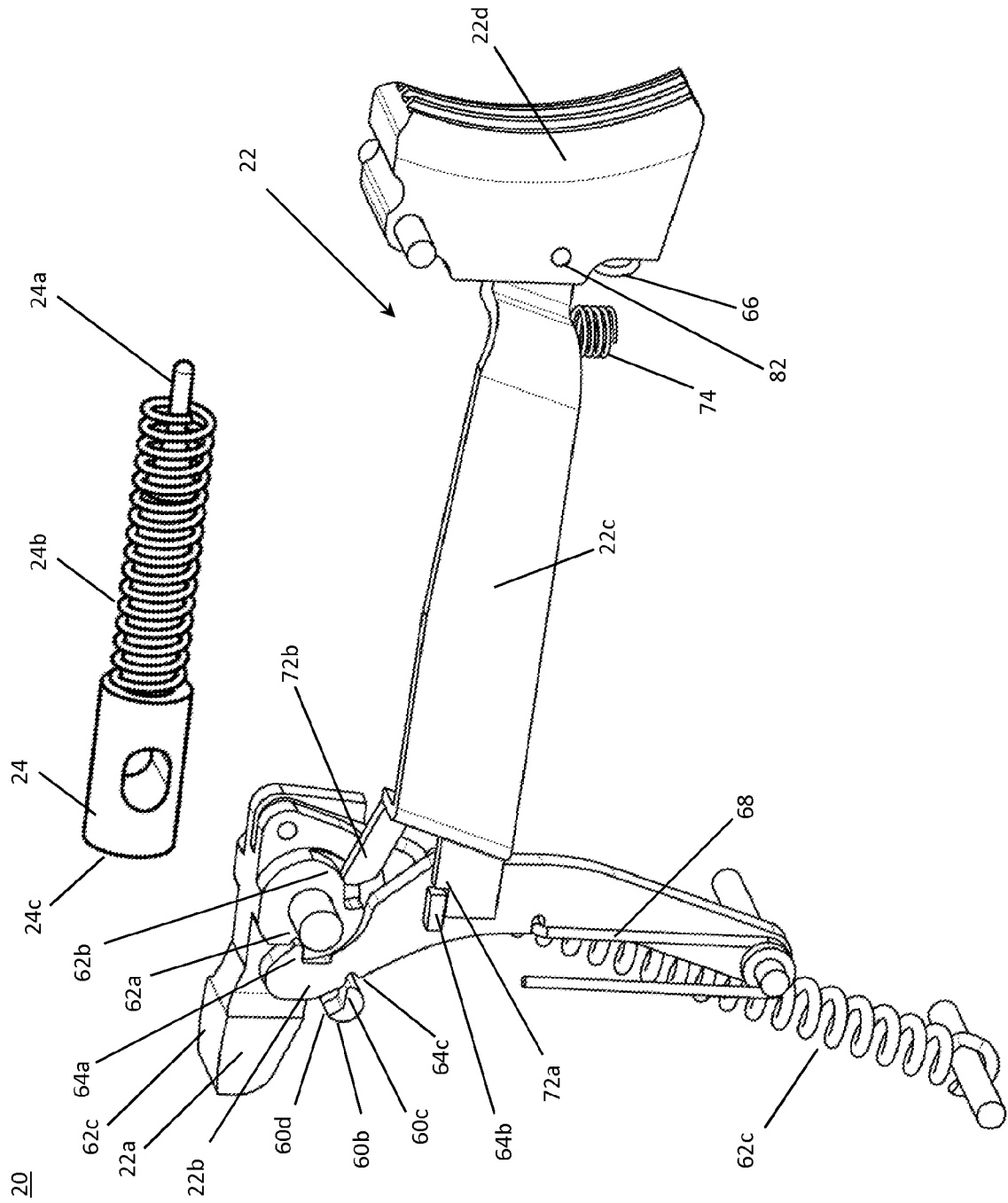


FIG. 3C

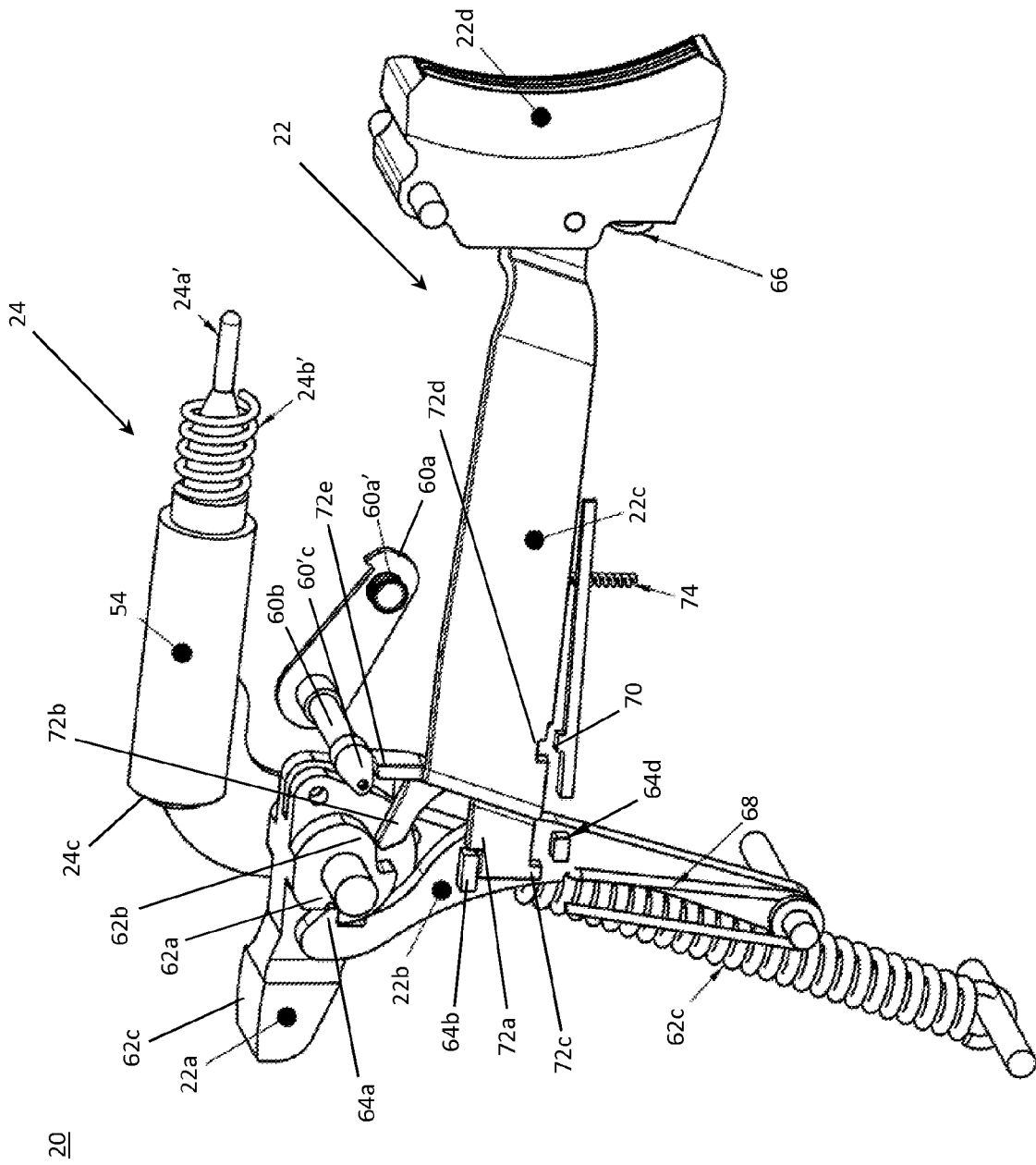
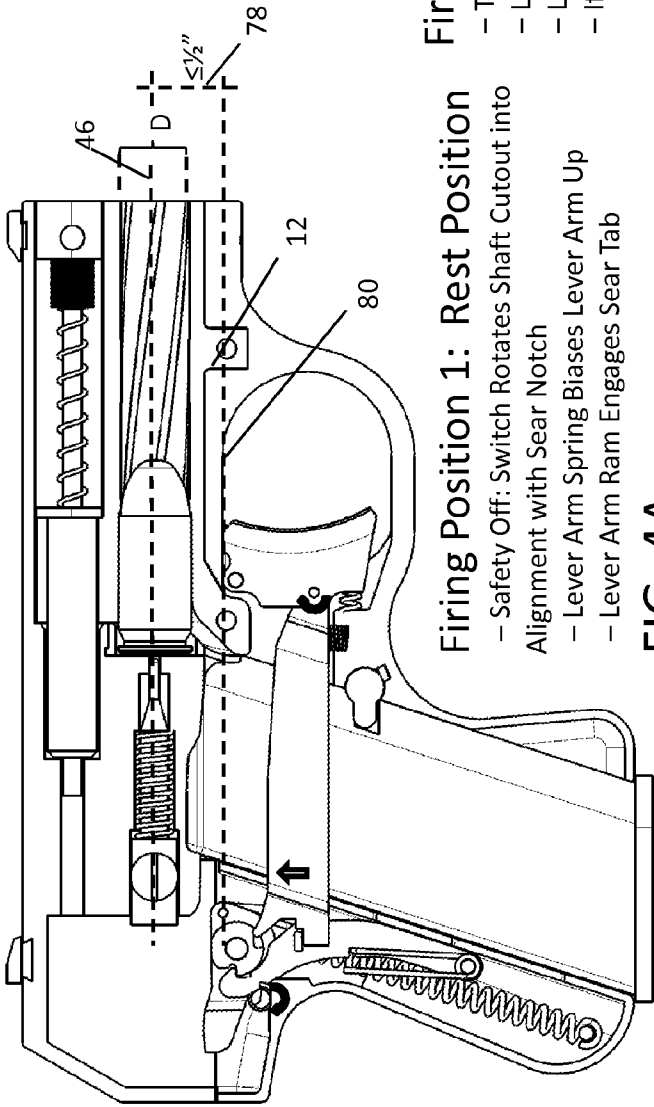


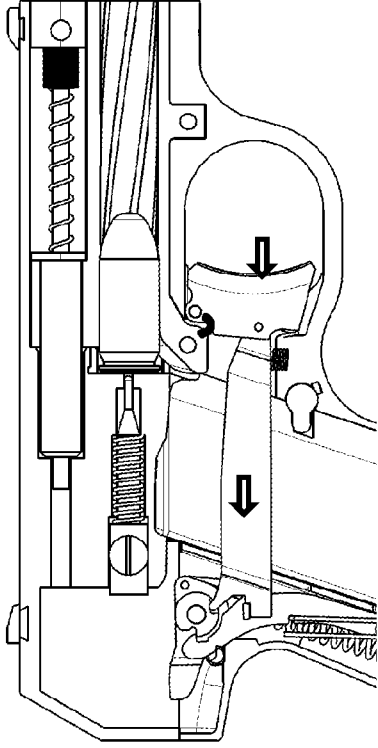
FIG. 3D



**Firing Position 1: Rest Position**

- Safety Off; Switch Rotates Shaft Cutout into Alignment with Sear Notch
- Lever Arm Spring Biases Lever Arm Up
- Lever Arm Ram Engages Sear Tab

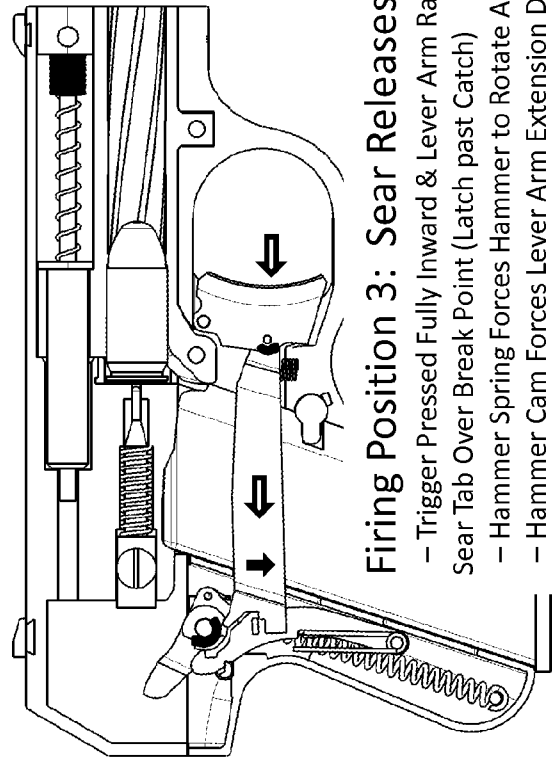
**FIG. 4A**



**Firing Position 2: Trigger Pull to Break Point**

- Trigger Pressed Inwardly
- Lever Arm Ram Pushes Sear Tab to Break Point (Latch at Catch)
- Lever Arm Extension Engages Hammer Cam
- If Trigger Released, Trigger Assembly Returns to Position 1

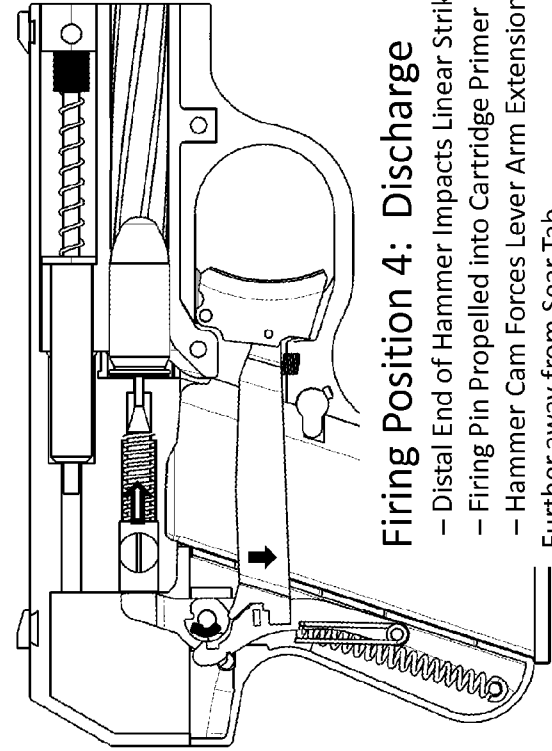
**FIG. 4B**



**Firing Position 3: Sear Releases Hammer**

- Trigger Pressed Fully Inward & Lever Arm Ram Pushes Sear Tab Over Break Point (Latch past Catch)
- Hammer Spring Forces Hammer to Rotate Around Pivot
- Hammer Cam Forces Lever Arm Extension Down & Disengages Lever Arm Ram from Sear Tab

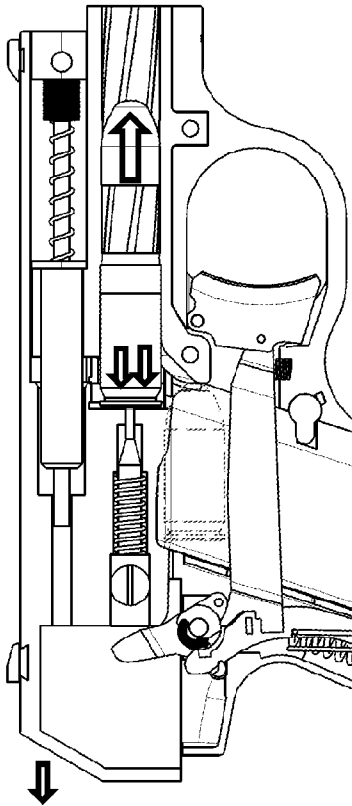
**FIG. 4C**



**Firing Position 4: Discharge**

- Distal End of Hammer Impacts Linear Striker
- Firing Pin Propelled into Cartridge Primer
- Hammer Cam Forces Lever Arm Extension Fully Down & Further away from Sear Tab

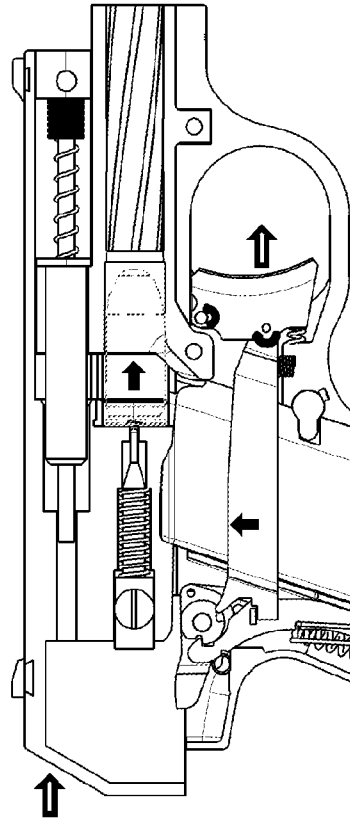
**FIG. 4D**



**Firing Position 5: Slide Forced Back & Cock**

- Slide Bearing Surface Pushes Hammer
- Hammer Rotates Back Around Pivot
- Hammer Cam Allows Lever Arm Extension Up & Lever Arm Spring Biases Lever Arm Up
- Lever Arm Ram Engages Sear Tab

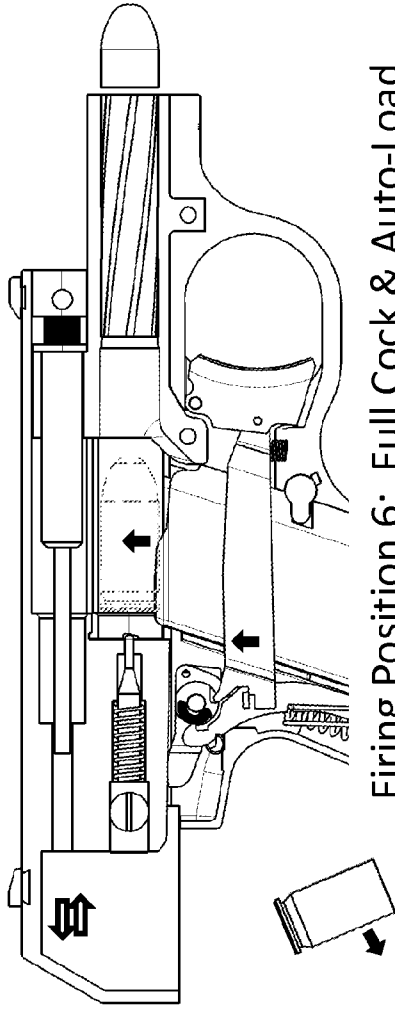
**FIG. 4E**



**Firing Position 7: Slide Chambers Round**

- Slide Spring Biases Slide Forward
- Trigger Spring Biases Trigger & Lever Arm Biased Forward
- Lever Arm Spring Biases Lever Arm Up to Engage Sear Tab
- Sear Spring Biases Sear Forward (Latch on Catch)
- Round in Magazine Forced into Cartridge Firing Chamber

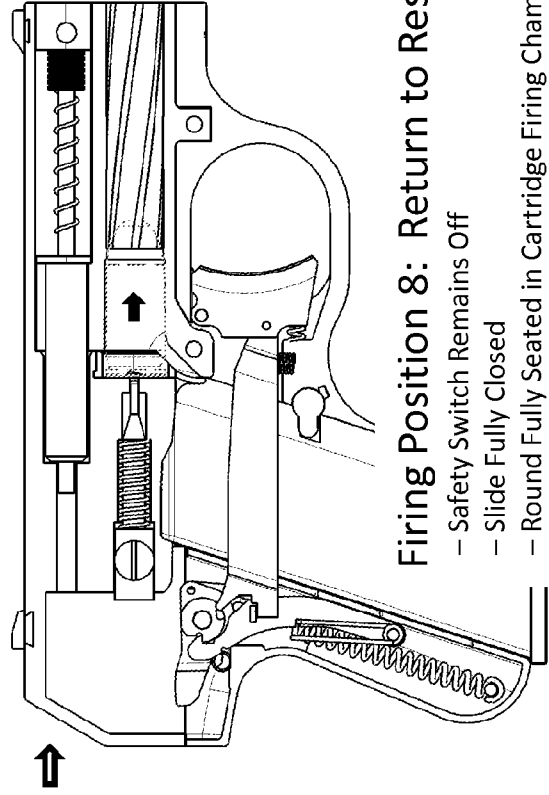
**FIG. 4G**



**Firing Position 6: Full Cock & Auto-Load**

- Slide Bearing Surface Fully Cocks Hammer
- Sear Spring Biases Sear Forward & Latch Engages Catch
- Lever Arm Spring Pushes Lever Arm Up Against Sear Tab & Trigger Remains Pressed Inward
- Spent Shell Forced out of Cartridge Firing Chamber

**FIG. 4F**

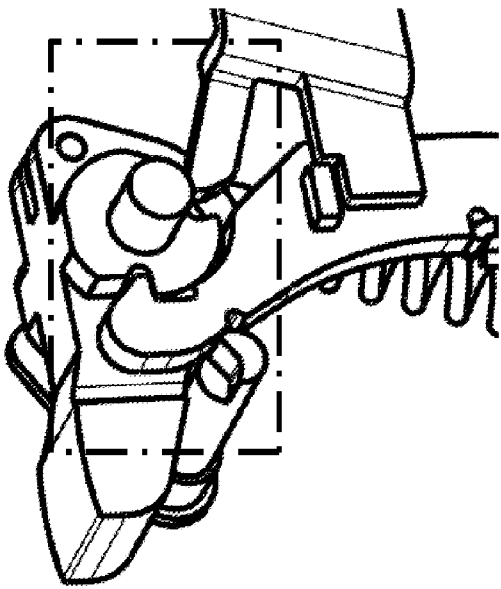


**Firing Position 8: Return to Rest**

- Safety Switch Remains Off
- Slide Fully Closed
- Round Fully Seated in Cartridge Firing Chamber
- Ready to Discharge Cartridge

**FIG. 4H**

Safety Lock Engaged – Non-Firing Position



Safety Lock Disengaged – Firing Position

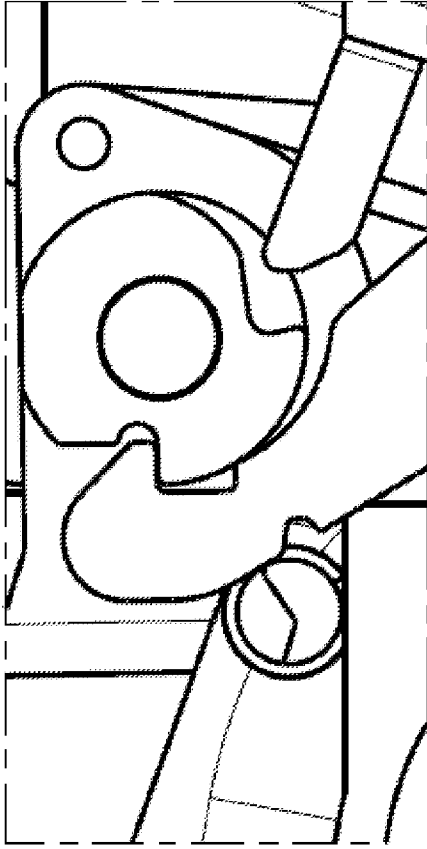
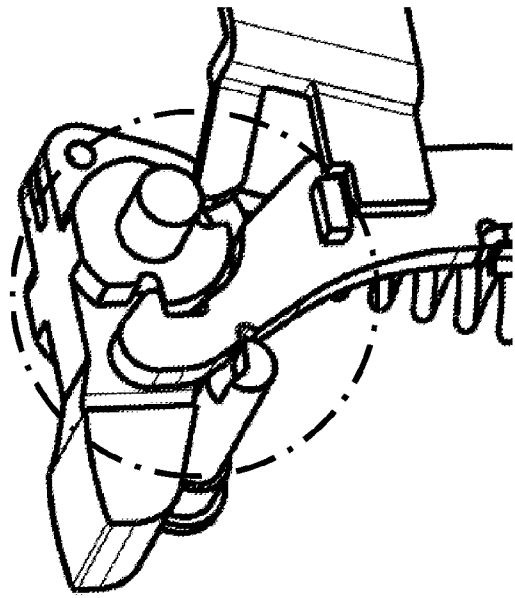


FIG. 5A

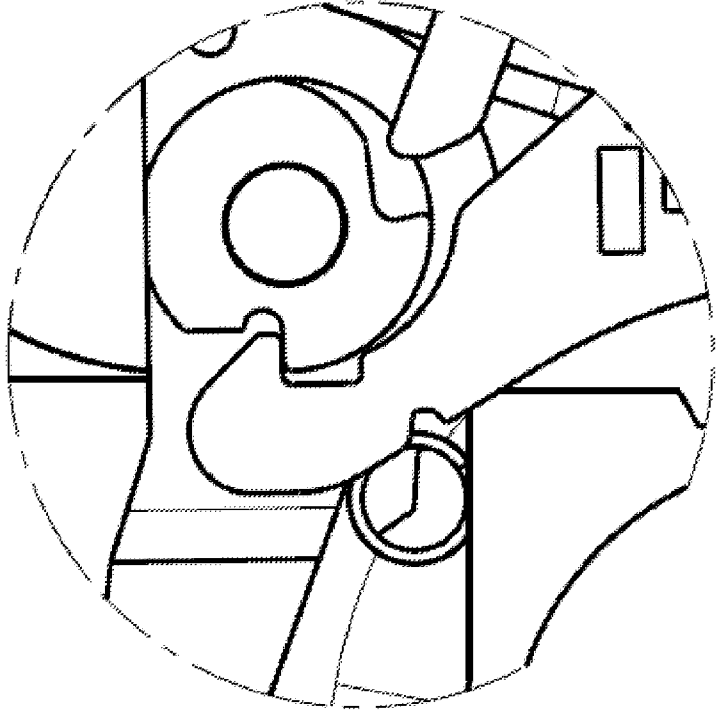


FIG. 5B

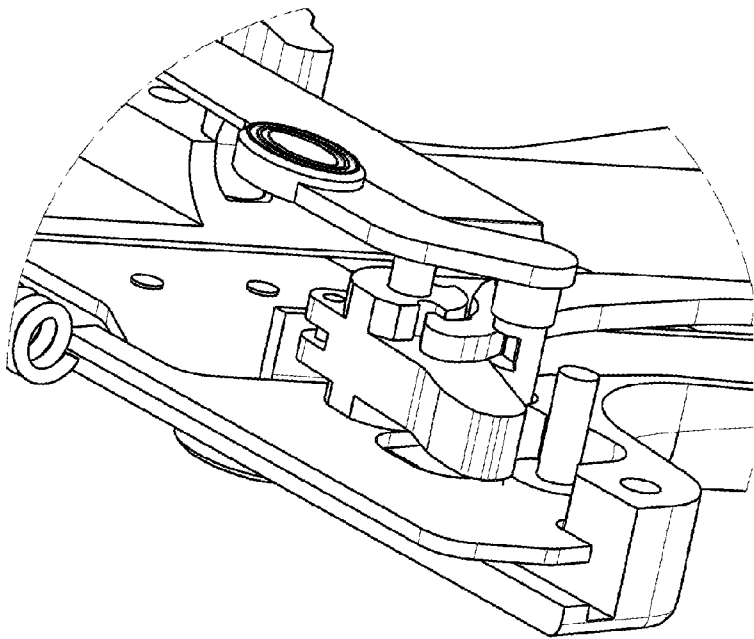


FIG. 5C

Safety Lock Engaged  
Non-Firing Position

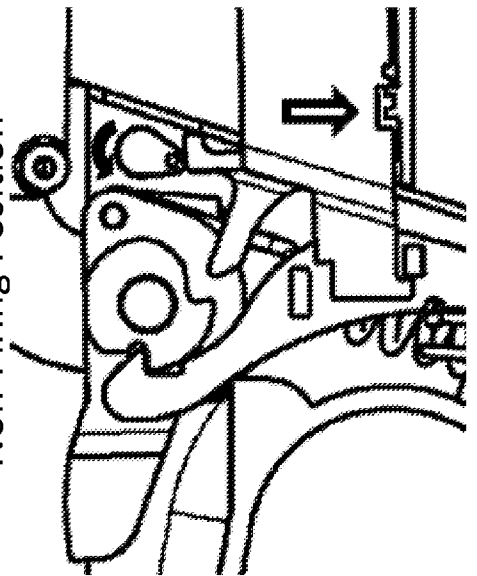


FIG. 6A

Safety Lock Disengaged  
Firing Position

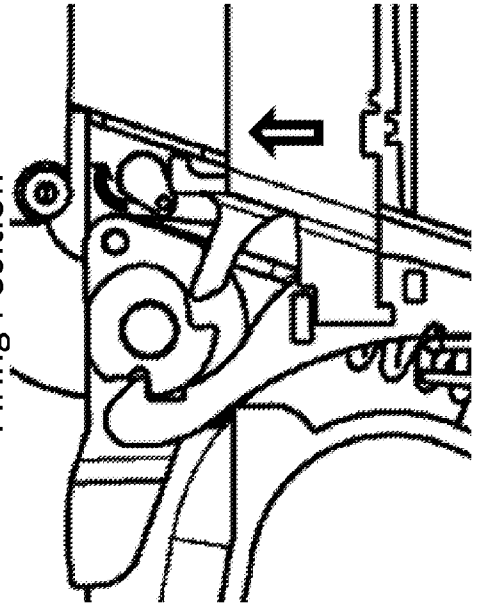


FIG. 6B