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Attorney for Plaintiffs

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF IDAHO

ABC IP, LLC, a Delaware limited liability
company, and RARE BREED TRIGGERS,
INC., a Texas corporation,

Plaintiffs,

vs.

BEOWULF MACHINE AND DEFENSE
LLC, an Idaho limited liability company,
and JOSEPH DEAN DOELL, an
individual,

Defendants.

Case No.:

COMPLAINT FOR PATENT
INFRINGEMENT

JURY TRIAL DEMANDED

This is an action for patent infringement in which ABC IP LLC (“ABC”), Rare Breed Triggers, Inc. (“Rare Breed”) (collectively, “Plaintiffs”) accuse Beowulf Machine and Defense LLC (“Beowulf”) and Joseph Dean Doell (collectively, “Defendants”) of infringing U.S. Patent Nos. 12,038,247, 12,031,784, 12,529,538, 12,578,159, and 12,636,403 as follows:

PARTIES

1. ABC is a limited liability company organized under the laws of the State of Delaware with an address at 8 The Green, Suite A, Dover, Delaware 19901.

2. Rare Breed is a Texas corporation having a place of business at 2710 Central Freeway, Suite 150-151, Wichita Falls, TX 76306.

3. Upon information and belief, Beowulf is an Idaho limited liability company having a principal address at 4543 Independence Avenue, Chubbuck, ID 83202-4918, and a mailing address of 2797 N Westminster Place, Boise, ID 83704.

4. Upon information and belief, Joseph Dean Doell is an individual residing or having a place of business at 2797 N. Westminster Place, Boise, ID 83704, and is the Manager of Beowulf who directs the operations thereof, including to engage in the acts accused to constitute patent infringement.

JURISDICTION AND VENUE

5. This is an action for patent infringement arising under 35 U.S.C. §§ 271(a)–(c), 281, and 284–85.

6. This Court has subject matter jurisdiction over this action under 28 U.S.C. § 1338, which directs that United States District Courts shall have original jurisdiction of any civil action arising under any Act of Congress relating to patents and pursuant to 28 U.S.C. § 1331, which pertains to civil actions arising under the laws of the United States.

7. Personal jurisdiction over Defendants is proper in this District because the Defendants reside in and/or have a regular and established place of business in this District.

8. Venue is proper in this district pursuant to 28 U.S.C. § 1400(b). Defendants reside in, or have committed acts of infringement and have a regular and established place of business in, this District.

BACKGROUND

9. This lawsuit asserts contributory and induced infringement of U.S. Patent Nos. 12,038,247 (“the ’247 Patent”), 12,031,784 (“the ’784 Patent”), 12,529,538 (“the ’538 Patent”), 12,578,159 (“the ’159 Patent”), and 12,636,403 (“the ’403 Patent”) (together, “the Asserted Patents”).

10. The ’247 Patent was lawfully and properly issued by the United States Patent and Trademark Office on July 16, 2024. Each and every claim of the ’247 Patent is valid and enforceable. A true and correct copy of the ’247 Patent is attached as Exhibit A.

11. The ’784 Patent was lawfully and properly issued by the United States Patent and Trademark Office on July 9, 2024. Each and every claim of the ’784 Patent is valid and enforceable. A true and correct copy of the ’784 Patent is attached as Exhibit B.

12. The ’538 Patent was lawfully and properly issued by the United States Patent and Trademark Office on January 20, 2026. Each and every claim of the ’538 Patent is valid and enforceable. A true and correct copy of the ’538 Patent is attached as Exhibit C.

13. The ’159 Patent was lawfully and properly issued by the United States Patent and Trademark Office on March 17, 2026. Each and every claim of the ’159 Patent is valid and enforceable. A true and correct copy of the ’159 Patent is attached as Exhibit D.

14. The ’403 Patent was lawfully and properly issued by the United States Patent and Trademark Office on May 26, 2026. Each and every claim of the ’403 Patent is valid and enforceable. A true and correct copy of the ’403 Patent is attached as Exhibit E.

15. ABC is the current owner by assignment of all right, title and interest in and to the Asserted Patents. These assignments have been recorded at the United States Patent and Trademark Office (“USPTO”).

16. Rare Breed is the exclusive licensee of the Asserted Patents.

17. Plaintiffs have complied with the requirements of 35 U.S.C. § 287 either because the Asserted Patents are not practiced by ABC or any licensee and/or because any licensee has been required to mark its product.

18. Upon information and belief, Defendants have committed acts of contributory and induced patent infringement, which will be described in more detail below. These acts are in violation of 35 U.S.C. § 271 and should be considered willful.

THE INVENTIONS

19. A typical AR15-pattern firearm, for example, is considered a semiautomatic firearm. The operation of a *standard disconnect* AR-pattern trigger mechanism is commenced by the trigger member being pulled by the user. The trigger member releases the hammer from the trigger sear and allows the hammer to strike the firing pin. A portion of the propellant gas is used to begin the process of sending the bolt carrier to the rear of the firearm. The rearward movement of bolt carrier cocks the hammer on the disconnect and then the bolt is allowed to return forward into battery with a new round inserted into the chamber. While this is happening, in the standard AR-pattern semiautomatic trigger, the user can either continue to hold the trigger member in a pulled (i.e., fired) state or allow the trigger to return to its reset state, in which the sear, rather than the disconnect, engages and holds the hammer in a cocked position. When the user reduces pressure on the trigger member to allow the trigger spring to reset the trigger member, the disconnect releases the hammer to engage the trigger sear.

20. In the standard AR-pattern trigger assembly, the purpose of the disconnect is to hold the hammer in a cocked position until the trigger member is reset by a trigger spring when the user lets the trigger reset. The disconnect allows the firearm to be fired only a single time when the trigger is pulled and held, because the user is not typically able to manually reset the trigger rapidly enough so that the sear engages before the bolt carrier or bolt returns to its in-battery

position. The disconnecter prevents the firearm from either firing multiple rounds on a single pull of the trigger, or from allowing the hammer to simply “follow” the bolt carrier as it returns to battery without firing a second round, leaving the hammer uncocked.

21. In contrast, in what Plaintiffs have coined a “forced reset” trigger mechanism, cycling of the bolt carrier or bolt causes the trigger member to be mechanically moved to the reset position and hold the trigger member there until the bolt or bolt carrier is back in battery, when it is safe for the user to pull the trigger again, without the need for a disconnecter.

22. The ’247 and ’159 Patents provide a novel device for accelerating the firing sequence of any semiautomatic firearm, in contrast to a standard semiautomatic trigger or other prior art devices that allow an accelerated rate of semiautomatic firing. The device can be selected to operate in either a standard semiautomatic mode or a “forced reset” semiautomatic mode and uses a cam, rotated by cycling of the action, to cause the trigger member to reset and prevent the trigger member from being pulled again until the action has returned to the in-battery position.

23. The ’784 Patent provides a device that works in a trigger system as an extended trigger member locking mechanism for use with a semi-automatic firearm that employs, in some embodiments, a “deflectable extension of the locking member that is actuated by forward movement of the bolt carrier,” among other innovations as explicitly claimed. Certain inventions of the ’784 Patent overcome the geometric limitations of prior art designs for use in multiple and varied semi-automatic firearm designs by allowing a locking member to deflect or fold separately from the body portion of the locking member when contacted by the forward portion of the bolt carrier as it cycles to the rear.

24. The ’538 Patent provides a safety mechanism for a firearm that employs a cam selector, a lever, and a trigger. The cam selector contains multiple recesses and is configured to

operate between a first mode, a second mode, and a third mode. In the first mode, a portion of the trigger referred to as a first trigger tail portion is movable within the first recess. In the second mode, the first trigger tail portion is allowed to engage the second recess and be moved down by a cam portion of the second recess when the cam selector rotates. In the third mode, the cam selector is configured to prevent the trigger from being pulled.

25. The '403 Patent describes and claims a similarly operating device with the additional feature that it can be selected to operate in either of two distinct modes: 1) standard disconnecter semiautomatic mode and 2) "forced reset" semiautomatic mode.

26. The claims of the patents define the scope of the patented inventions.

THE INFRINGING DEVICE

27. On information and belief, Defendants previously or are currently making, using, selling, and/or offering for sale within the United States products that are a component of the patented machine, manufacture, or combination, or apparatus constituting a material part of the invention defined by claims of the Asserted Patents, knowing the same to be especially made or especially adapted for use in an infringement of the Asserted Patents, and not a staple article or commodity of commerce suitable for substantial noninfringing use, including at last pre-cut triggers for the Super Safety, which embody the technology claimed in the Asserted Patents.

28. On information and belief, Defendants previously have or currently are making, using, selling, and/or offering for sale a component made especially for the Super Safety, namely, at least pre-cut triggers for the Super Safety, to companies who use, sell, or offer for sale in multiple variants, the Super Safety, including but not limited to DNT, LLC, including at least:

- a. A partial kit, which includes at minimum the cam and cam lever components, and may further include one or more additional components—when these components are installed in combination with a standard AR-pattern hammer

and disconnecter, with standard springs, the combination creates the invention of the '247, '784, '538, '159, and '403 Patents—and/or;

- b. A complete kit, which includes at minimum the cam and cam lever components and additional components (e.g., a standard AR-pattern hammer, disconnecter, standard springs, and a modified trigger); and/or
- c. A complete kit preinstalled in a receiver and/or complete firearm, which includes cam and cam lever components and additional components (e.g., a standard AR-pattern hammer, disconnecter, standard springs, and a modified trigger) preinstalled in an AR-pattern receiver.

29. An exemplary image of the especially made or especially adapted trigger member is shown below:



30. The Super Safety can operate in a “disconnecter mode,” which is much like that of a standard AR-15 trigger. The user can switch between safe, standard semiautomatic with disconnecter, and “forced reset” semiautomatic with cam modes by moving the safety selector laterally between positions.

COUNT I – INFRINGEMENT OF THE '247 PATENT

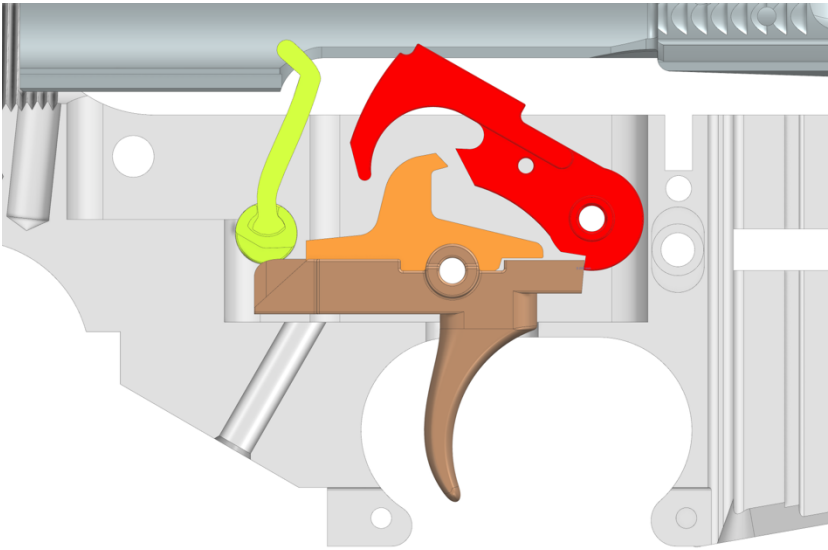
31. Plaintiffs re-allege and incorporate the allegations of the preceding paragraphs as if fully set forth herein.

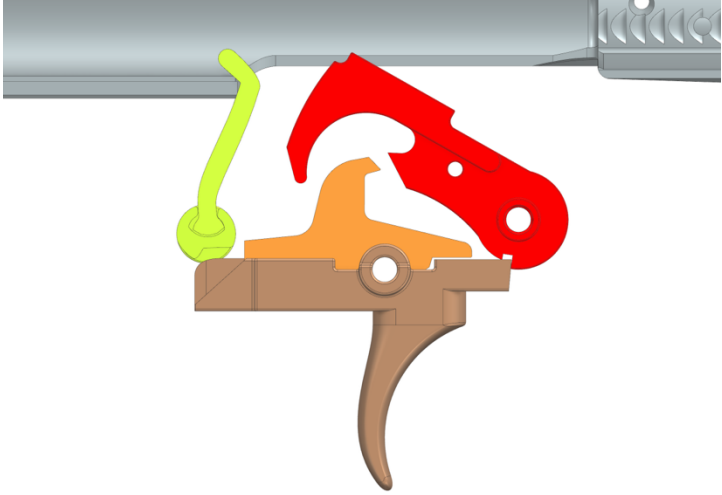
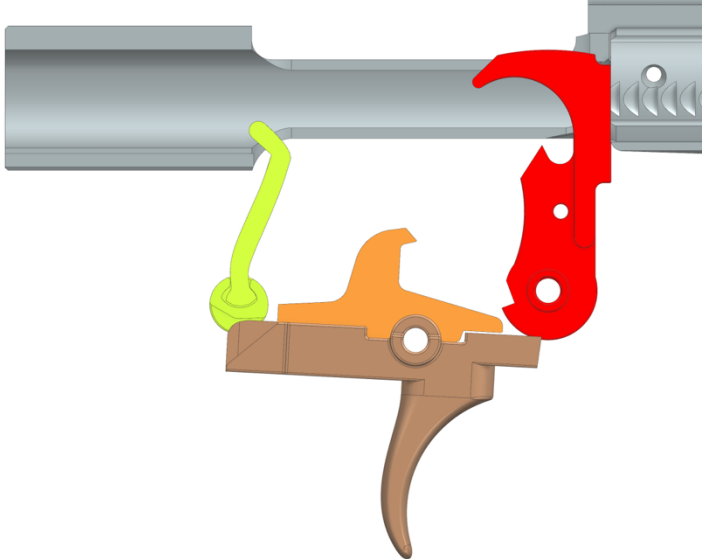
32. In violation of 35 U.S.C. § 271, Defendants have infringed, by inducing others to infringe, and/or contributing to the infringement of, one or more claims of the '247 Patent, including but not limited to claim 15, literally and/or under the doctrine of equivalents, by among other things, making, using, offering for sale, selling, and/or importing into the United States unlicensed products in a manner that infringes the '247 Patent. Such unlicensed products include especially made or especially adapted trigger members for the Super Safety.

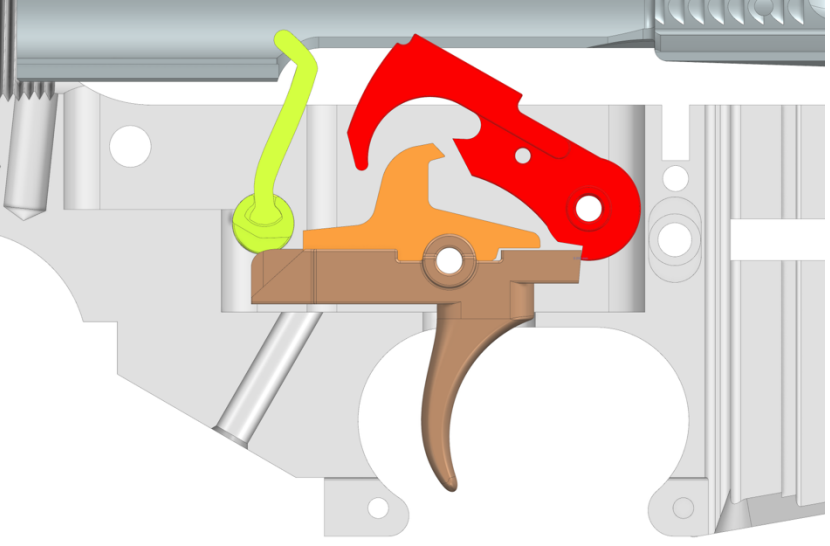
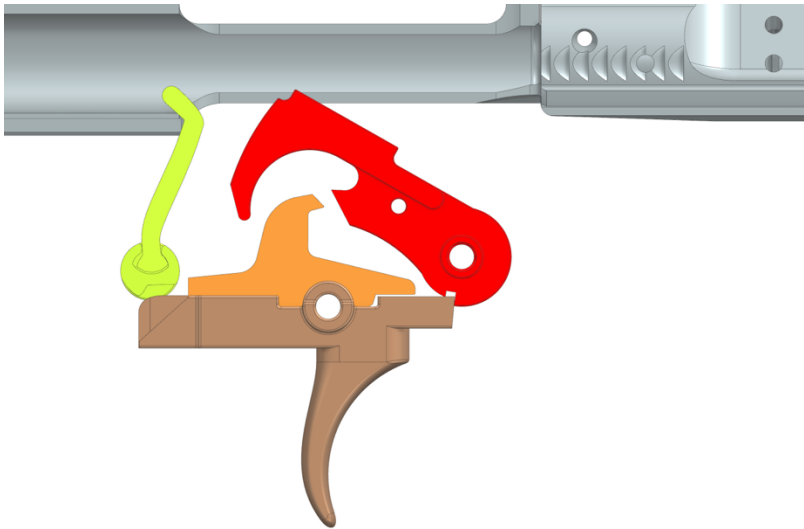
33. On information and belief, Defendants have and continue to willfully infringe, induce others to infringe, and/or contribute to the infringement of one or more claims of the '247 Patent, including but not limited to claim 15, literally and/or under the doctrine of equivalents.

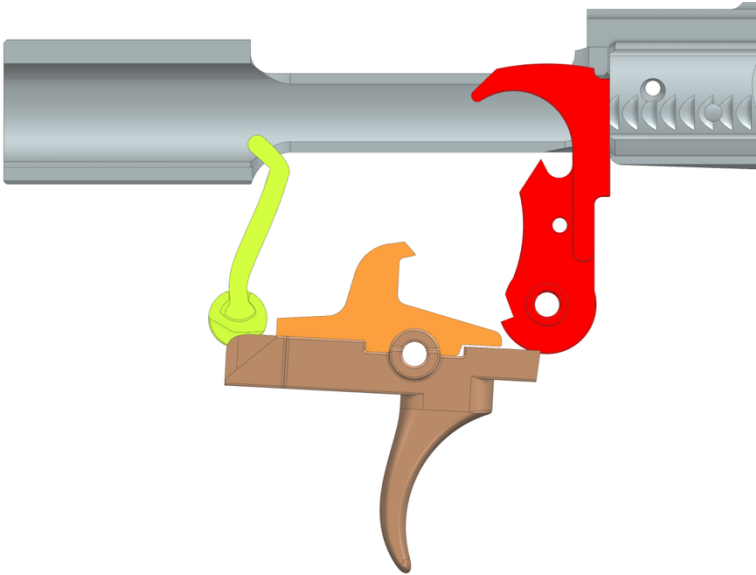
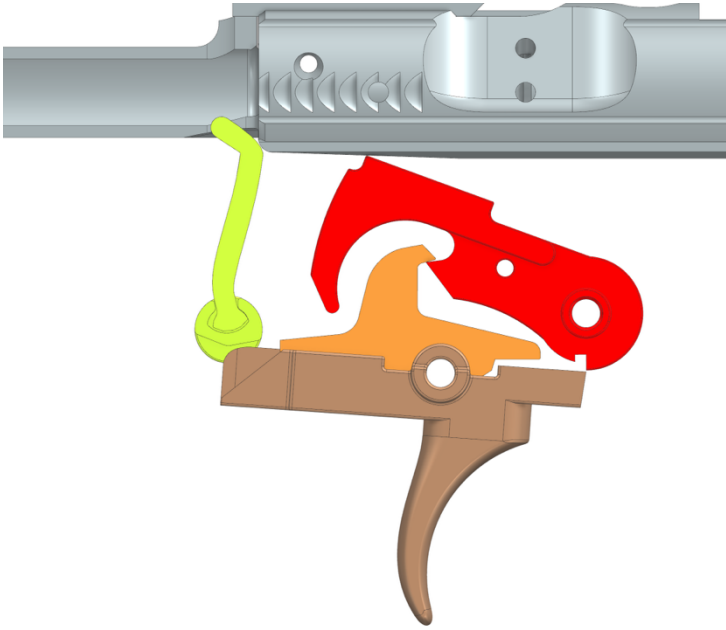
34. An exemplary comparison of the Super Safety, when assembled and used as intended, with claim 15 of the '247 Patent, is illustrated in the chart below:

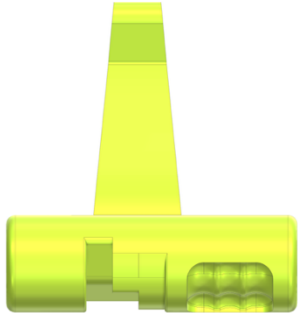
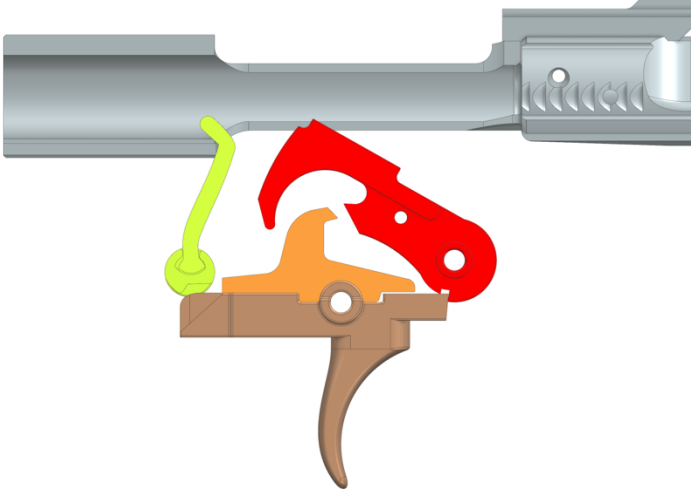
'247 Patent Claim 15	The Super Safety
15. A firearm trigger mechanism comprising:	When installed and used as directed, the Super Safety is part of a trigger mechanism and functions as a cam that in at least one mode, both causes the reset of the trigger and locks the trigger during the cycle of operation. 

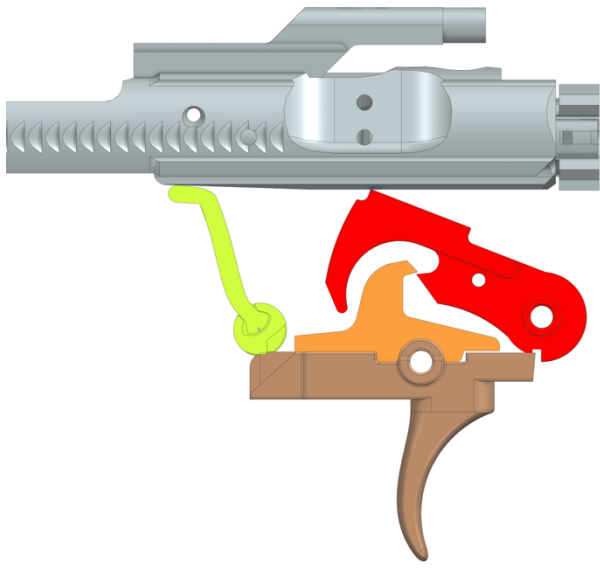
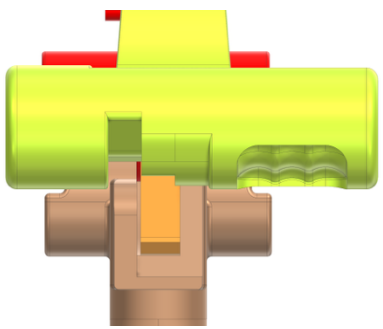
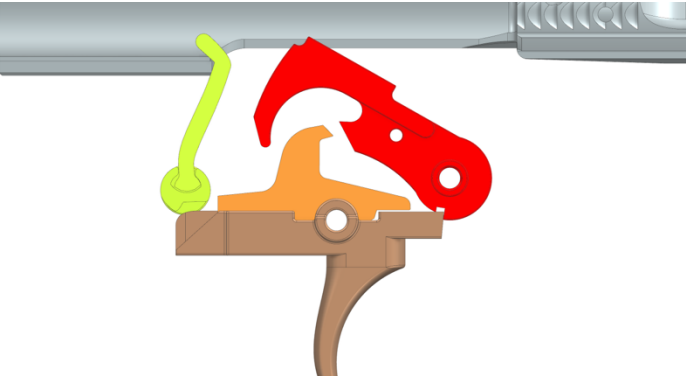
'247 Patent Claim 15	The Super Safety
	 The Super Safety <i>See also, Ex. F, Super Safety 3D Printed Active Trigger System v4.4, (“Super Safety Guide”) at 12</i>
a hammer having a sear catch and a hook for engaging a disconnector and adapted to be mounted in a fire control mechanism pocket of a receiver	The Super Safety (yellow) is installed in a fire control mechanism pocket of a receiver along with a hammer (red) that has a sear catch and a hook for engaging a disconnector (orange).  (Plaintiff-generated renderings of the Super Safety here and below)
to pivot on a transverse hammer pivot axis between set and released positions,	The hammer (red) pivots on a transverse hammer pivot axis between set and released positions, depicted below. The

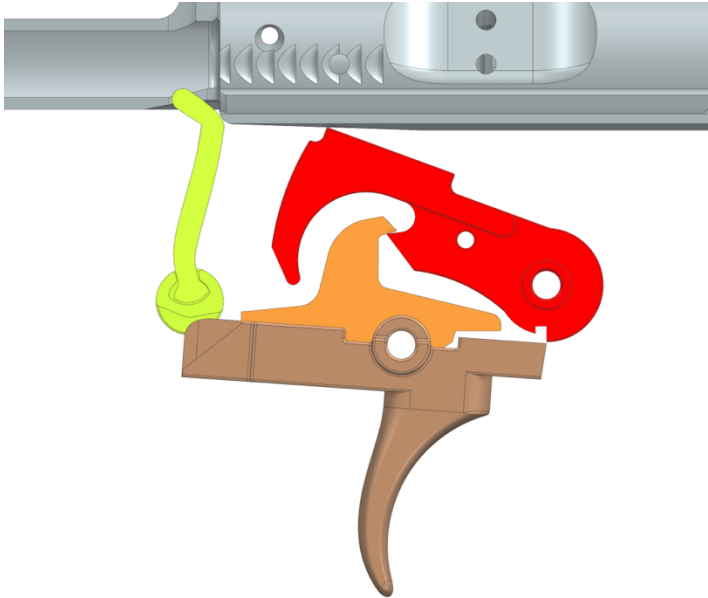
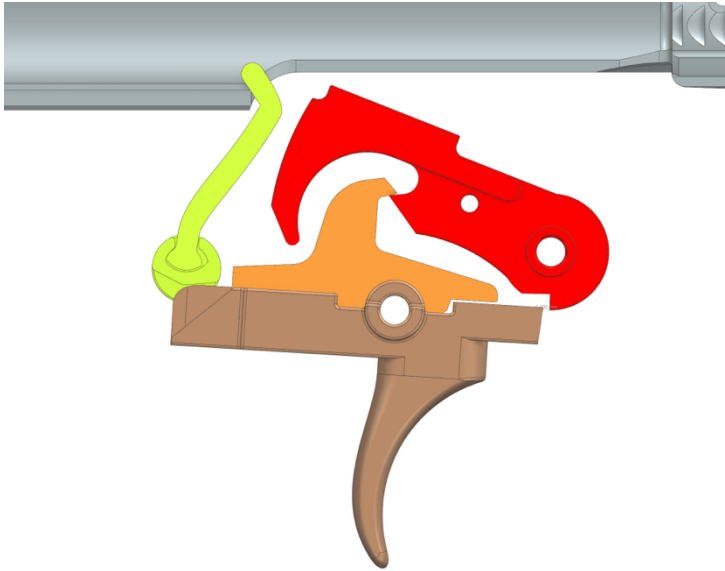
'247 Patent Claim 15	The Super Safety
said hammer adapted to be pivoted rearward by rearward movement of a bolt carrier,	hammer is adapted to be pivoted rearward by rearward movement of a bolt carrier.  Hammer Set Position  Hammer Released Position
a trigger member having a sear and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse trigger member pivot axis between set and released positions,	The Super Safety (yellow) is installed with a trigger member (brown) in the fire control mechanism pocket and the trigger member pivots on a transverse trigger member pivot axis between set and released positions. The trigger member (brown) has a sear.

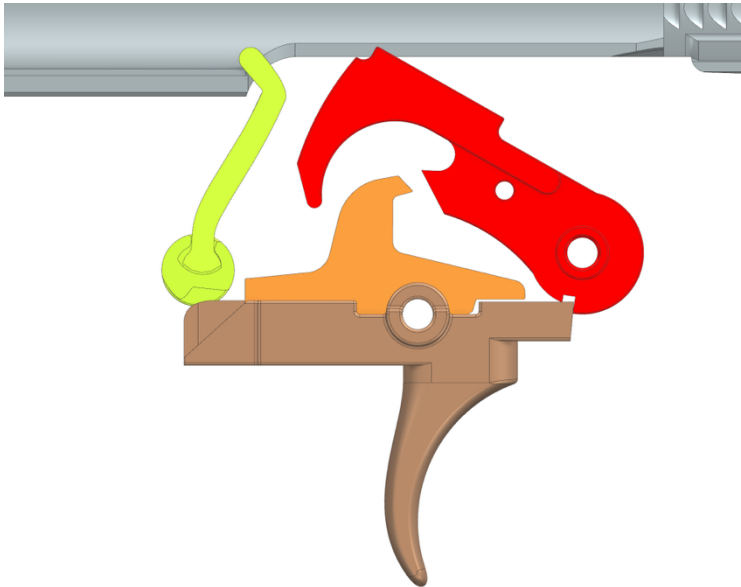
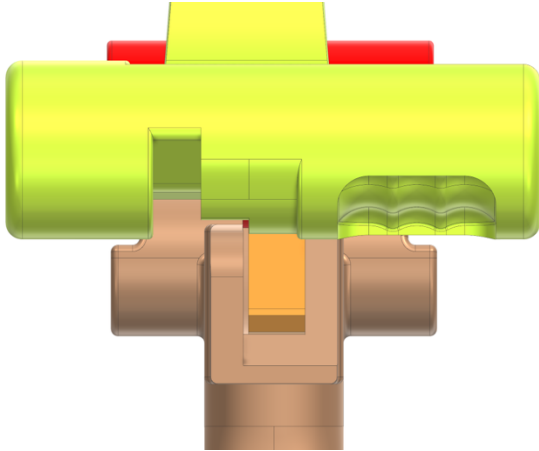
'247 Patent Claim 15	The Super Safety
	
wherein said sear and sear catch are in engagement in said set positions of said hammer and trigger member	The sear of the trigger member (brown) and sear catch of the hammer (red) are in engagement when the hammer and trigger member are in their set positions.  Trigger Member Set Position
and are out of engagement in said released positions of said hammer and trigger member,	The sear of the trigger member (brown) and sear catch of the hammer (red) are out of engagement in the released position.

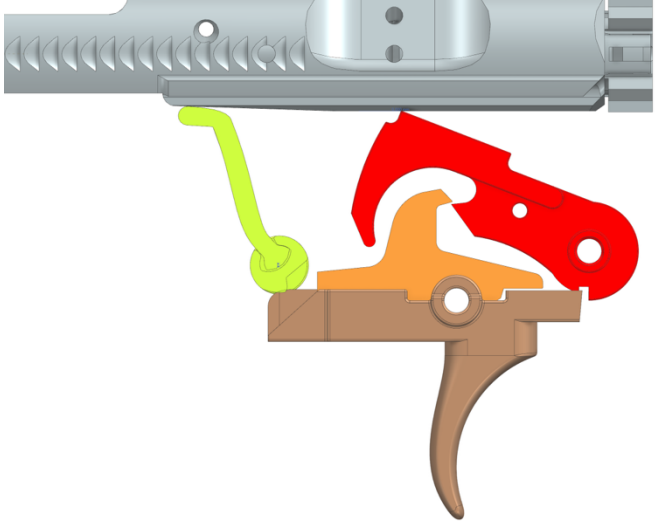
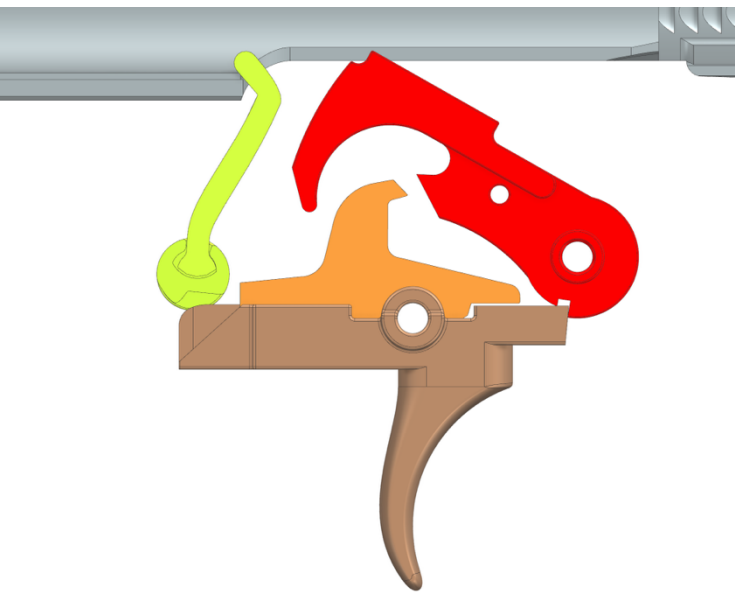
'247 Patent Claim 15	The Super Safety
	 The diagram shows a cross-section of a firearm's trigger assembly. A brown trigger is at the bottom. Above it is an orange disconnect member with a hook at its top. A red hammer is positioned above the orange member. A green wire is connected to the trigger and the orange member. The orange member is in a released position, not yet engaged with the hammer. Trigger Member Released Position
said disconnecter having a hook for engaging said hammer and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse disconnecter pivot axis,	The disconnecter (orange) is adapted to be mounted in the fire control mechanism pocket to pivot on a transverse disconnecter pivot axis. The disconnecter has a hook for engaging the hammer (red).  The diagram shows the same trigger assembly as above, but the orange disconnect member is now pivoted upwards so that its hook is engaged with the bottom of the red hammer. This prevents the hammer from striking the trigger. Disconnecter Hook Engaged
and a cam having a cam lobe and adapted to be movably mounted in the	The Super Safety has a cam with a cam lobe and lever that is adapted to be movably mounted in the fire control mechanism

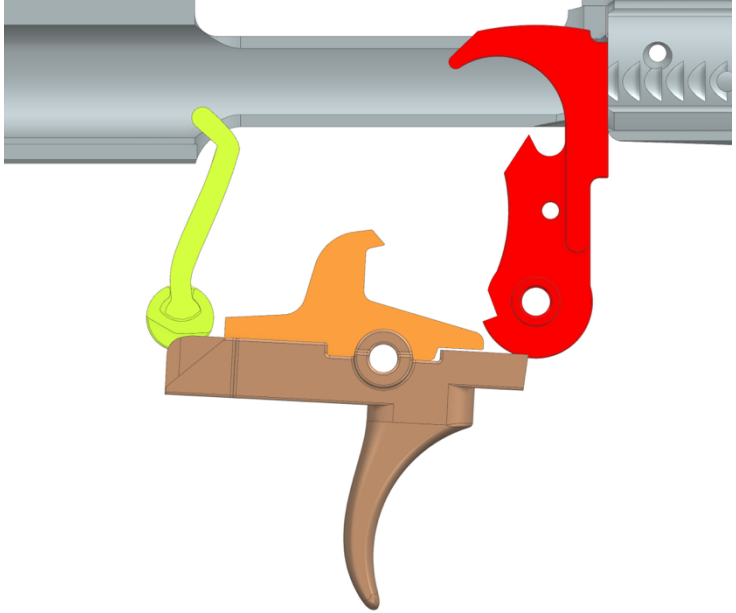
'247 Patent Claim 15	The Super Safety
fire control mechanism pocket,	pocket. (See image above depicting Super Safety, shown in yellow, in fire control mechanism pocket)  Super Safety Cam with Lobe and Lever
said cam being movable between a first position and a second position, in said second position said cam lobe forces said trigger member towards said set position,	The cam is movable between a first position and a second position.  Cam and Lobe First Position In the second position, the cam lobe mechanically moves the trigger member (brown) toward the set position when the cam is in the “forced reset” semi-automatic mode.

'247 Patent Claim 15	The Super Safety
	 Cam and Lobe Second Position
whereupon in a standard semi-automatic mode, said cam is in said first position,	During at least part of the cycle in the standard semi-automatic mode,  . . . the cam is in the first position. 

'247 Patent Claim 15	The Super Safety
rearward movement of the bolt carrier causes rearward pivoting of said hammer such that said disconnecter hook catches said hammer hook, and thereafter the bolt carrier moves forward into battery, at which time a user must manually release said trigger member to free said hammer from said disconnecter to permit said	Rearward movement of the bolt carrier causes rearward pivoting of the hammer (red) such that the disconnecter (orange) hook catches the hammer hook.  Thereafter, the bolt carrier moves forward into battery,  ... at which time a user must manually release the trigger member (brown) to free said hammer (red) from the disconnecter (orange) to permit the hammer and trigger member

'247 Patent Claim 15	The Super Safety
hammer and trigger member to pivot to said set positions so that the user can pull said trigger member to fire the firearm, and	to pivot to the set positions so that the user can pull the trigger member to fire the firearm. 
whereupon in a forced reset semi-automatic mode, said cam is in said second position, rearward movement of the bolt carrier causes rearward pivoting of said hammer such that said disconnector	When in the “forced reset” semi-automatic mode,  ... the cam is in the second position during at least part of the cycle and mechanically moves the trigger member toward the set position. Rearward movement of the bolt carrier causes rearward pivoting of the hammer (red) such that the disconnector (orange) hook is prevented from catching the hammer hook.

'247 Patent Claim 15	The Super Safety
hook is prevented from catching said hammer hook,	
and thereafter the bolt carrier moves forward into battery,	Thereafter, the bolt carrier moves forward into battery, 
at which time the user can pull said trigger member to fire the firearm.	. . . at which time the user can pull the trigger member (brown) to fire the firearm.

'247 Patent Claim 15	The Super Safety
	

35. On information and belief, in addition to contributory infringement, Defendant takes active steps to induce others, including its customers, to directly infringe the '247 patent. Defendant takes such active steps knowing that those steps will induce, encourage, and facilitate direct infringement by others. Such active steps include, but are not limited to, installation of, encouraging, advertising, promoting, and instructing others to use and/or how to use the Super Safety.

36. On information and belief, Defendants knew, know or should know or have known that such activities induce others to directly infringe at least claim 15 of the '247 Patent.

37. On information and belief, Defendants also contribute to the infringement of the '247 Patent by others, including its customers. Acts by Defendants that contribute to the infringement of others include, but are not limited to, the sale, offer for sale, and/or importation by Defendants of the components of the Super Safety, such as the especially made or especially adapted trigger member. The components are not suitable for substantial noninfringing use as they

are specially designed and adapted to be used in a fire control unit to mechanically reset a trigger mechanism and infringe the '247 Patent.

38. Defendants have engaged in egregious infringement behavior with knowledge of the '247 Patent, which has been duly issued by the USPTO, and is presumed valid. On information and belief, Defendants have known or should have known that their actions constituted and continue to constitute infringement of the '247 Patent and that the '247 Patent is valid at least through the service of this complaint. Defendants could not reasonably or subjectively believe that their actions do not constitute infringement of the '247 Patent, nor could they reasonably or subjectively believe that the patent is invalid. Despite that knowledge and subjective belief, and the objectively high likelihood that their actions constitute infringement, Defendants have continued its infringing activities. As such, Defendants willfully infringe the '247 Patent.

39. By their actions, Defendants have injured Plaintiffs and is liable to Plaintiffs for infringement of the '247 Patent pursuant to 35 U.S.C. § 271.

40. By their actions, Defendants' infringement of the '247 Patent has irreparably injured Plaintiffs. Unless such infringing acts are enjoined by this Court, Plaintiffs will continue to suffer additional irreparable injury.

41. By their actions, Defendants' infringement of the '247 Patent has damaged and continues to damage Plaintiffs in an amount yet to be determined.

42. Defendants' infringement of the '247 patent is exceptional and entitles Plaintiffs to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

43. Defendants' acts of infringement are willful and for no other purpose than to deliberately and irreparably harm Plaintiffs' business, sales, reputation, and good-will.

44. Plaintiffs have been substantially harmed by Defendants' infringing activities and are entitled to relief including but not limited to a preliminary injunction, a permanent injunction, damages adequate to compensate for the infringement, being lost profits or no less than a reasonable royalty, treble damages, and attorneys' fees.

COUNT II – INFRINGEMENT OF THE '784 PATENT

45. Plaintiffs re-allege and incorporate the allegations of the preceding paragraphs as if fully set forth herein.

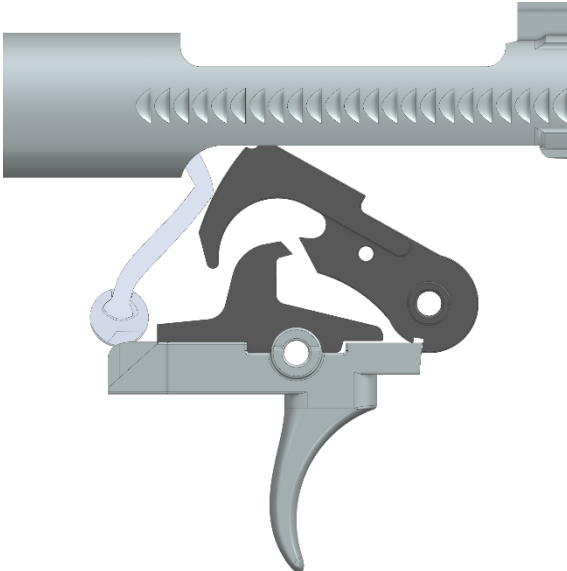
46. In violation of 35 U.S.C. § 271, Defendants have infringed, by inducing others to infringe, and/or contributing to the infringement of, one or more claims of the '784 patent, including but not limited to claim 1, literally and/or under the doctrine of equivalents, by among other things, making, using, offering for sale, selling, and/or importing into the United States components of unlicensed products in a manner that infringes the '784 patent. Such unlicensed products include trigger members especially made or especially adapted for the Super Safety.

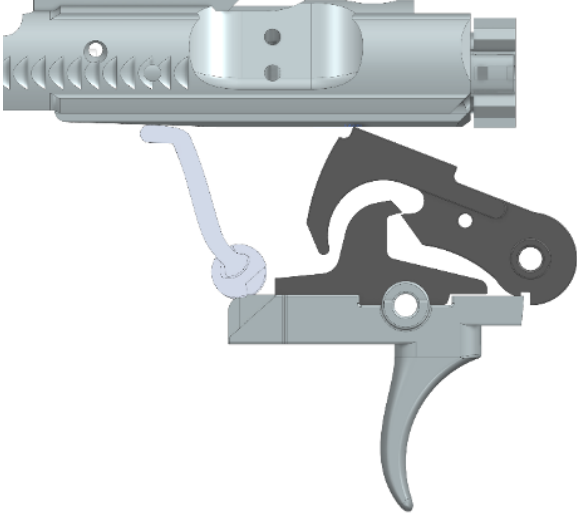
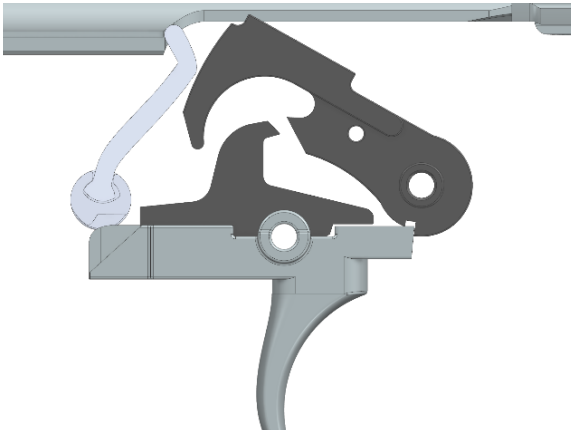
47. On information and belief, Defendants have and continue to willfully infringe, by inducing others to infringe, and/or contributing to the infringement of, one or more claims of the '784 patent, including but not limited to claim 1, literally and/or under the doctrine of equivalents.

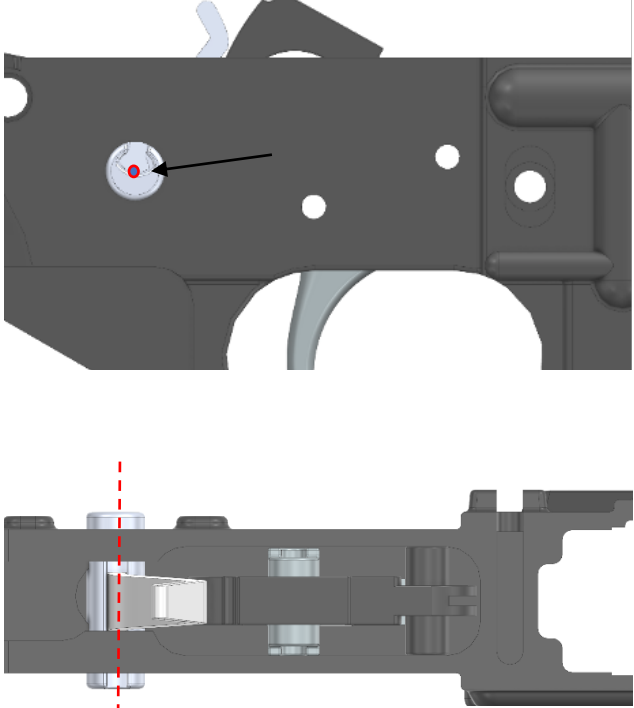
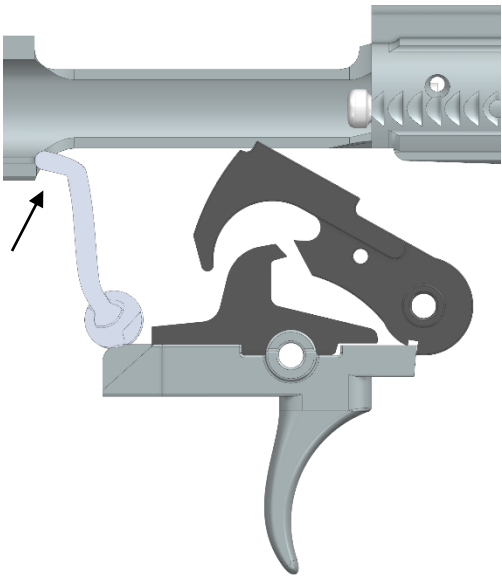
48. An exemplary comparison of the Super Safety, when assembled and used as intended, with claim 1 of the '784 Patent is illustrated in the chart below:

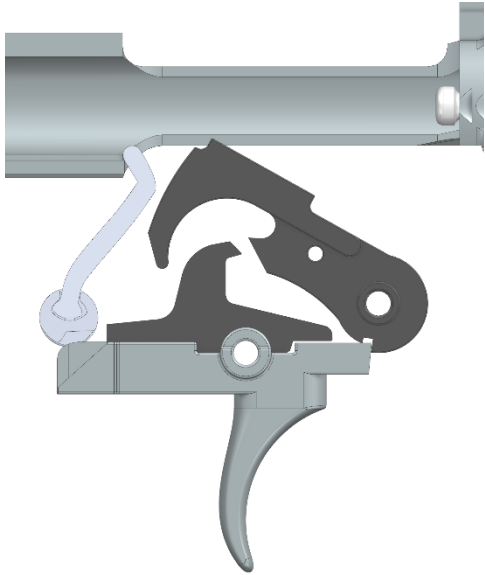
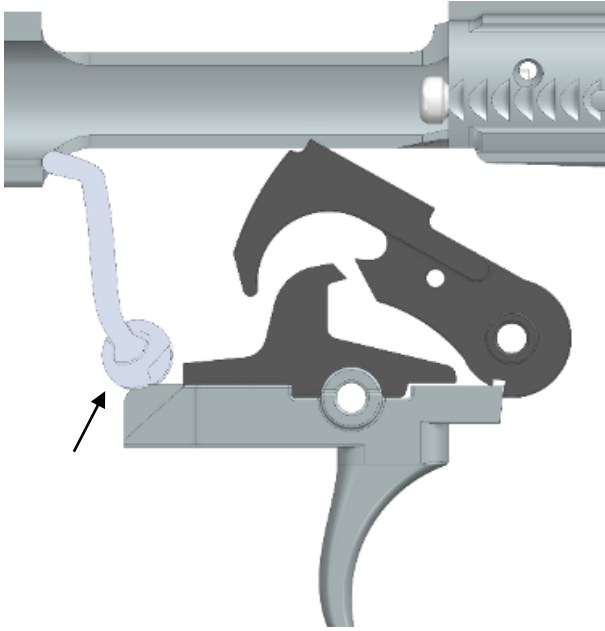
'784 Patent, Claim 1	Infringing Device (Super Safety)
1. In a forced reset trigger mechanism, an extended trigger member locking device, comprising:	When installed and used as directed, the Super Safety is part of a forced reset trigger mechanism and functions as an extended trigger member locking device.

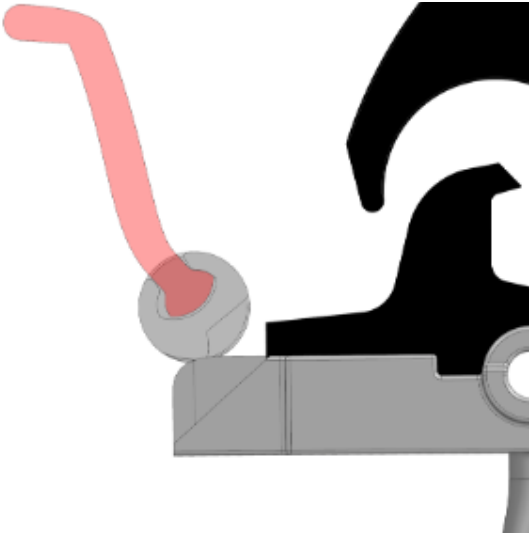
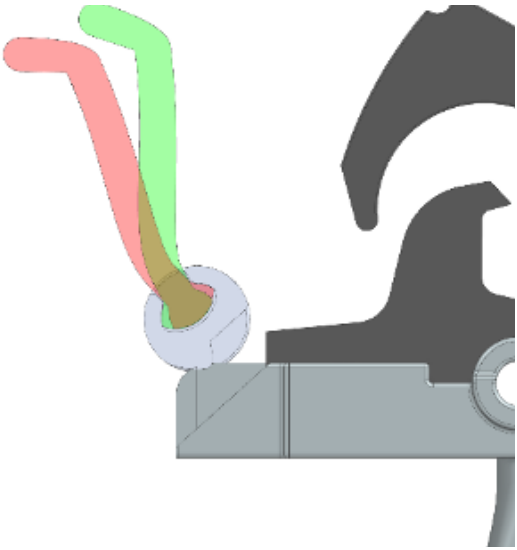
'784 Patent, Claim 1	Infringing Device (Super Safety)
	  Super Safety Ex. F, Super Safety Printed Active Trigger System v4.4, Hoffman Tactical (July 19, 2023) (“Super Safety Guide”) at 12

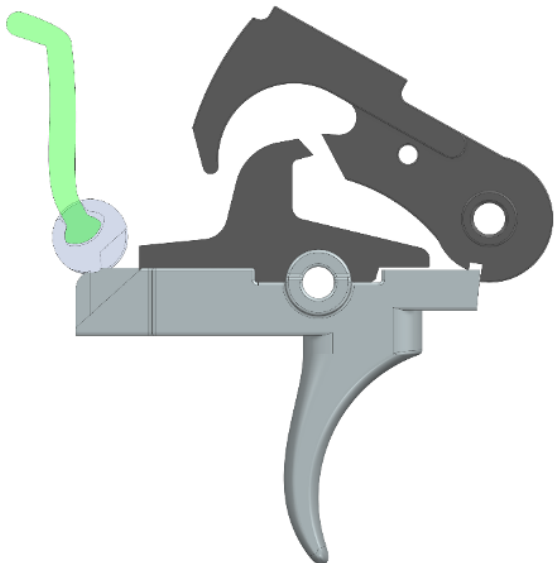
'784 Patent, Claim 1	Infringing Device (Super Safety)
	 Super Safety Installed (Plaintiff-generated renderings of Super Safety here and below; Locking member and bolt carrier shown here and below in section view for clarity) “The Super Safety is a mechanism that actively resets the trigger of a firearm to allow the operator to fire again, quickly, and efficiently. The Super Safety has been designed to operate with AR-15 pattern firearms that use a mil-spec bolt carrier and fire control group.” Ex. F, Super Safety Guide at 1.
a locking member that is movable between a first position in which it locks a trigger against pulling movement	The Super Safety operates as a locking member and has a first position in which the Super Safety locks the trigger member against pulling movement.

'784 Patent, Claim 1	Infringing Device (Super Safety)
	 Locked First Position
and a second position where it does not restrict movement of the trigger member,	The Super Safety is moveable from the first position to a second position where it does not restrict movement of the trigger member.  Unlocked Second Position
the locking member configured to be movably supported by a frame	The Super Safety is movably (pivotal) about the axis depicted below) supported by a frame (the lower receiver).

'784 Patent, Claim 1	Infringing Device (Super Safety)
	
and including a generally upward extension portion configured to make actuating contact with a surface of the bolt carrier,	The Super Safety has an upward extending portion (lever arm) configured to make actuating contact with a surface of the bolt carrier. 
such actuating contact causing the locking member to move from the first position to the second position,	The actuating contact causes the locking member to move from the first position to the second position.

'784 Patent, Claim 1	Infringing Device (Super Safety)
	 Unlocked Second Position
the locking member having a body portion that is movably supported	The Super Safety has a body portion that is movably supported by the lower receiver. 
and an upwardly extending deflectable portion that is separately movable relative to the body portion between an extended position	The Super Safety has an upwardly extending deflectable portion (lever arm). The dovetail connection is designed to allow separate movement of the lever arm relative to the body portion between one position (depicted in red) where it is extended and

'784 Patent, Claim 1	Infringing Device (Super Safety)
	another position where it is deflected (depicted in green).  Below illustrates the upward extending deflectable portion's (lever arm) total separate travel with an overlay of the lever in both positions without the body portion moving.  “The dovetail joint does not immediately transfer torque from the lever to the cam. The lever pivots in the cam until the void is filled. Once the void is filled the hammer can transfer torque to the cam via the upper and lower contact surfaces and. Note that the void, the lower contact surface, and the upper contact

'784 Patent, Claim 1	Infringing Device (Super Safety)
	surface, are shown on arbitrary sides of the dovetail, these features may be on either side of the dovetail depending on which direction the lever is moving. The amount that the lever rotates in the dovetail before transferring torque to the cam is such that as the bolt carrier completes its forward movement, the cam rotates the neutral surface away from the cam follower and to a point where the cam follower begins to slide against the cam surface.” (reference numerals removed for clarity). Ex. F, Super Safety Guide at 4. https://www.scribd.com/document/843484122/Super-Safety-Documentation
and a deflected position.	The lever is now shown deflected independent of the body. 

49. On information and belief, in addition to contributory infringement, Defendants take active steps to induce others, including their customers, to directly infringe the '784 patent. Defendants take such active steps knowing that those steps will induce, encourage, and facilitate direct infringement by others. Such active steps include, but are not limited to, installation of,

encouraging, advertising, promoting, and instructing others to use and/or how to use the Super Safety while selling products.

50. On information and belief, Defendants know or should know that such activities induce others to directly infringe at least claim 1 of the '784 Patent.

51. On information and belief, Defendants also contribute to the infringement of the '784 Patent by others, including its customers. Acts by Defendants that contribute to the infringement of others include, but are not limited to, the sale, offer for sale, and/or importation by Defendants of the components of the Super Safety, such as the especially made or especially adapted trigger members. The components are not suitable for substantial noninfringing use as they are specially designed and adapted to be used in a fire control unit to mechanically reset a trigger mechanism and infringe the '784 Patent.

52. Defendants have engaged in egregious infringement behavior with knowledge of the '784 Patent, which has been duly issued by the USPTO, and is presumed valid. On information and belief, Defendants knew or should have known that their actions constituted and continue to constitute infringement of the '784 Patent and that the '784 Patent is valid at least through the service of this complaint. Defendants could not reasonably or subjectively believe that their actions do not constitute infringement of the '784 Patent, nor could they reasonably or subjectively believe that the patent is invalid. Despite that knowledge and subjective belief, and the objectively high likelihood that its actions constitute infringement, Defendants have continued their infringing activities. As such, Defendants willfully infringe or have infringed the '784 Patent.

53. By their actions, Defendants have injured Plaintiffs and is liable to Plaintiffs for infringement of the '784 Patent pursuant to 35 U.S.C. § 271.

54. By their actions, Defendants' infringement of the '784 Patent has irreparably injured Plaintiffs. Unless such infringing acts are enjoined by this Court, Plaintiffs will continue to suffer additional irreparable injury.

55. By their actions, Defendants' infringement of the '784 Patent has damaged and continues to damage, Plaintiffs in an amount yet to be determined.

56. Defendants' infringement of the '784 patent is exceptional and entitles Plaintiffs to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

57. Defendants' acts of infringement are willful and for no other purpose than to deliberately and irreparably harm Plaintiffs' business, sales, reputation, and good-will.

58. Plaintiffs have been substantially harmed by Defendants' infringing activities and are entitled to relief including but not limited to a preliminary injunction, a permanent injunction, damages adequate to compensate for the infringement, being lost profits or no less than a reasonable royalty, treble damages, and attorneys' fees.

COUNT III — INFRINGEMENT OF THE '538 PATENT

59. Plaintiffs re-allege and incorporate the allegations of the preceding paragraphs as if fully set forth herein.

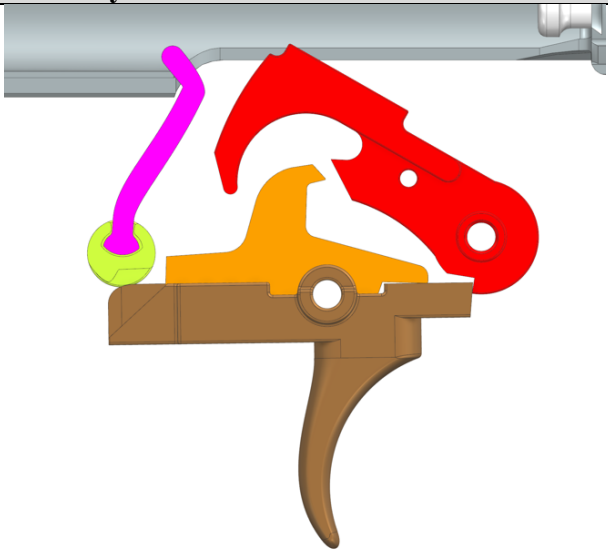
60. In violation of 35 U.S.C. § 271, Defendants have infringed, at least by inducing others to infringe, and/or contributing to the infringement of, one or more claims of the '538 patent, including but not limited to claim 1, literally and/or under the doctrine of equivalents, by among other things, making, using, offering for sale, selling, and/or importing into the United States unlicensed products in a manner that infringes the '538 patent. Such unlicensed products include trigger members especially made or especially adapted the Super Safety.

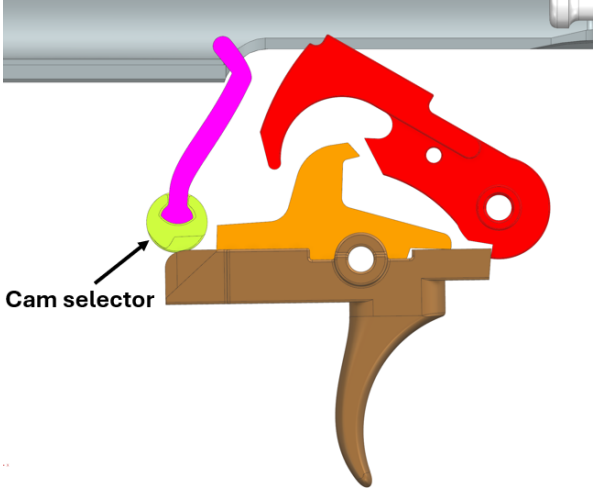
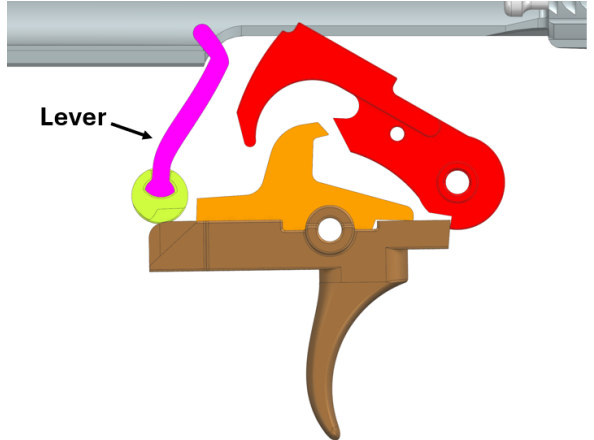
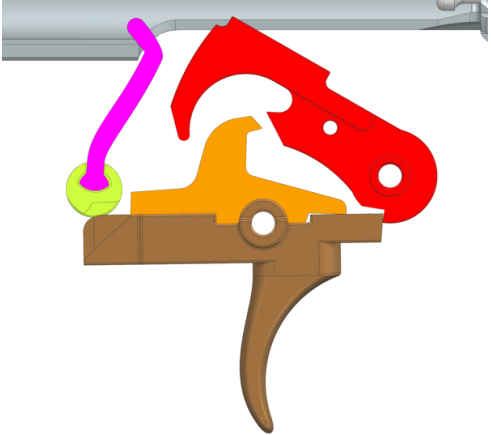
61. On information and belief, Defendants have and continues to willfully infringe, at least by inducing others to infringe, and/or contributing to the infringement of, one or more claims

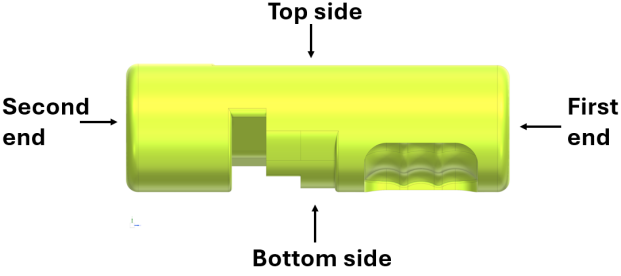
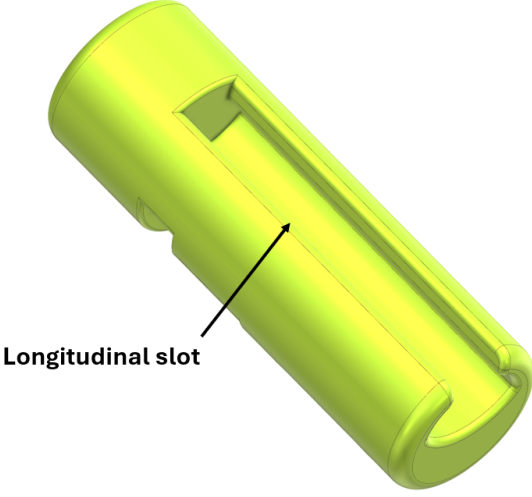
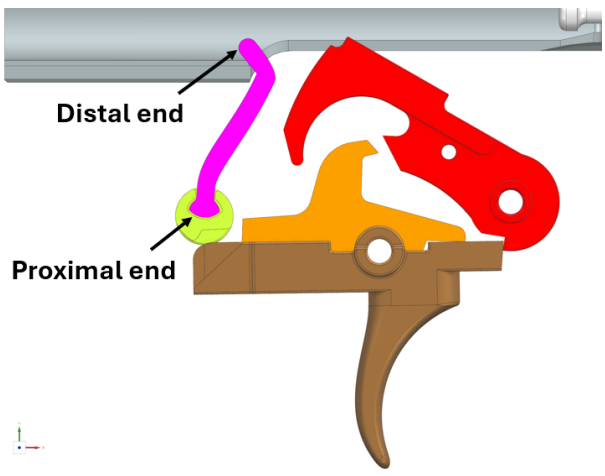
of the '538 patent, including but not limited to claim 1, literally and/or under the doctrine of equivalents.

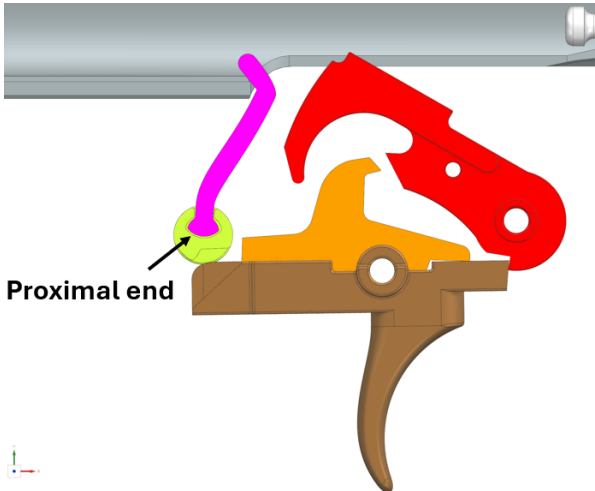
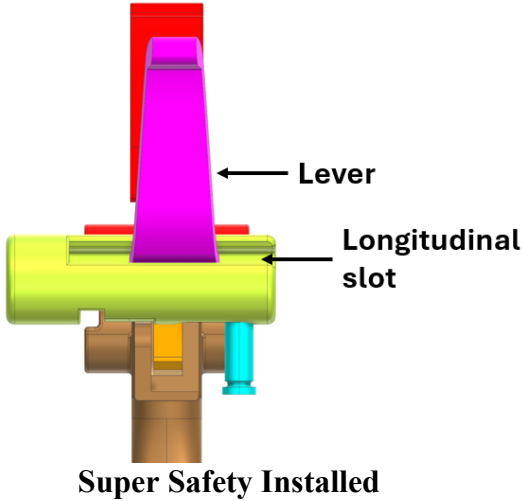
62. An exemplary comparison of the Super Safety, when assembled and used as intended, with claim 1 of the '538 Patent is illustrated in the chart below:

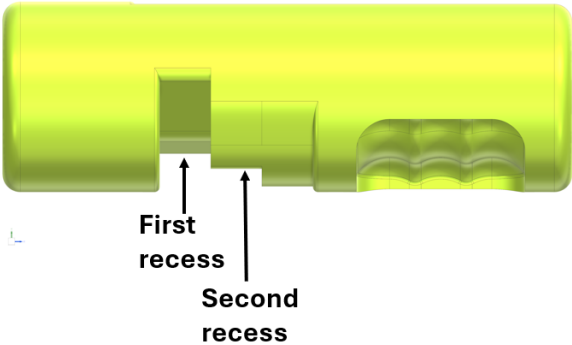
'538 Patent, Claim 1	The Super Safety
1. A safety mechanism for a firearm comprising:	The Super Safety is part of a trigger mechanism installed into a firearm receiver in place of a standard safety. (Super Safety) Ex. F, Super Safety 3D Printed Active Trigger System v4.4, Hoffman Tactical (July 19, 2023) (“Super Safety Guide”) at 12.

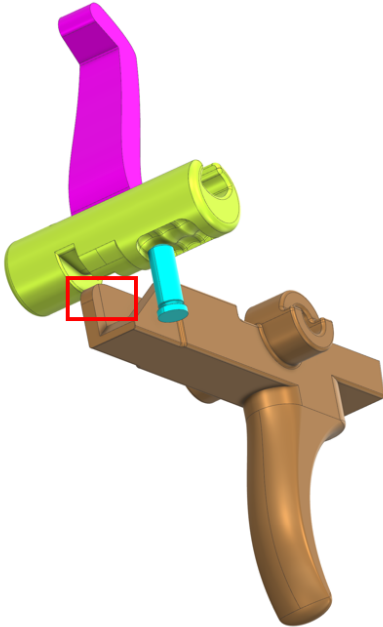
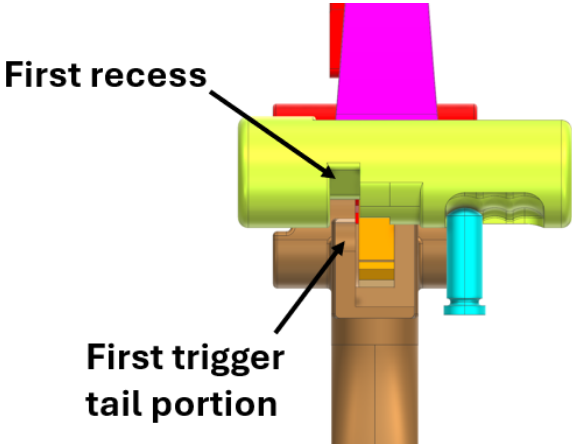
'538 Patent, Claim 1	The Super Safety
	 Super Safety Installed (Plaintiff-generated renderings of Super Safety here and below; cam selector and bolt carrier shown in section view for clarity)
a cam selector;	The Super Safety includes a dual mode cam selector that allows for selection of safe, active reset, and passive reset modes.  Dual Mode Cam Selector Ex. F, Super Safety Guide at 1

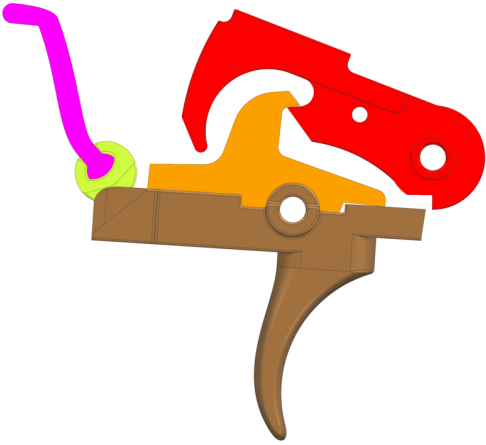
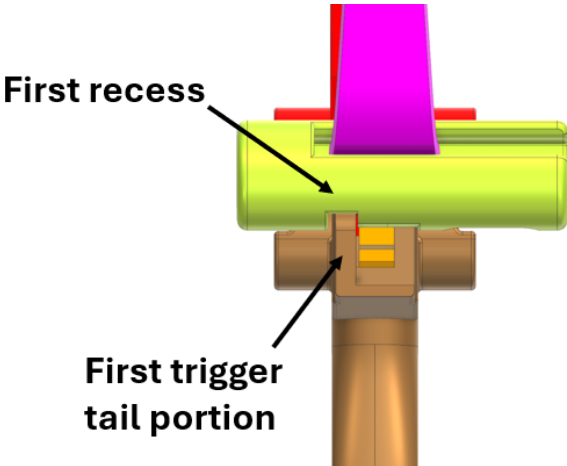
'538 Patent, Claim 1	The Super Safety
	 A diagram of a mechanical assembly. A horizontal grey bar is at the top. Below it, a red curved piece is positioned above a yellow piece. A brown trigger is at the bottom. A green circular cam selector is on the yellow piece, with a pink lever extending upwards from it. An arrow points to the green circle with the label "Cam selector".
a lever;	The Super Safety has a lever (pink) extending upward from the cam selector.  A diagram of the same mechanical assembly as above. An arrow points to the pink lever with the label "Lever".
a trigger;	The cam selector operates on a trigger (brown).  A diagram of the same mechanical assembly as above. The brown trigger is highlighted.

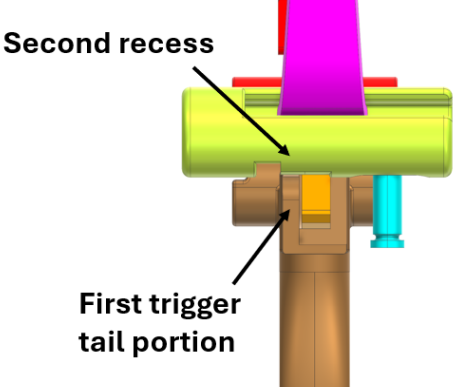
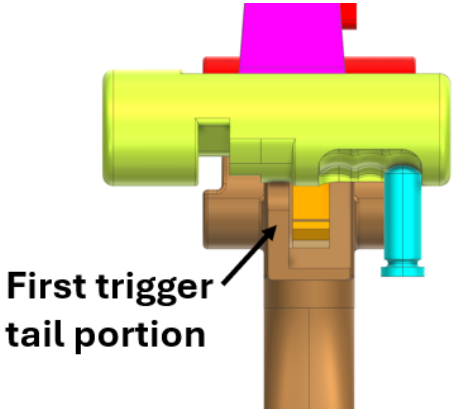
'538 Patent, Claim 1	The Super Safety
the cam selector comprising a first end, a second end, a top side, and a bottom side;	The Super Safety dual mode cam selector has two ends, a top side, and a bottom side as illustrated below. 
the cam selector comprising a longitudinal slot positioned on the top side of the cam selector;	The Super Safety dual mode cam selector comprises a longitudinal slot that is positioned on the top side and extends along the cam selector. 
the lever comprising a proximal end and a distal end;	The Super Safety lever (pink) has a proximal end and a distal end, as illustrated below. 

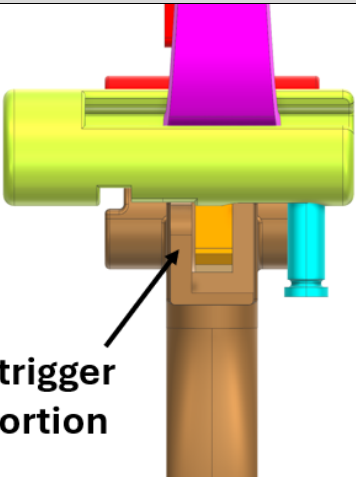
'538 Patent, Claim 1	The Super Safety
the longitudinal slot being configured to receive the proximal end of the lever;	The longitudinal slot on the top side of the cam selector (yellow) is configured to receive the proximal end of the lever (pink).  Ex. F, Super Safety Guide at 12  Proximal end  Lever Longitudinal slot Super Safety Installed

'538 Patent, Claim 1	The Super Safety
the cam selector further comprising a first recess and a second recess on the bottom side of the cam selector;	The Super Safety dual mode cam selector has a first recess and a second recess on the bottom side of the cam. 
the trigger comprising a first trigger tail portion;	The Super Safety dual mode trigger has a first trigger tail portion, shown in the red box below.  Ex. F, Super Safety Guide at 10.

'538 Patent, Claim 1	The Super Safety
	
the cam selector being configured to operate between a first mode, a second mode, and a third mode;	The Super Safety dual mode cam is operable in three modes: (1) passive reset (standard semi-automatic) (2) active reset, and (3) safe. Ex. F, Super Safety Guide at 1.
wherein the first mode of the cam selector is configured to allow the first trigger tail portion to be movable within the first recess,	The Super Safety dual mode cam selector is operable in standard semi-automatic mode, in which the first trigger tail aligns with the first recess of the cam.  First recess First trigger tail portion Standard Semi-Automatic Mode When the cam selector is in the first mode, the first trigger tail portion is movable within the first recess of the cam.

'538 Patent, Claim 1	The Super Safety
	 Super Safety Installed   First recess First trigger tail portion Super Safety Installed, Trigger Pulled, Lever and Cam Rotated

'538 Patent, Claim 1	The Super Safety
	 Super Safety Installed, Lever and Cam Rotated  Second recess First trigger tail portion
and wherein the third mode of the cam selector is configured to prevent the trigger from being pulled.	The Super Safety dual mode cam is operable in safe mode, in which the first trigger tail portion does not align with a recess in the cam. The trigger is not movable within a recess of the cam, and the cam therefore prevents the trigger from being pulled.  First trigger tail portion

'538 Patent, Claim 1	The Super Safety
	 First trigger tail portion

63. On information and belief, in addition to contributory infringement, Defendants take active steps to induce others, including their customers, to directly infringe the '538 patent. Defendants take such active steps knowing that those steps will induce, encourage, and facilitate direct infringement by others. Such active steps include, but are not limited to, installation of, encouraging, advertising, promoting, and instructing others to use and/or how to use the Super Safety while selling products.

64. On information and belief, Defendants know, knew, should know or should have known that such activities induce others to directly infringe at least claim 1 of the '538 Patent.

65. On information and belief, Defendants also contribute to the infringement of the '538 Patent by others, including their customers. Acts by Defendants that contribute to the infringement of others include, but are not limited to, the sale, offer for sale, and/or importation by Defendants of the components of the Super Safety, such as the especially made or especially adapted trigger member. The components are not suitable for substantial noninfringing use as they are specially designed and adapted to be used in a fire control unit to mechanically reset a trigger mechanism and infringe the '538 Patent.

66. Defendants have engaged in egregious infringement behavior with knowledge of the '538 Patent, which has been duly issued by the USPTO, and is presumed valid. On information and belief, Defendants have known or should have known that their actions constituted and continue to constitute infringement of the '538 Patent and that the '538 Patent is valid at least through the service of this complaint. Defendants could not reasonably or subjectively believe that their actions do not constitute infringement of the '538 Patent, nor could it reasonably or subjectively believe that the patent is invalid. Despite that knowledge and subjective belief, and the objectively high likelihood that its actions constitute infringement, Defendants have continued their infringing activities. As such, Defendant willfully infringes the '538 Patent.

67. By their actions, Defendants have injured Plaintiffs and are liable to Plaintiffs for infringement of the '538 Patent pursuant to 35 U.S.C. § 271.

68. By their actions, Defendants' infringement of the '538 Patent has irreparably injured Plaintiffs. Unless such infringing acts are enjoined by this Court, Plaintiffs will continue to suffer additional irreparable injury.

69. By their actions, Defendants' infringement of the '538 Patent has damaged and continues to damage, Plaintiffs in an amount yet to be determined.

70. Defendants' infringement of the '538 patent is exceptional and entitles Plaintiffs to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

71. Defendants' acts of infringement are willful and for no other purpose than to deliberately and irreparably harm Plaintiffs' business, sales, reputation, and good-will.

72. Plaintiffs have been substantially harmed by Defendants' infringing activities and are entitled to relief including but not limited to a preliminary injunction, a permanent injunction,

damages adequate to compensate for the infringement, being lost profits or no less than a reasonable royalty, treble damages, and attorneys' fees.

COUNT IV — INFRINGEMENT OF THE '159 PATENT

73. Plaintiffs re-allege and incorporate the allegations of the preceding paragraphs as if fully set forth herein.

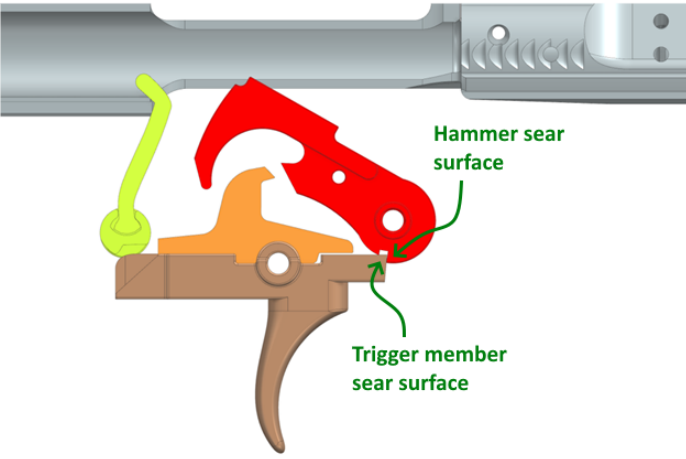
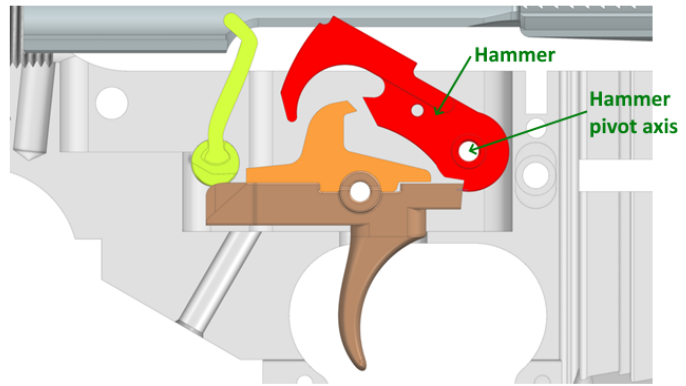
74. In violation of 35 U.S.C. § 271, Defendants have infringed, by inducing others to infringe and/or contributing to the infringement of, one or more claims of the '159 patent, including but not limited to claim 1, literally and/or under the doctrine of equivalents, by among other things, making, using, offering for sale, selling, and/or importing into the United States unlicensed products in a manner that infringes the '159 patent. Such unlicensed products include the Super Safety.

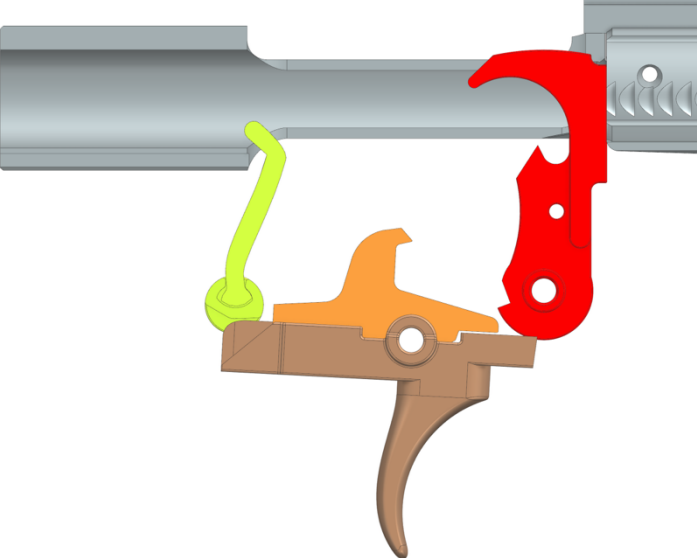
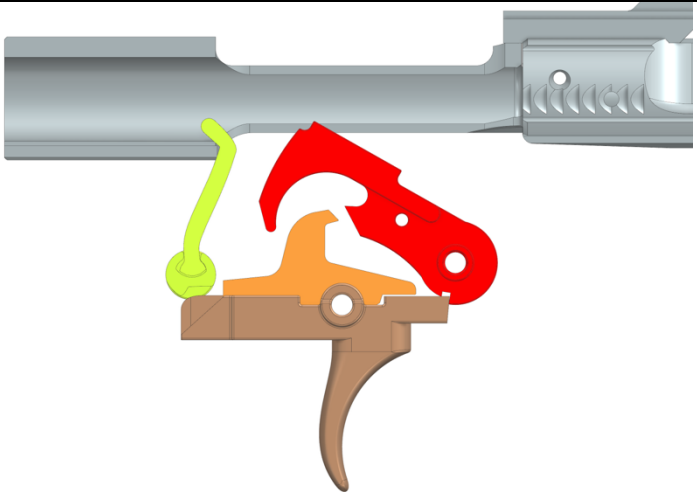
75. On information and belief, Defendants have and continue to willfully infringe, induce others to infringe, and/or contribute to the infringement of one or more claims of the '159 patent, including but not limited to claim 1, literally and/or under the doctrine of equivalents.

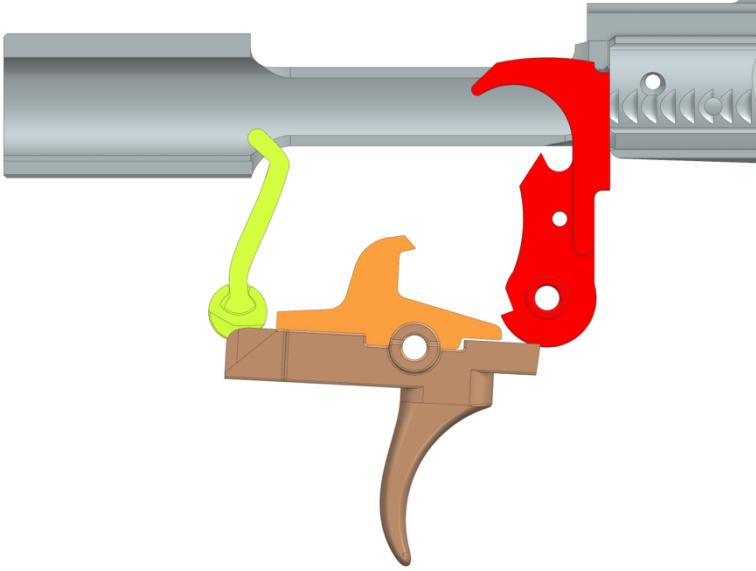
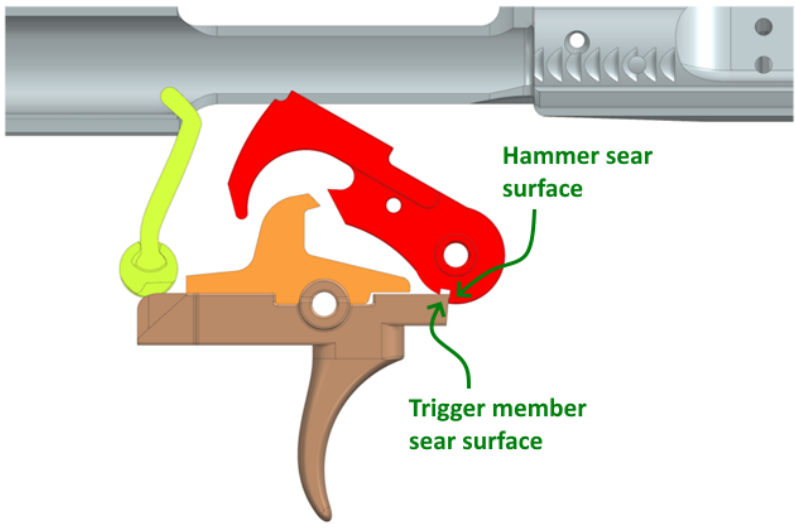
76. An exemplary comparison of the Super Safety, when assembled and used as intended, with claim 1 of the '159 Patent is illustrated in the chart below:

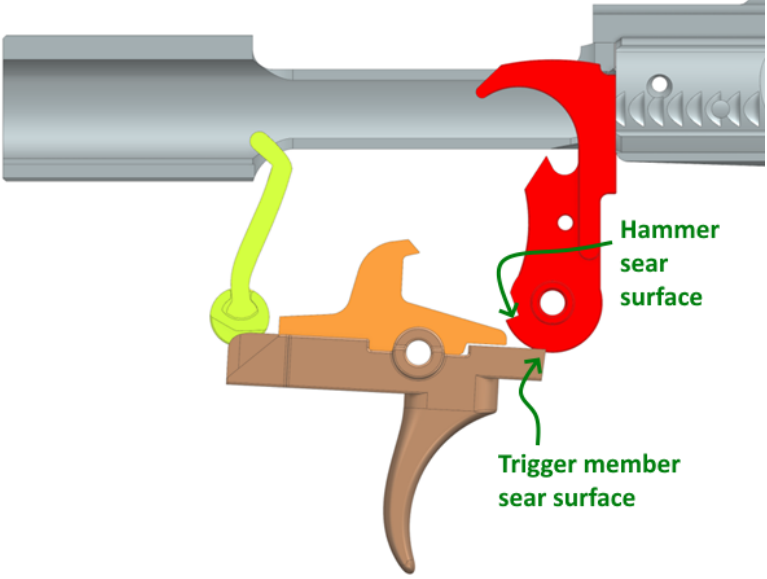
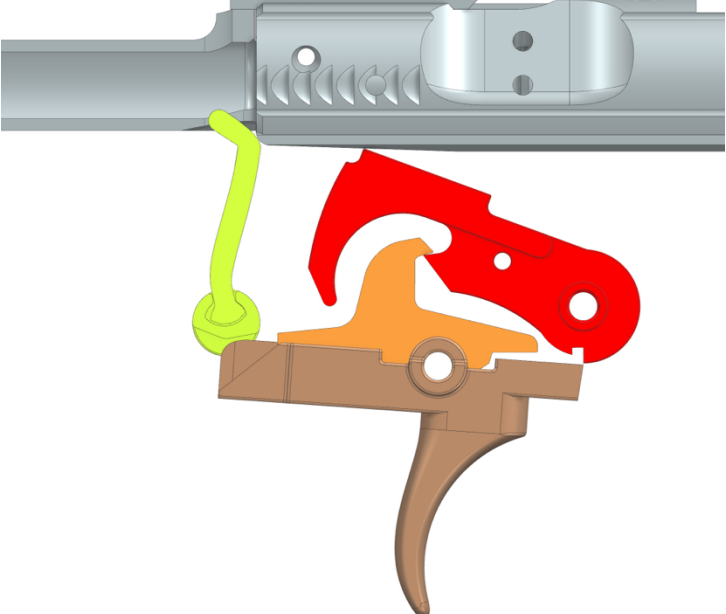
'159 Patent Claim 1	The Super Safety
1. A firearm trigger mechanism for a firearm having a fire control mechanism pocket and a reciprocating bolt means, the trigger mechanism operable in a first, standard semi-automatic mode and in a second, forced reset semi-automatic mode, the mechanism comprising:	When installed and used as directed, the Super Safety is part of a trigger mechanism that uses a bolt means. With the Super Safety installed, the trigger mechanism operates in a standard semi-automatic mode and a "forced reset" semi-automatic mode

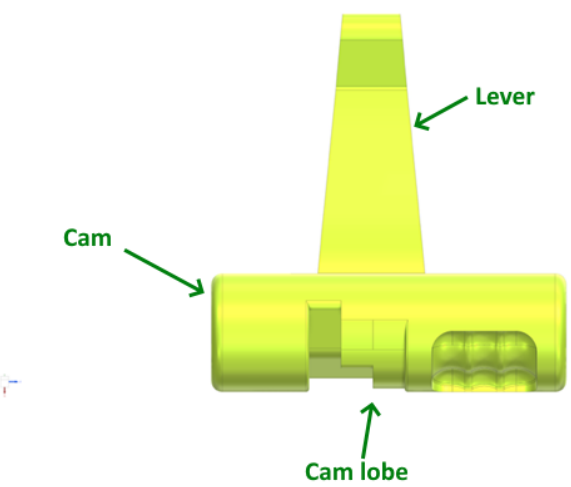
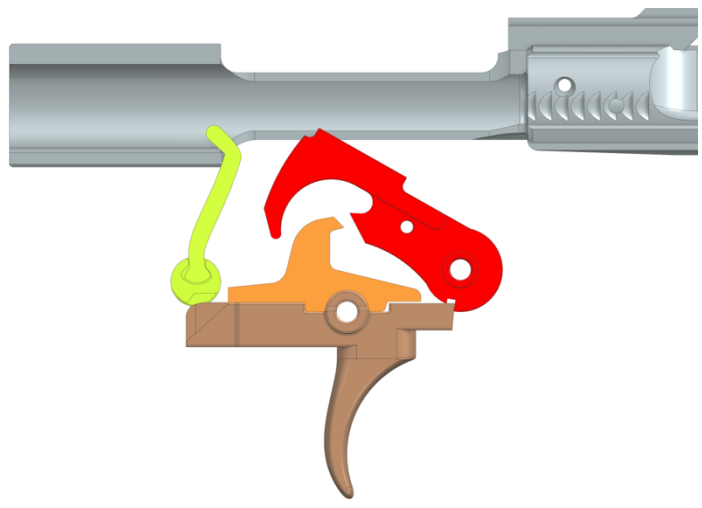
'159 Patent Claim 1	The Super Safety
	Super Safety Ex. F, Super Safety 3D Printed Active Trigger System v4.4, Hoffman Tactical (July 19, 2023) (“Super Safety Guide”) at 12 Super Safety (Installed) (Plaintiff-generated renderings of the Super Safety here and below)

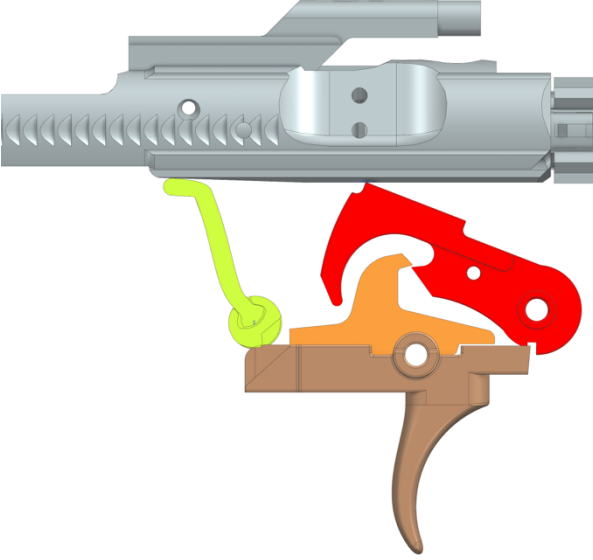
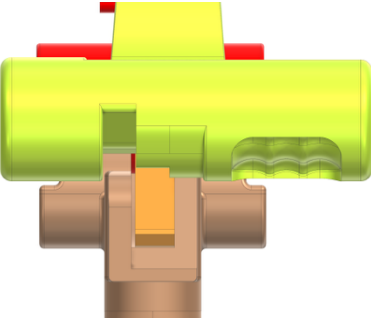
'159 Patent Claim 1	The Super Safety
a hammer having a sear surface and a hook for engaging a disconnector and adapted to be mounted in a fire control mechanism pocket of a receiver	The Super Safety (yellow) is installed in a fire control mechanism pocket of a receiver along with a hammer (red) that has a sear surface and a hook for engaging a disconnector (orange).  Super Safety (Installed)
to pivot on a transverse hammer pivot axis between set and released positions, the hammer adapted to be pivoted rearward by rearward movement of a bolt means,	The hammer (red) pivots on a transverse hammer pivot axis between set and released positions, depicted below. The hammer is adapted to be pivoted rearward by rearward movement of a bolt means.  Hammer Set Position

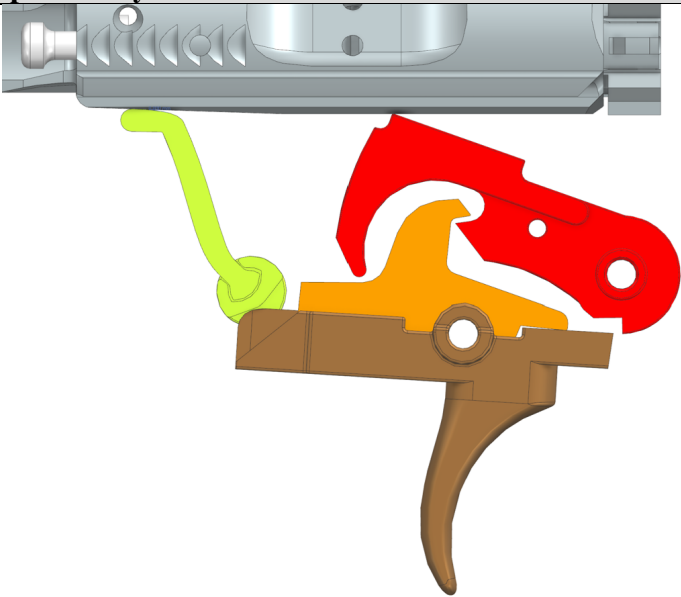
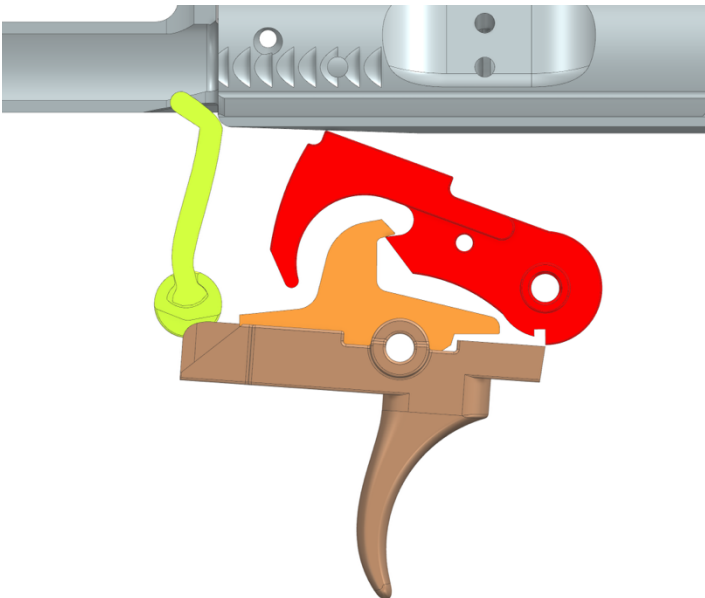
'159 Patent Claim 1	The Super Safety
	 Hammer Released Position
a trigger member having a trigger sear surface and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse trigger member pivot axis	The Super Safety (yellow) is installed with a trigger member (brown) in the fire control mechanism pocket and the trigger member pivots on a transverse trigger member pivot axis between set and released positions. The trigger member has a sear surface.
between set and	 Trigger Member Set Position

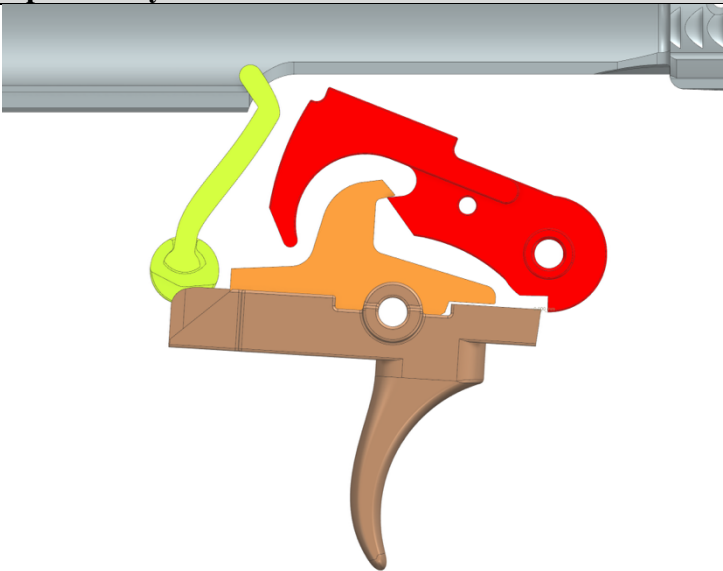
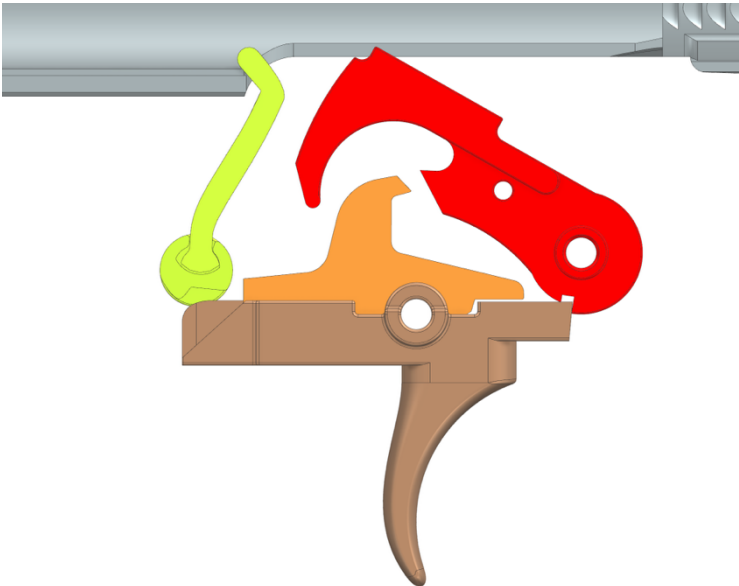
'159 Patent Claim 1	The Super Safety
released positions,	 The diagram shows a cross-section of a firearm's trigger assembly. A brown trigger member is in its released position, pointing downwards. A red hammer member is positioned above it, and a green sear spring is visible. The sear surface of the trigger member and the sear surface of the hammer member are not in contact. Trigger Member Released Position
wherein the trigger member sear surface and hammer sear surface are in engagement in the set positions of the hammer and trigger member	The sear surface of the trigger member (brown) and sear surface of the hammer (red) are in engagement when the hammer and trigger member are in their set positions.  The diagram shows the trigger assembly in its set position. The brown trigger member is moved upwards, and the red hammer member is moved downwards, such that their sear surfaces are in contact. Green arrows point to the 'Hammer sear surface' and the 'Trigger member sear surface'. Trigger Member and Hammer Member Set Position
and are out of engagement in the released positions of the hammer and trigger member,	The sear surface of the trigger member (brown) and sear catch surface of the hammer (red) are out of engagement in the released position.

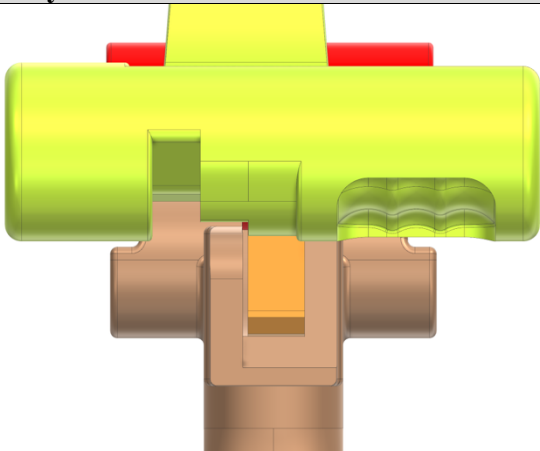
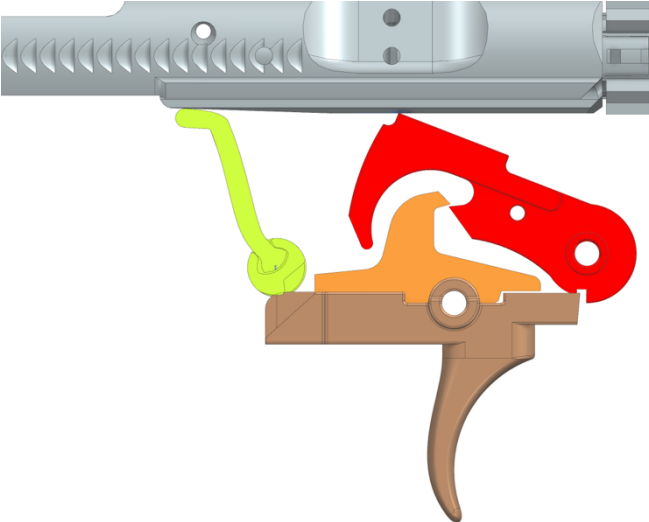
'159 Patent Claim 1	The Super Safety
	 Trigger Member and Hammer Member Released Positions
the disconnecter having a hook for engaging the hammer and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse disconnecter pivot axis, and	The disconnecter (orange) is adapted to be mounted in the fire control mechanism pocket to pivot on a transverse disconnecter pivot axis. The disconnecter has a hook for engaging the hammer (red).  Disconnecter Hook Engaged
a cam having a cam lobe and adapted to be movably mounted in the	The Super Safety has a cam with a cam lobe and lever that is adapted to be movably mounted in the fire control mechanism pocket. (See image above depicting Super Safety, shown in yellow, in fire control mechanism pocket)

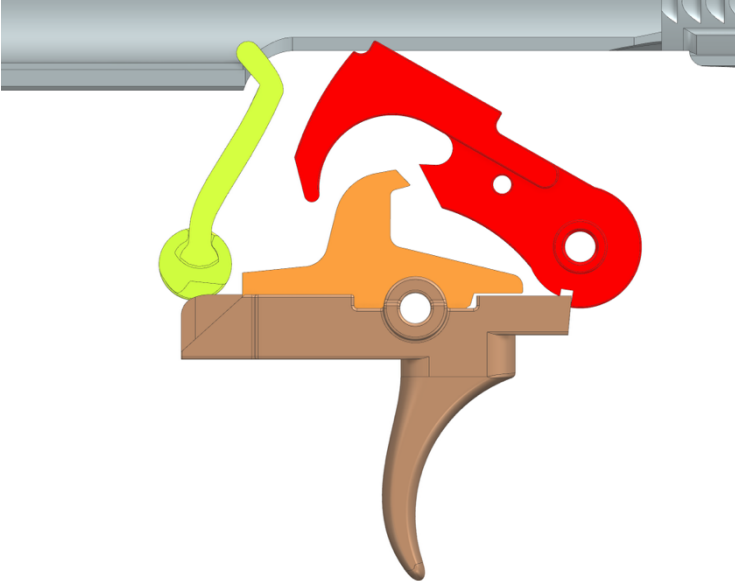
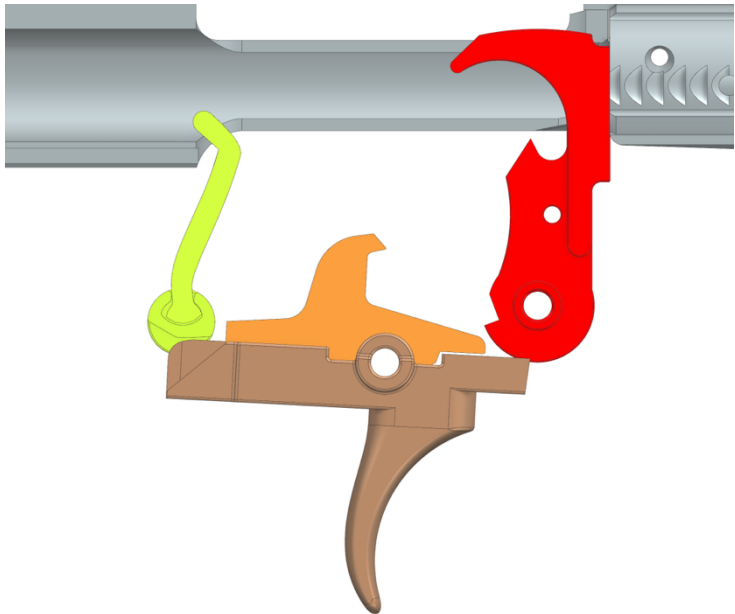
'159 Patent Claim 1	The Super Safety
fire control mechanism pocket,	 Super Safety Cam with Lobe and Lever
the cam being movable between a first position and a second position, in the second position the cam lobe forces the trigger member toward the set position,	The cam is movable between a first position and a second position.  Cam and Lobe First Position In the second position, the cam lobe mechanically moves the trigger member (brown) toward the set position when the cam is in the “forced reset” semi-automatic mode.

'159 Patent Claim 1	The Super Safety
	 Cam and Lobe Second Position
whereupon in the first mode,	While in the first (standard semi-automatic) mode, 
rearward movement of the bolt means causes rearward pivoting of the hammer such that the disconnector hook catches the hammer hook,	Rearward movement of the bolt means causes rearward pivoting of the hammer (red) such that the disconnector (orange) hook catches the hammer hook.

'159 Patent Claim 1	The Super Safety
	 Disconnecter Hook Catches the Hammer
and thereafter the bolt means moves forward into battery,	Thereafter, the bolt means moves forward into battery, 

'159 Patent Claim 1	The Super Safety
	 Pressure on Trigger Member Prevents Reset
at which time a user must manually reduce pressure on the trigger member to free the hammer from the disconnecter to permit the hammer and trigger member to pivot to the set positions so that the user can pull the trigger member to fire the firearm, and	... at which time a user must manually reduce pressure on the trigger member (brown) to free the hammer (red) from the disconnecter (orange) to permit the hammer and trigger member to pivot to the set positions so that the user can pull the trigger member to fire the firearm.  Reduced Pressure on Trigger Member Allows Reset
whereupon in a second mode,	When in the second (“forced reset” semi-automatic) mode,

'159 Patent Claim 1	The Super Safety
rearward movement of the bolt means causes rearward pivoting of the hammer such that the disconnecter hook is prevented from holding the hammer,	 ... rearward movement of the bolt means causes rearward pivoting of the hammer (red) and the cam to mechanically move the trigger member toward the reset position such that the disconnecter (orange) hook is prevented from holding the hammer hook. 
and thereafter the bolt means moves forward into battery,	Thereafter, the bolt means moves forward into battery and the hammer moves to its reset position,

'159 Patent Claim 1	The Super Safety
at which time the user can pull the trigger member to fire the firearm.	 ... at which time the user can pull the trigger member (brown) to fire the firearm without having to first release pressure on the trigger member. 

77. On information and belief, Defendants take active steps to induce others, including their customers, to directly infringe the '159 patent. Defendants take such active steps knowing that those steps will induce, encourage, and facilitate direct infringement by others. Such active

steps include, but are not limited to, installation of, encouraging, advertising, promoting, and instructing others to use and/or how to use the Super Safety while selling products.

78. On information and belief, Defendants knew, know, should have known, or should know that such activities induce others to directly infringe at least claim 1 of the '159 Patent.

79. On information and belief, Defendants also contribute to the infringement of the '159 Patent by others, including their customers. Acts by Defendants that contribute to the infringement of others include, but are not limited to, the sale, offer for sale, and/or importation by Defendants of the components of the Super Safety, such as the especially made or especially adapted trigger member. The components are not suitable for substantial noninfringing use as they are specially designed and adapted to be used in a fire control unit to mechanically reset a trigger mechanism and infringe the '159 Patent.

80. Defendants have engaged in egregious infringement behavior with knowledge of the '159 Patent, which has been duly issued by the USPTO, and is presumed valid. On information and belief, Defendants have known or should have known that their actions constituted and continue to constitute infringement of the '159 Patent and that the '159 Patent is valid at least through the service of this complaint. Defendants could not reasonably or subjectively believe that their actions do not constitute infringement of the '159 Patent, nor could they reasonably or subjectively believe that the patent is invalid. Despite that knowledge and subjective belief, and the objectively high likelihood that its actions constitute infringement, Defendants have continued their infringing activities. As such, Defendants willfully infringe or infringed the '159 Patent.

81. By their actions, Defendants have injured Plaintiffs and are liable to Plaintiffs for infringement of the '159 Patent pursuant to 35 U.S.C. § 271.

82. By their actions, Defendants' infringement of the '159 Patent has irreparably injured Plaintiffs. Unless such infringing acts are enjoined by this Court, Plaintiffs will continue to suffer additional irreparable injury.

83. By their actions, Defendants' infringement of the '159 Patent has damaged and continues to damage, Plaintiffs in an amount yet to be determined.

84. Defendants' infringement of the '159 patent is exceptional and entitles Plaintiffs to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

85. Defendants' acts of infringement are willful and for no other purpose than to deliberately and irreparably harm Plaintiffs' business, sales, reputation, and good-will.

86. Plaintiffs have been substantially harmed by Defendants' infringing activities and are entitled to relief including but not limited to a preliminary injunction, a permanent injunction, damages adequate to compensate for the infringement, being lost profits or no less than a reasonable royalty, treble damages, and attorneys' fees.

COUNT V — INFRINGEMENT OF THE '403 PATENT

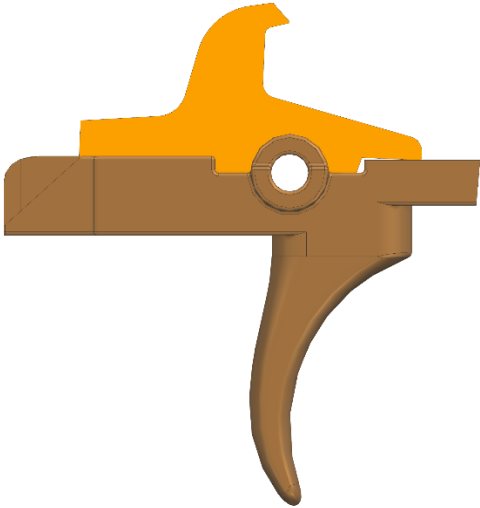
87. Plaintiffs re-allege and incorporate the allegations of the preceding paragraphs as if fully set forth herein.

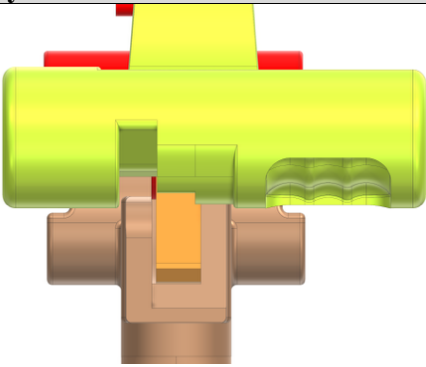
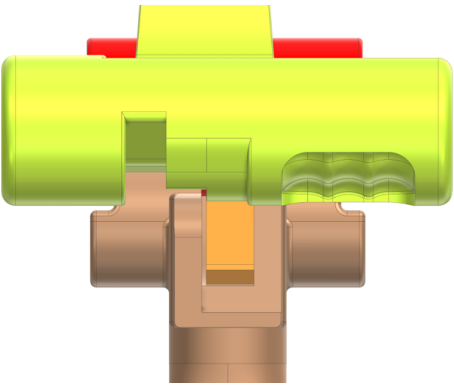
88. In violation of 35 U.S.C. § 271, Defendants have infringed, at least by inducing others to infringe, and/or contributing to the infringement of, one or more claims of the '403 patent, including but not limited to claim 38, literally and/or under the doctrine of equivalents, by among other things, making, using, offering for sale, selling, and/or importing into the United States unlicensed products in a manner that infringes the '403 patent. Such unlicensed products include trigger members especially made or especially adapted for the Super Safety.

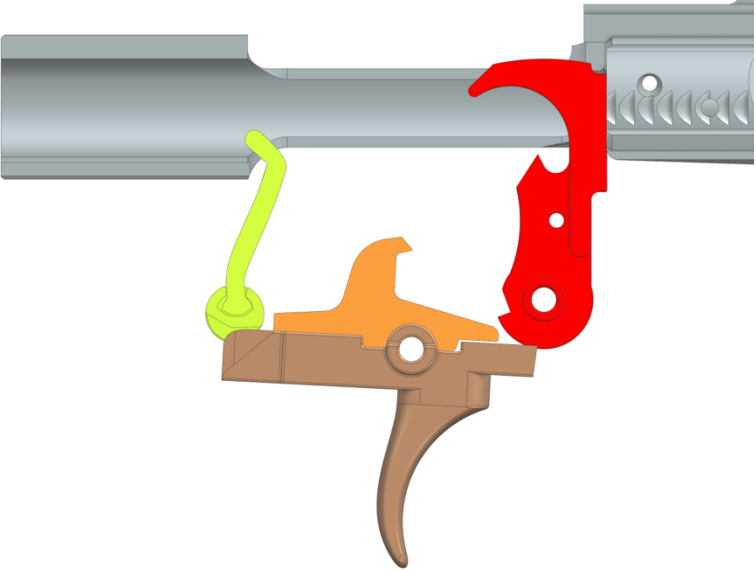
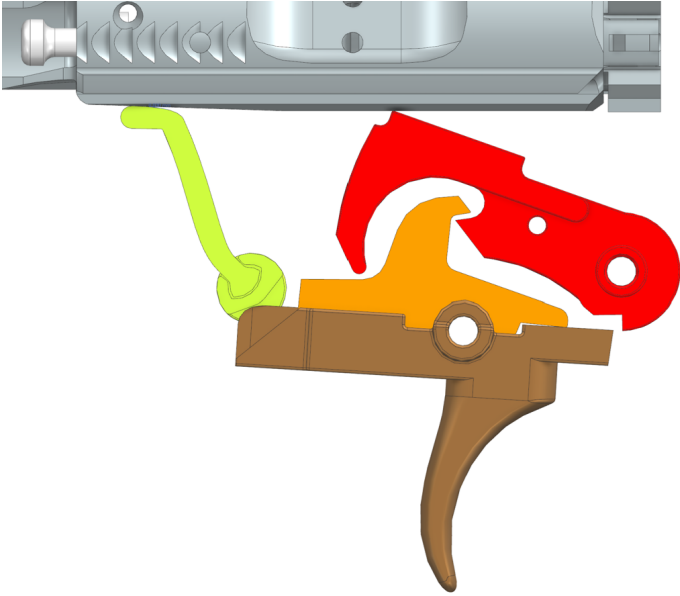
89. On information and belief, Defendants have and continue to willfully infringe, induce others to infringe, and/or contribute to the infringement of one or more claims of the '403 patent, including but not limited to claim 38, literally and/or under the doctrine of equivalents.

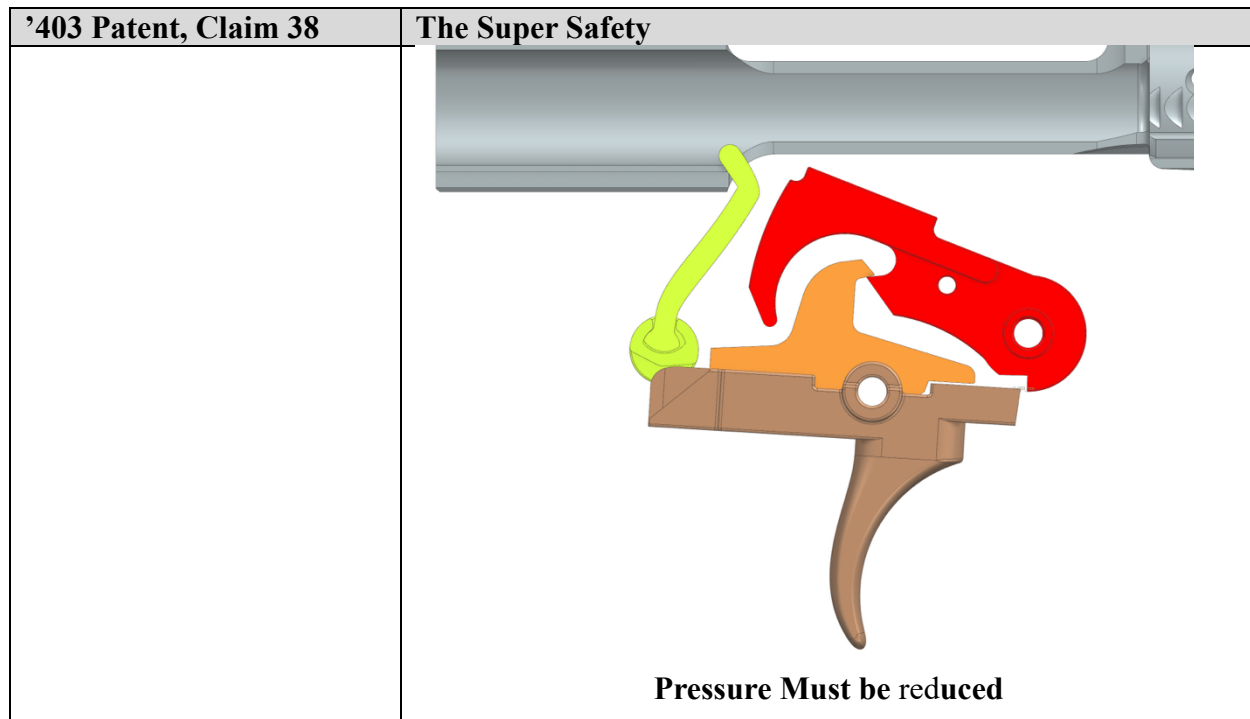
90. An exemplary comparison of the Super Safety, when assembled and used as intended, with claim 38 of the '403 patent is illustrated in the chart below:

'403 Patent, Claim 38	The Super Safety
38. A forced reset trigger mechanism, comprising:	When installed and used as directed, the Super Safety is part of a trigger mechanism.   Super Safety Ex. F, Super Safety Printed Active Trigger System v4.4, Hoffman Tactical (July 19, 2023) (“Super Safety Guide”) at 12
a hammer having a hammer hook and adapted to pivot on a transverse hammer pivot axis;	The Super Safety (yellow) is installed in a fire control mechanism pocket along with a hammer (red) that has a hammer hook and pivots on a transverse axis.

'403 Patent, Claim 38	The Super Safety
	 Super Safety (Installed) (Plaintiff-generated renderings of Super Safety here and below)
a disconnecter having a disconnecter hook and adapted to pivot on a transverse disconnecter pivot axis; a trigger member; and	The Super Safety is installed along with a disconnecter (orange) which has a disconnecter hook and pivots on a transverse disconnecter pivot axis, and a trigger member (brown)  Disconnecter and Trigger Member
a safety selector adapted to be movable between a standard semi-automatic position and a forced reset semi-automatic position,	The Super Safety is a safety selector adapted to be movable between a standard semi-automatic position,

'403 Patent, Claim 38	The Super Safety
	 Super Safety (installed) in Standard Semi-Automatic Position . . . and a “forced reset” semi-automatic position,  Super Safety (installed) in “Forced Reset” Semi-Automatic Position
wherein when the safety selector is in the standard semi-automatic position and the trigger member is rearwardly actuated,	When safety selector is in the standard semi-automatic position the trigger member (brown) is rearwardly actuated.

'403 Patent, Claim 38	The Super Safety
and after the hammer pivots rearward to a position where the hammer hook is past the disconnecter hook, rearward pressure on the trigger member must be reduced to permit the trigger member to then be actuated to fire a firearm.	 The hammer (red) pivots rearward to a position where the hammer hook is past the disconnecter hook (orange),  Hammer Hook is Past Disconnecter Hook . . . rearward pressure on the trigger member (brown) must be reduced to permit the trigger member to then be actuated to fire a firearm.



91. On information and belief, in addition to direct infringement, Defendants take active steps to induce others, including their customers, to directly infringe the '403 patent. Defendants take such active steps knowing that those steps will induce, encourage, and facilitate direct infringement by others. Such active steps include, but are not limited to, encouraging, advertising, promoting, and instructing others to use and/or how to use the Infringing Device while selling products.

92. On information and belief, Defendants know, knew, should have known, or should know that such activities induce others to directly infringe at least claim 38 of the '403 Patent.

93. On information and belief, Defendants also contribute to the infringement of the '403 Patent by others, including their customers. Acts by Defendants that contribute to the infringement of others include, but are not limited to, the sale, offer for sale, and/or importation by Defendant of the components of the Infringing Device, such as the trigger members especially made or especially adapted for the Super Safety. The components are not suitable for substantial

noninfringing use as they are specially designed and adapted to be used in a fire control unit to mechanically reset a trigger mechanism and infringe the '403 Patent.

94. Defendants have engaged in egregious infringement behavior with knowledge of the '403 Patent, which has been duly issued by the USPTO, and is presumed valid. On information and belief, Defendants have known or should have known that their actions constituted and continue to constitute infringement of the '403 Patent and that the '403 Patent is valid at least through the service of this complaint. Defendants could not reasonably or subjectively believe that their actions do not constitute infringement of the '403 Patent, nor could they reasonably or subjectively believe that the patent is invalid. Despite that knowledge and subjective belief, and the objectively high likelihood that its actions constitute infringement, Defendants have continued their infringing activities. As such, Defendants willfully infringes the '403 Patent.

95. By their actions, Defendants have injured Plaintiffs and are liable to Plaintiffs for infringement of the '403 Patent pursuant to 35 U.S.C. § 271.

96. By their actions, Defendants' infringement of the '403 Patent has irreparably injured Plaintiffs. Unless such infringing acts are enjoined by this Court, Plaintiffs will continue to suffer additional irreparable injury.

97. By their actions, Defendants' infringement of the '403 Patent has damaged and continues to damage, Plaintiffs in an amount yet to be determined.

98. Defendants' infringement of the '403 patent is exceptional and entitles Plaintiffs to attorneys' fees and costs incurred in prosecuting this action under 35 U.S.C. § 285.

99. Defendants' acts of infringement are willful and for no other purpose than to deliberately and irreparably harm Plaintiffs' business, sales, reputation, and good-will.

100. Plaintiffs have been substantially harmed by Defendants' infringing activities and are entitled to relief including but not limited to a preliminary injunction, a permanent injunction, damages adequate to compensate for the infringement, being lost profits or no less than a reasonable royalty, treble damages, and attorneys' fees.

PRAYER FOR RELIEF

WHEREFORE, Plaintiffs respectfully request that this Court enter judgment against Defendants as follows:

- a. Each of the Asserted Patents has been and continues to be infringed by Defendants;
- b. Defendants' infringement of each of the Asserted Patents has been, and continues to be, willful;
- c. Each of the Asserted Patents is enforceable and not invalid;
- d. A preliminary injunction enjoining Defendants and their principals, agents, successors, assigns, attorneys, servants, affiliates, employees, divisions, branches, subsidiaries, parents, and all others acting in active concert therewith from infringement or contributing to the infringement of each of the Asserted Patents during the pendency of this case; or other such equitable relief as the Court determines is warranted;
- e. A permanent injunction enjoining Defendants and their principals, agents, successors, assigns, attorneys, servants, affiliates, employees, divisions, branches, subsidiaries, parents, and all others acting in active concert therewith from infringement or contributing to the infringement of each of the Asserted Patents; or other such equitable relief as the Court determines is warranted;
- f. An award of damages adequate to compensate Plaintiffs for the infringement of each of the Asserted Patents that has occurred, together with pre-judgment interests and costs, post-judgment interests and costs, and an accounting;

g. An award of all other damages permitted by 35 U.S.C. § 284, including increased damages up to three times the amount of compensatory damages found;

h. An award of all profits received by Defendants from sales and revenues of any kind made as a result of its trademark infringement and unfair competition;

i. An award of all damages sustained by Plaintiffs as a result of Defendants' infringement, including ascertainable damages, the costs incurred by Plaintiffs for the costs for this action, and Plaintiffs' reasonable attorneys' fees;

j. A finding that this action is an exceptional case under 35 U.S.C. § 285, and an award to Plaintiffs of their costs and attorneys' fees incurred in this action; and

k. Any and all other relief, at law or equity, to which Plaintiffs may show themselves to be entitled or which this Court deems just and proper.

DEMAND FOR JURY TRIAL

Plaintiffs, under Rule 38 of the Federal Rules of Civil Procedure, request a trial by jury of any issues so triable by right.

DATED: October 6, 2026.

/s/ Jared W. Allen

Jared W. Allen

Beard St. Clair Gaffney PA

Attorney for Plaintiffs

EXHIBIT A

US012038247B2

(12) **United States Patent**
Blakley

(10) **Patent No.:** **US 12,038,247 B2**

(45) **Date of Patent:** **Jul. 16, 2024**

(54) **FIREARM TRIGGER MECHANISM**

FOREIGN PATENT DOCUMENTS

(71) Applicant: **ABC IP, LLC**, Dover, DE (US)

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(72) Inventor: **Brian A. Blakley**, Pinellas Park, FL (US)

(Continued)

(73) Assignee: **ABC IP, LLC**, Dover, DE (US)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

Statutory Invention Registration No. H107, Inventor: Bauer, Published Aug. 5, 1986 (8 pages).

Primary Examiner — Reginald S Tillman, Jr.

(21) Appl. No.: **18/325,225**

(74) *Attorney, Agent, or Firm* — Wood Herron & Evans LLP

(22) Filed: **May 30, 2023**

(65) **Prior Publication Data**

US 2024/0085136 A1 Mar. 14, 2024

Related U.S. Application Data

(60) Provisional application No. 63/374,941, filed on Sep. 8, 2022.

(51) **Int. Cl.**

F41A 19/45 (2006.01)

F41A 17/46 (2006.01)

(Continued)

(52) **U.S. Cl.**

CPC **F41A 19/45** (2013.01); **F41A 17/46** (2013.01); **F41A 19/10** (2013.01); **F41A 19/16** (2013.01); **F41A 19/15** (2013.01)

(58) **Field of Classification Search**

CPC F41A 19/10; F41A 19/45; F41A 19/15; F41A 17/46

(Continued)

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(57) **ABSTRACT**

A trigger mechanism that can be used in AR-pattern firearms has a hammer, a trigger member, a disconnecter, a cam, and a “three position” safety selector having safe, standard semi-automatic, and forced reset semi-automatic positions. In the standard semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and pivoting of the cam from a first position to a second position such that a cam lobe forces the trigger member towards the set position, but prior to reaching the set position the disconnecter hook catches the hammer hook, at which time a user must manually release the trigger member to free the hammer from the disconnecter to permit the hammer and trigger member to pivot to their set positions so that the user can pull the trigger member to fire the firearm. In the forced reset semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and pivoting of the cam from the first position to the second position such that the cam lobe forces the trigger member to the set position, the safety selector preventing the disconnecter hook from catching the hammer hook, at which time the user can pull the trigger member to fire the firearm without manually releasing the trigger member.

23 Claims, 18 Drawing Sheets

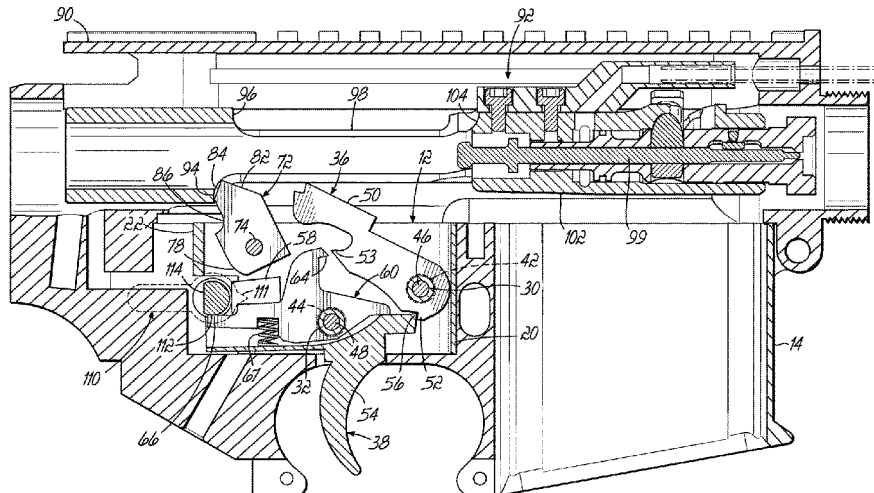


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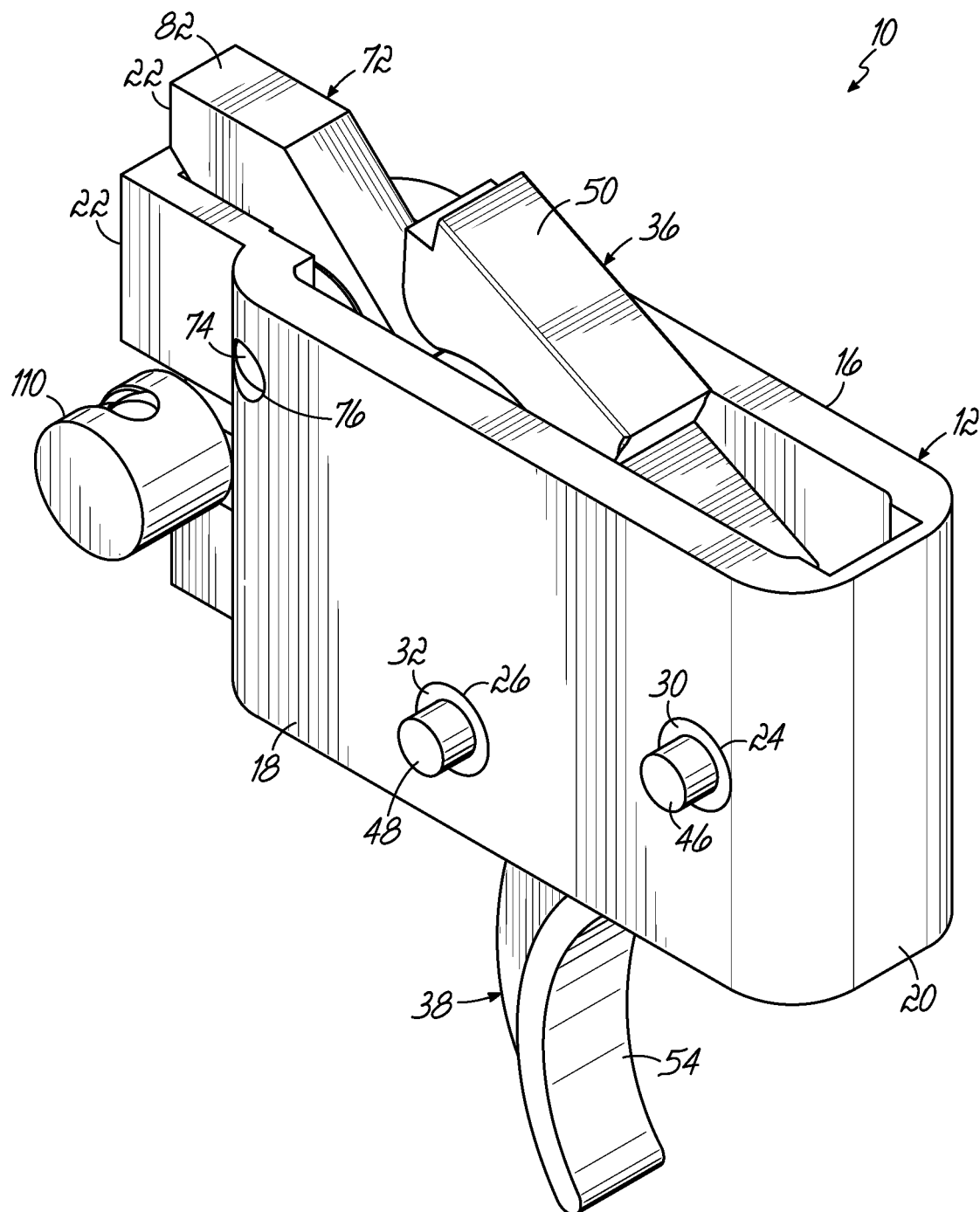


FIG. 1

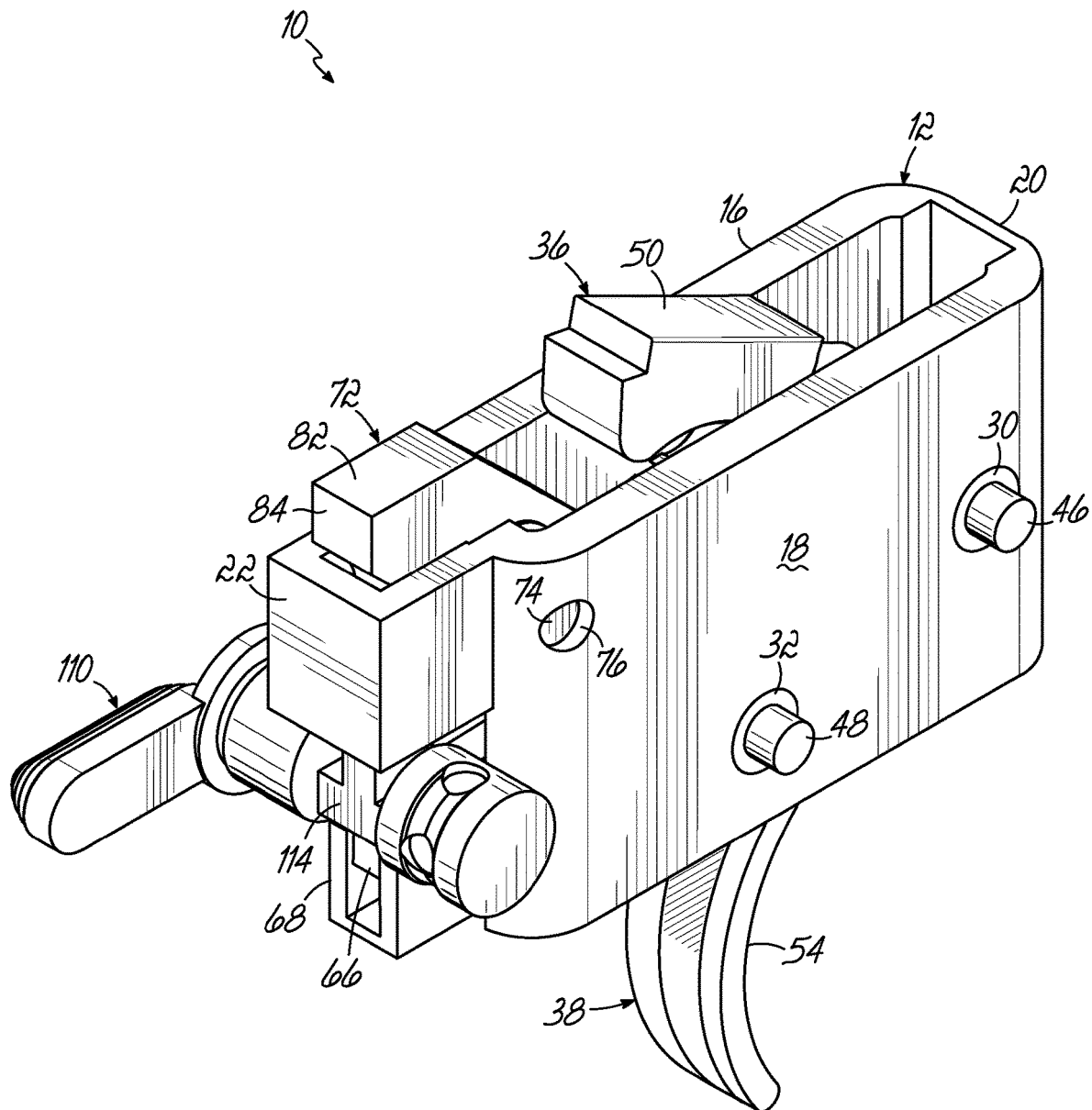


FIG. 2

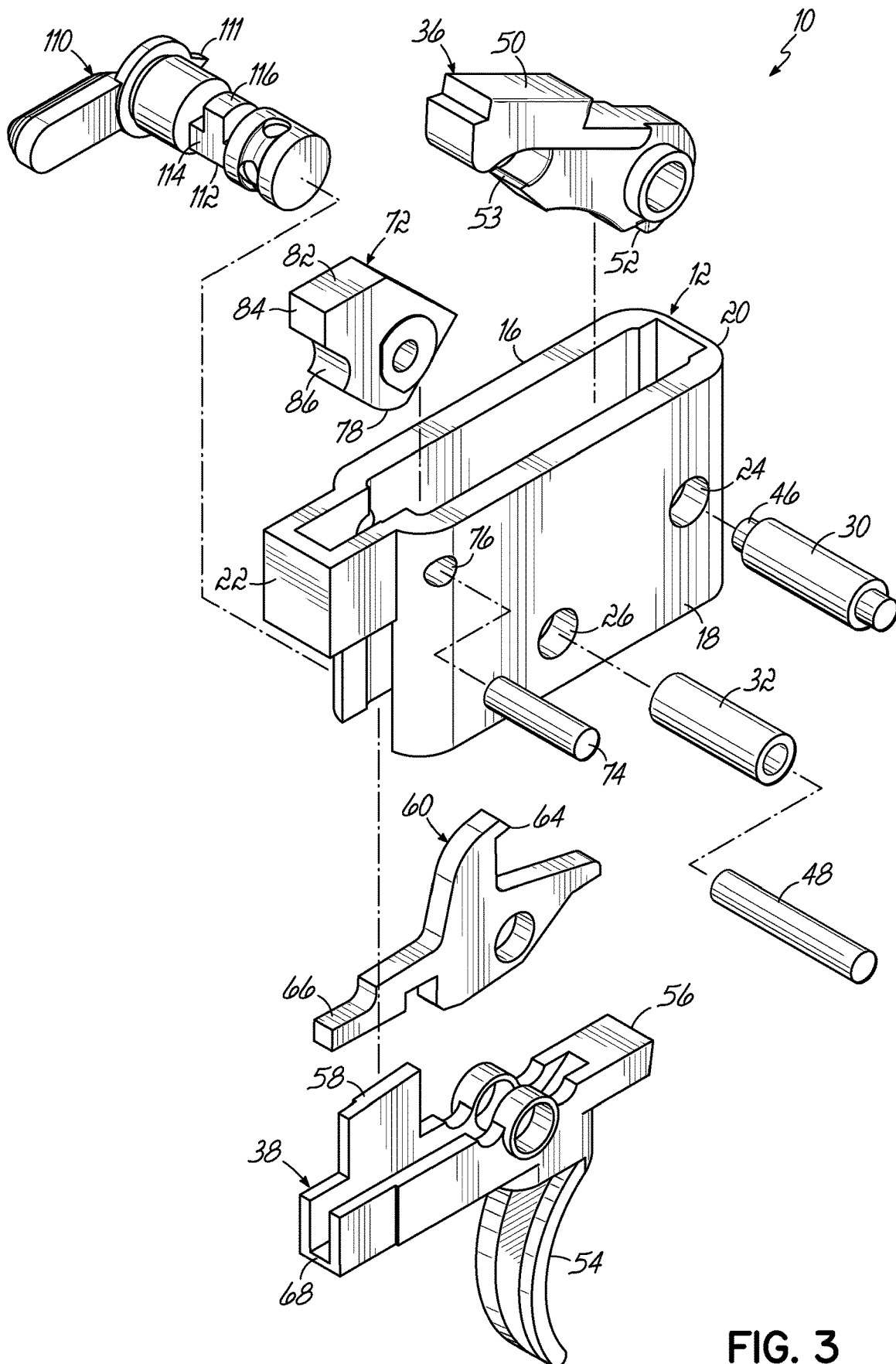


FIG. 3

Exhibit A

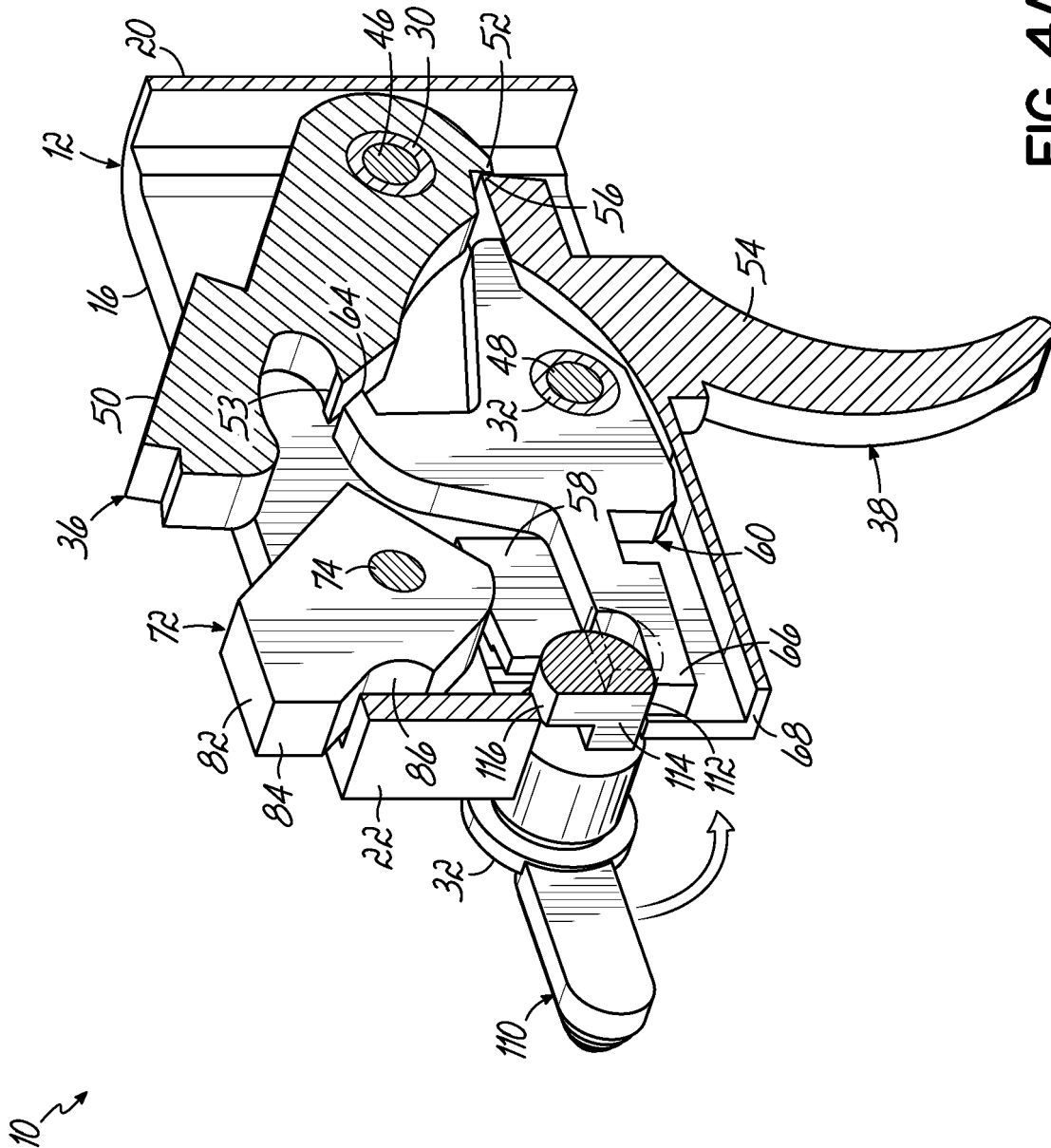
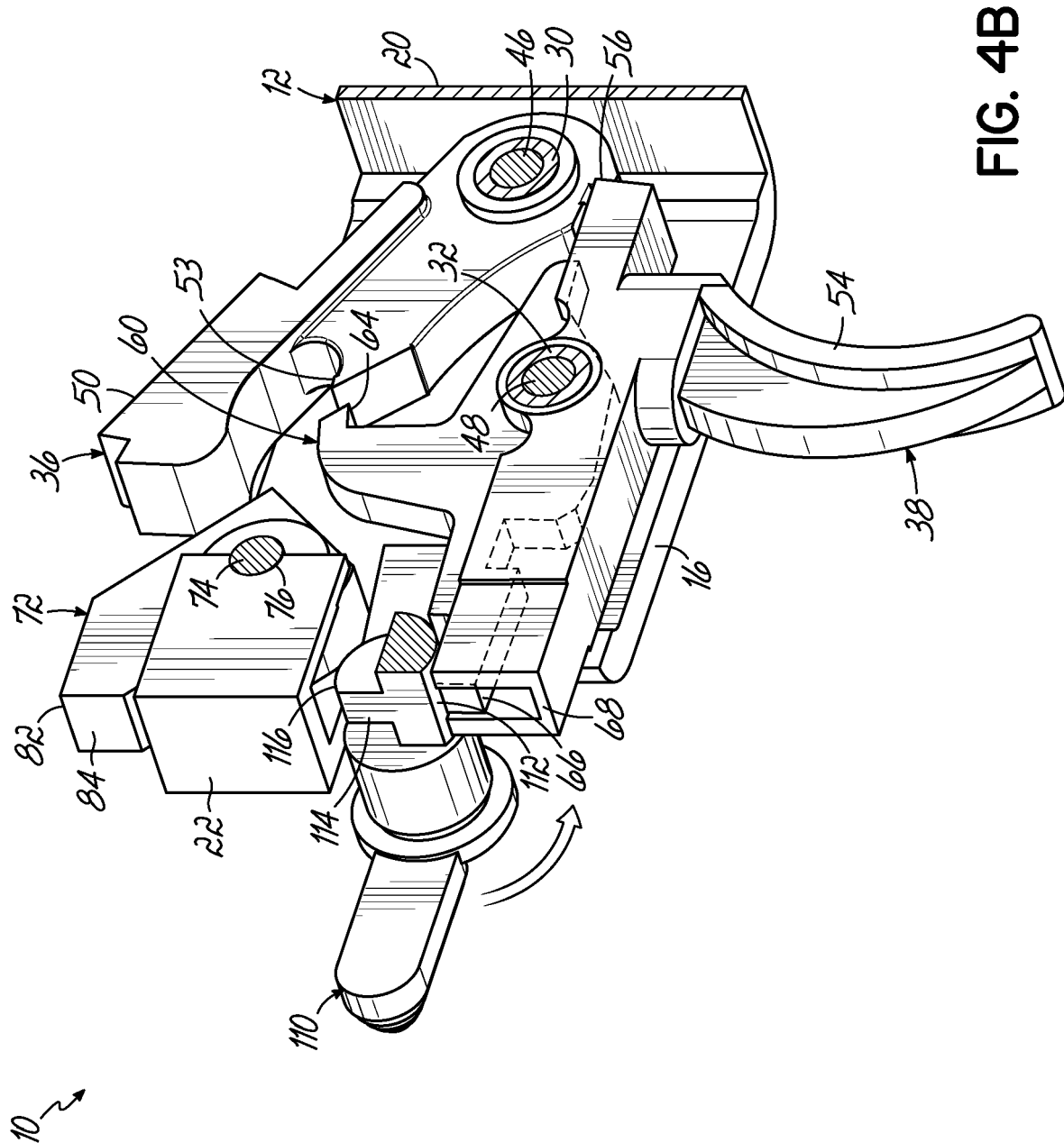
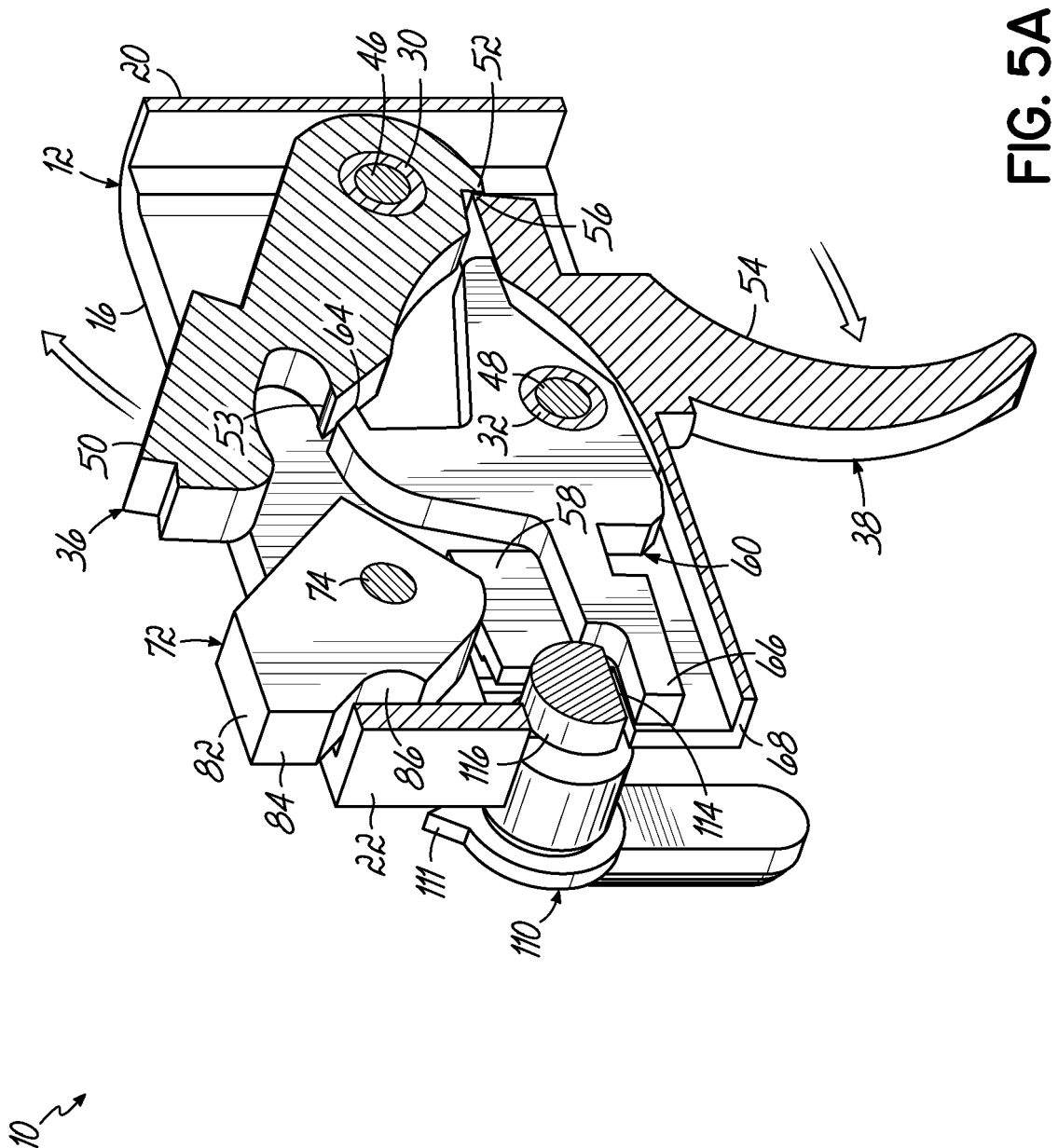
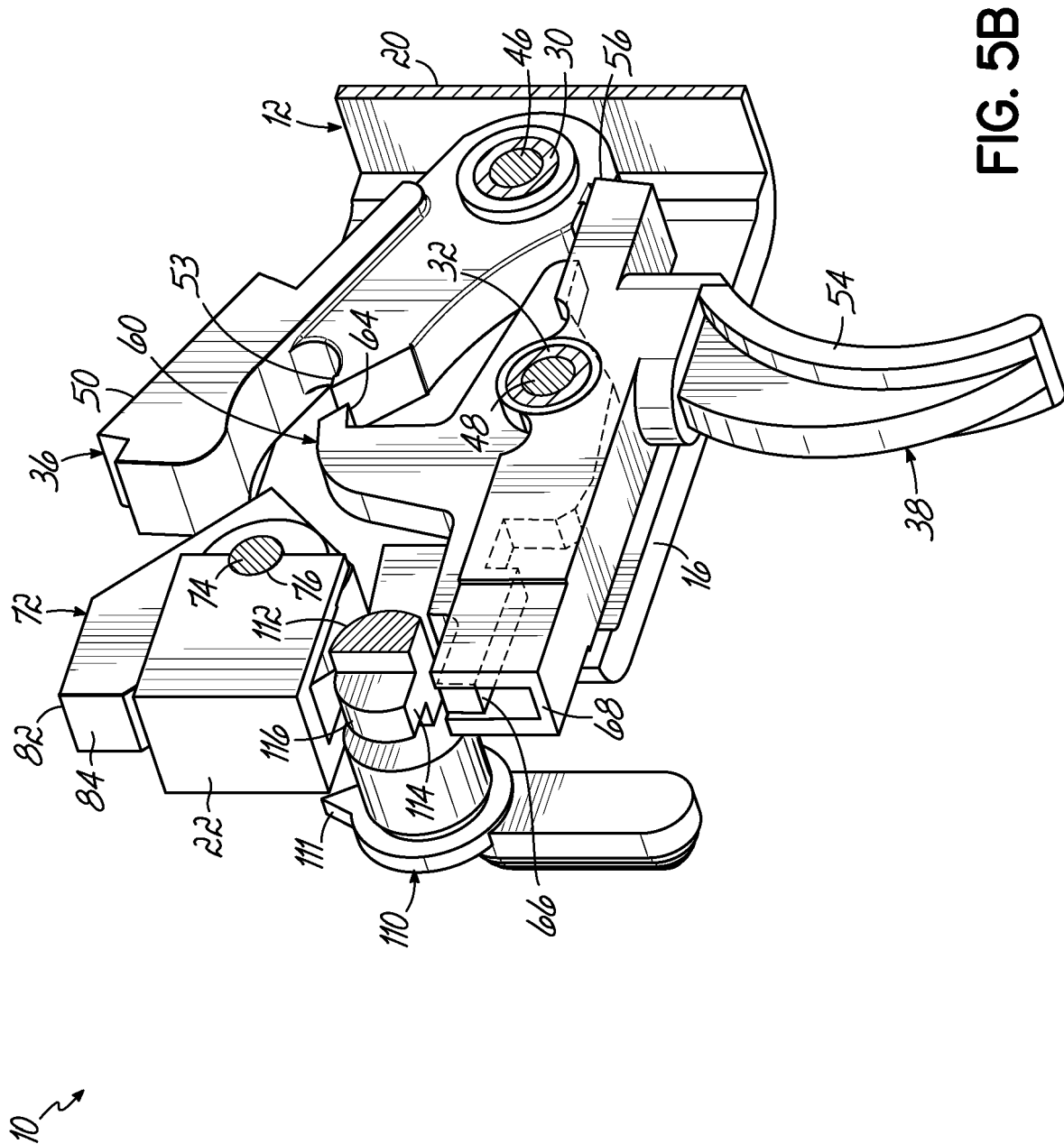


FIG. 4A







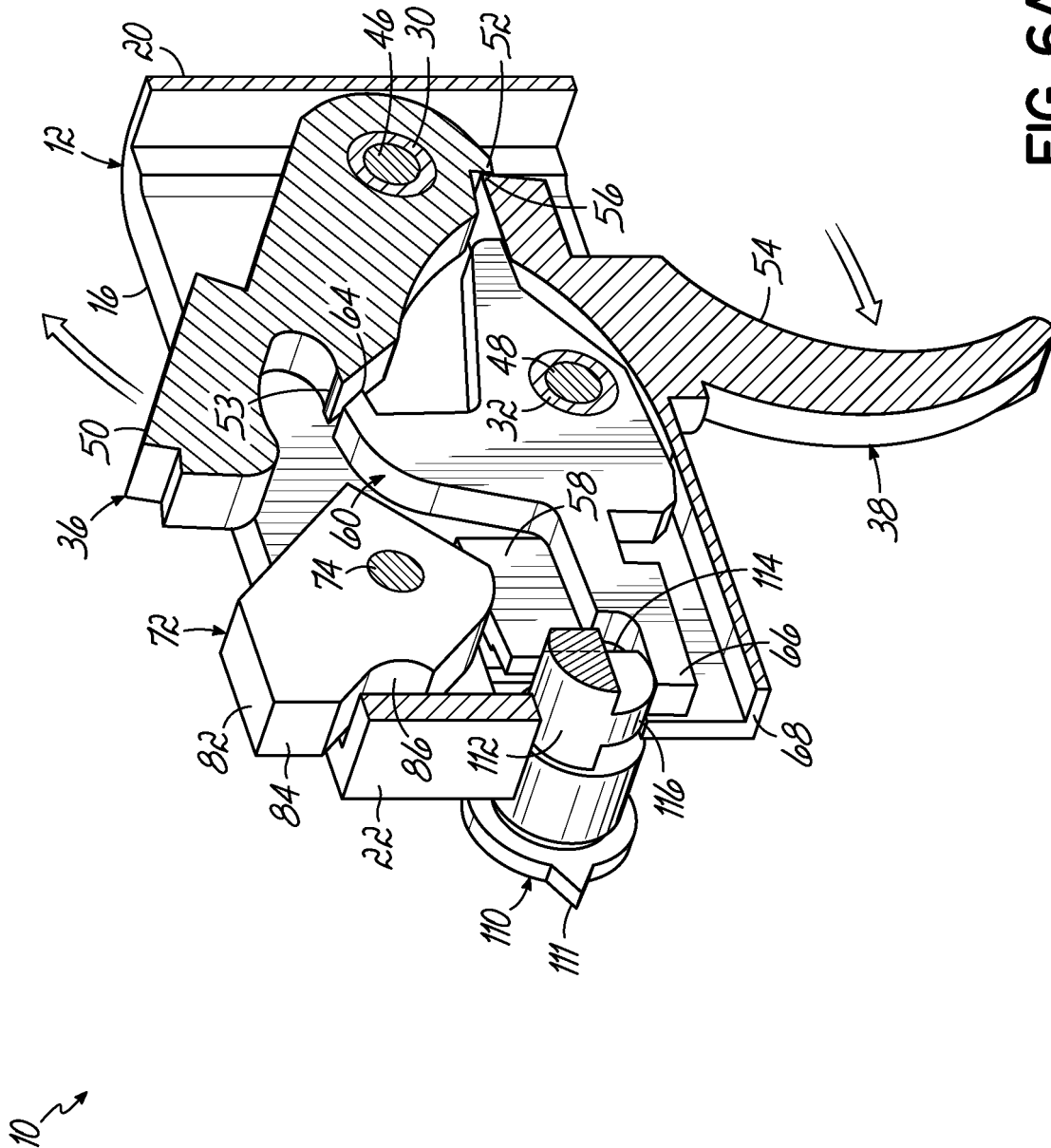
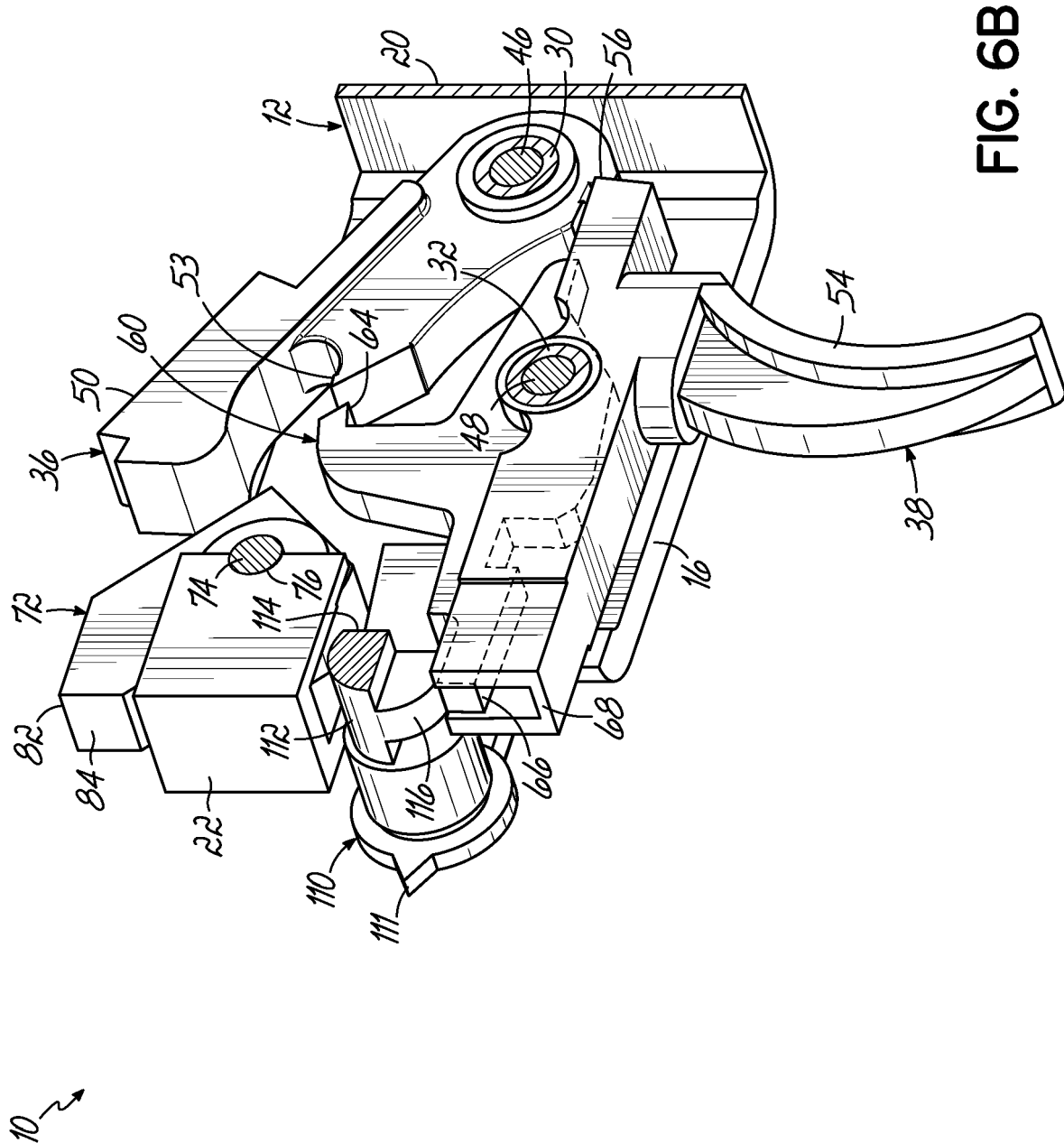


FIG. 6A



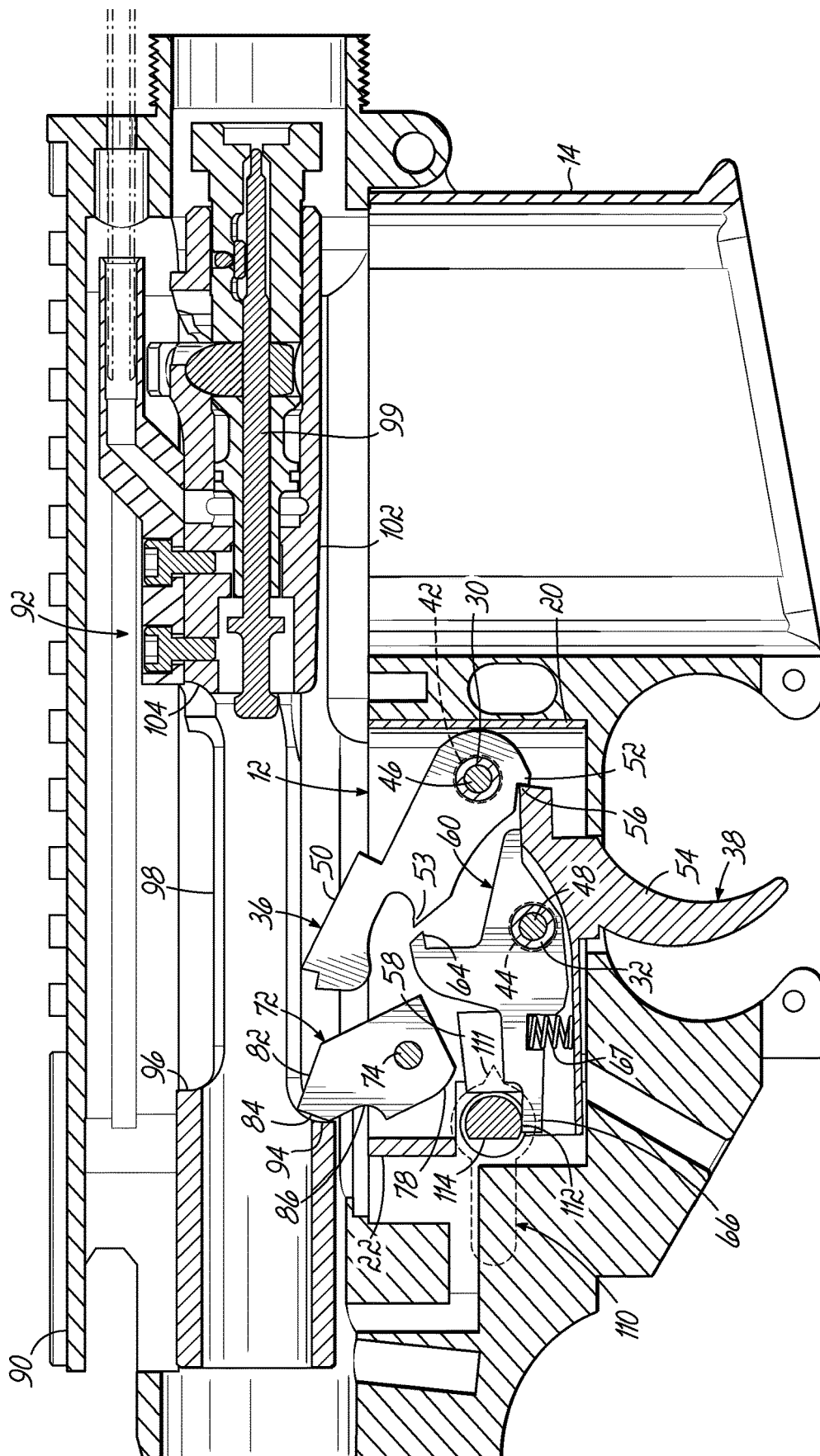


FIG. 7

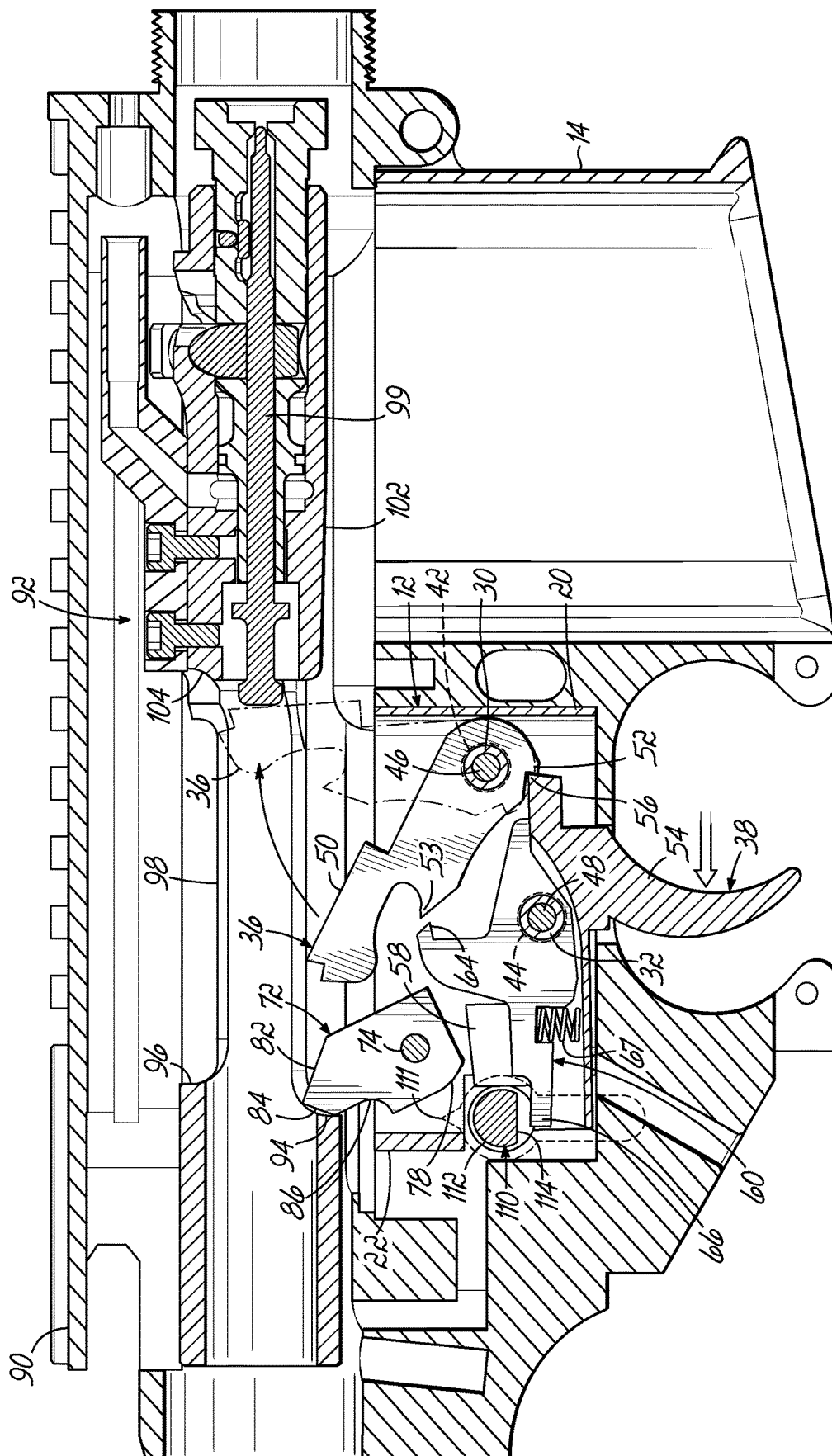


FIG. 8A

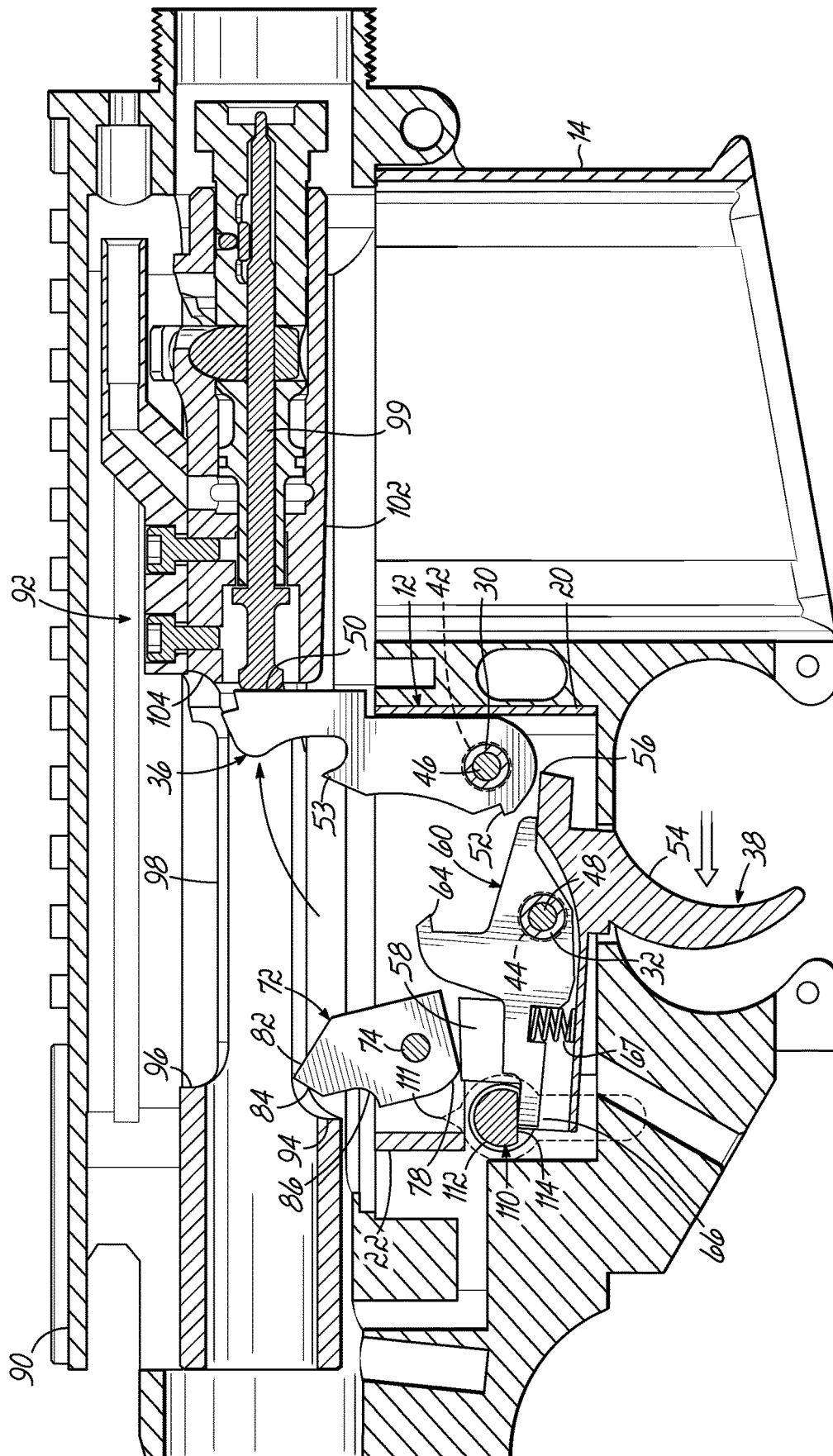


FIG. 8B

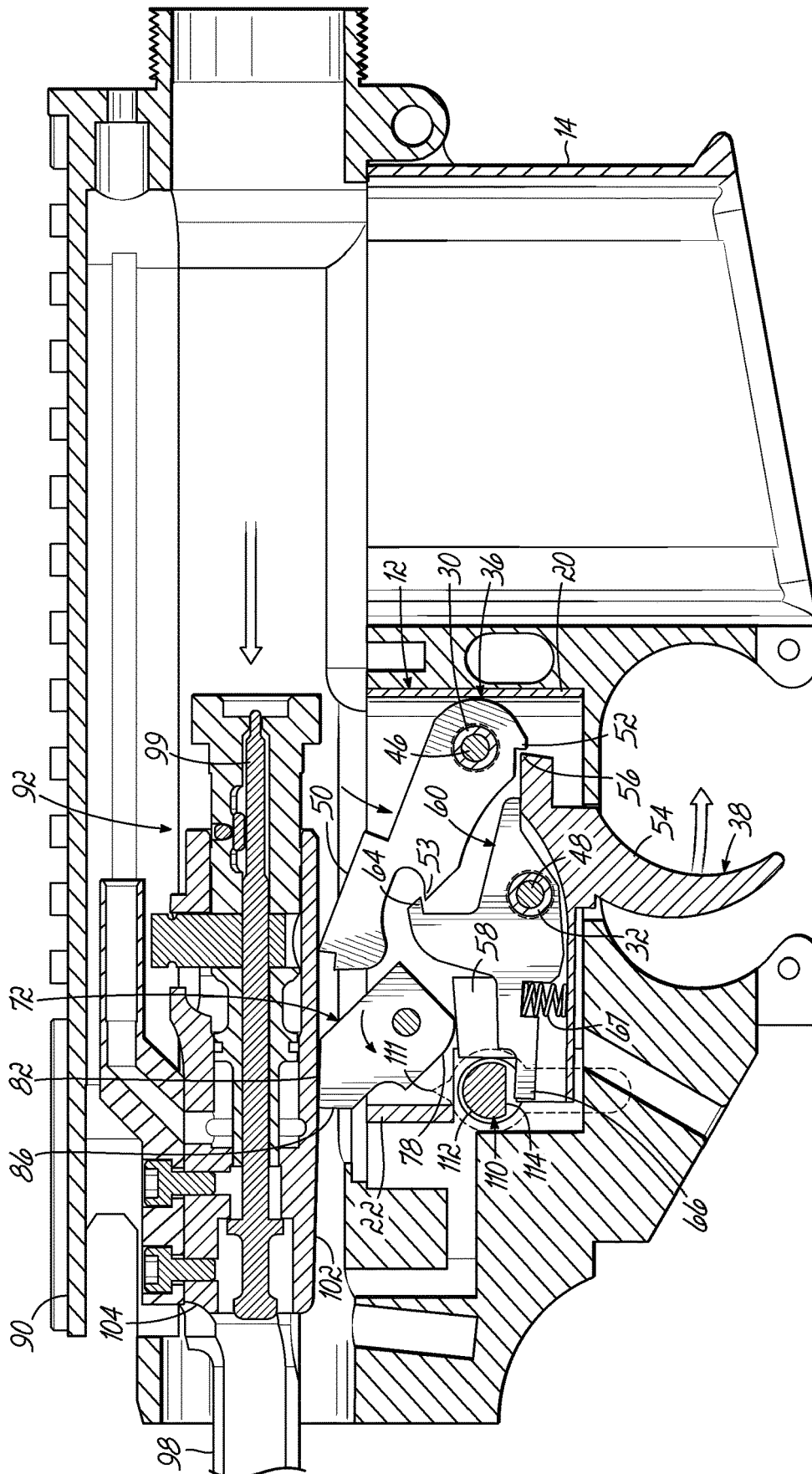


FIG. 8C

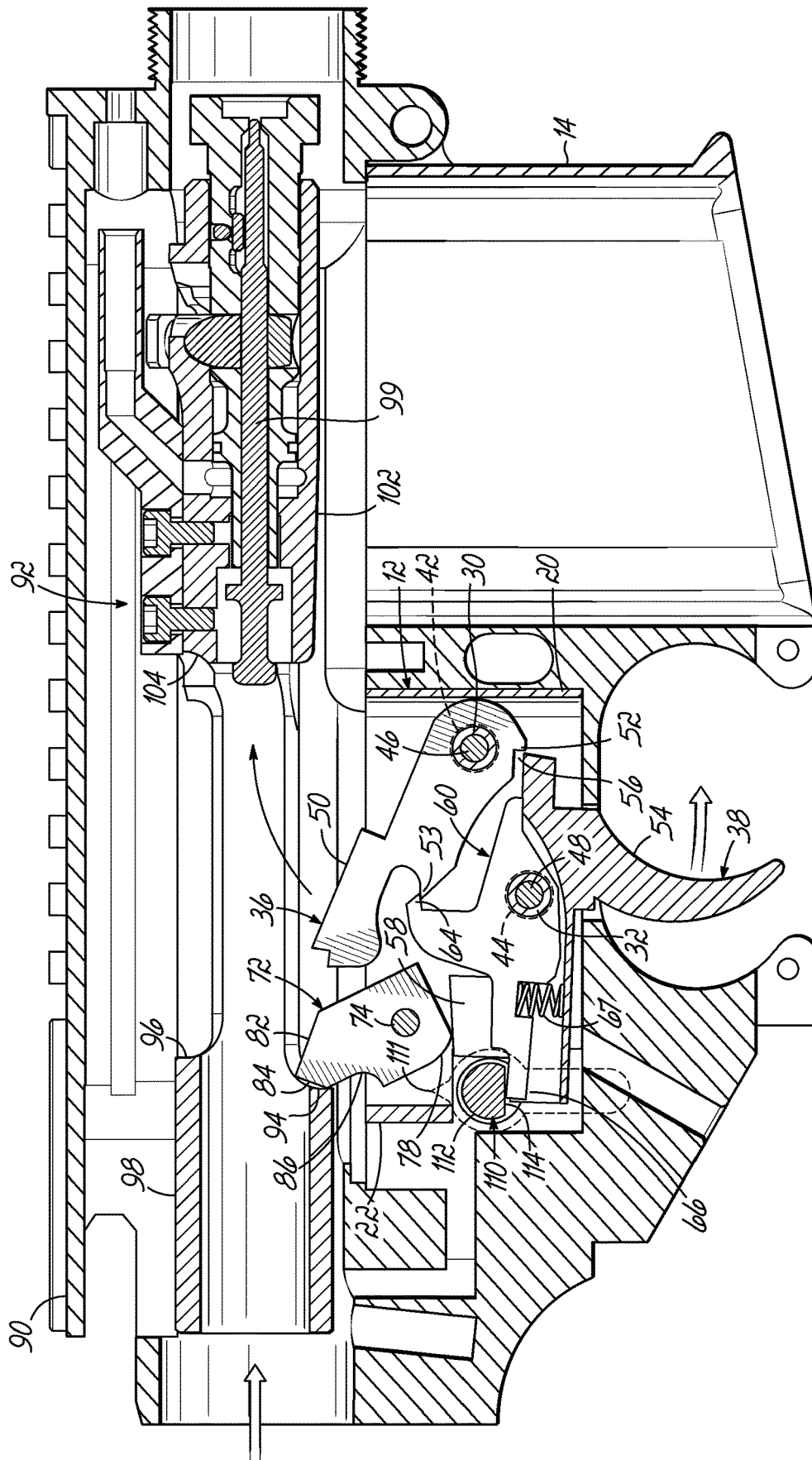


FIG. 8D

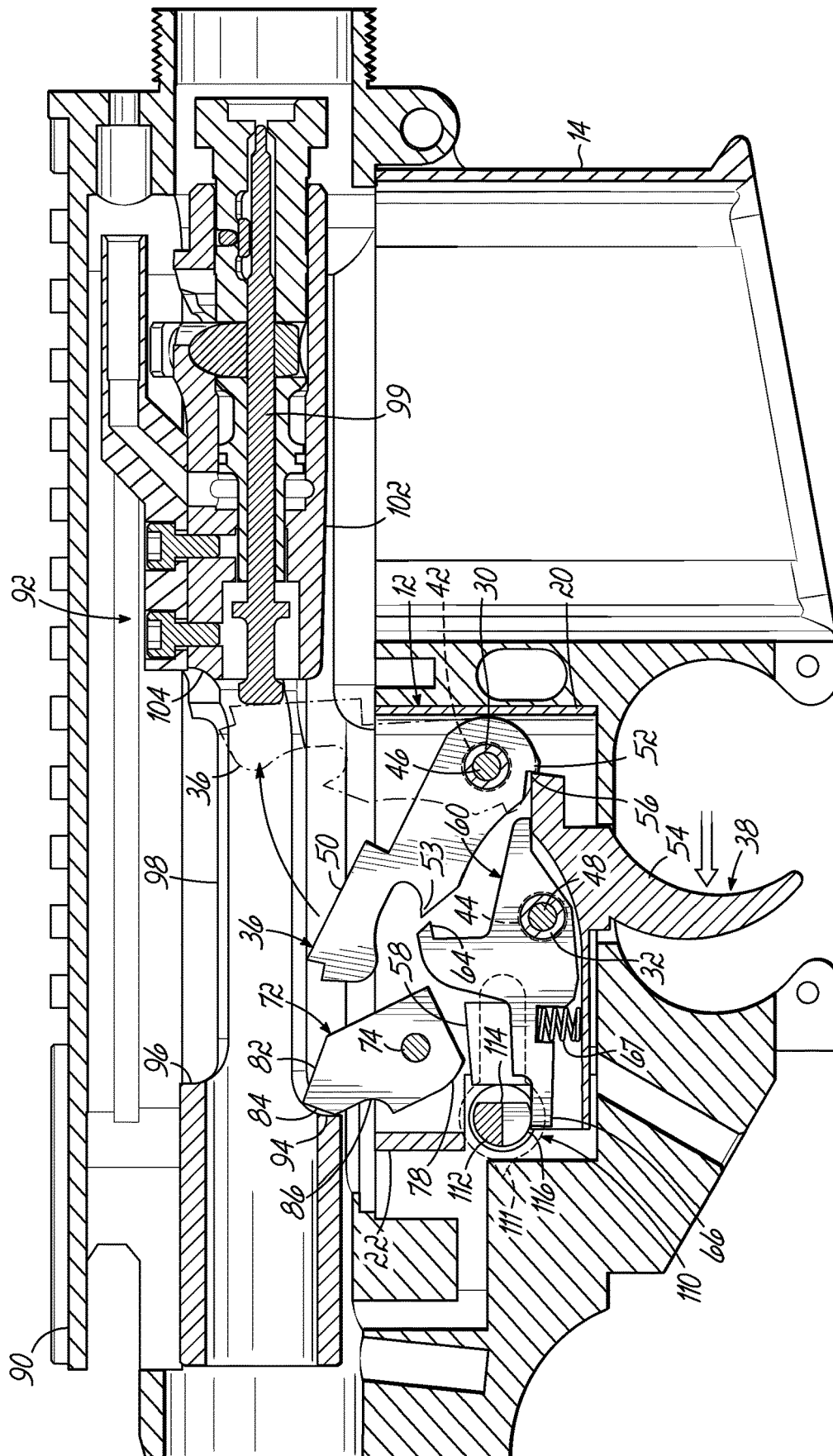


FIG. 9A

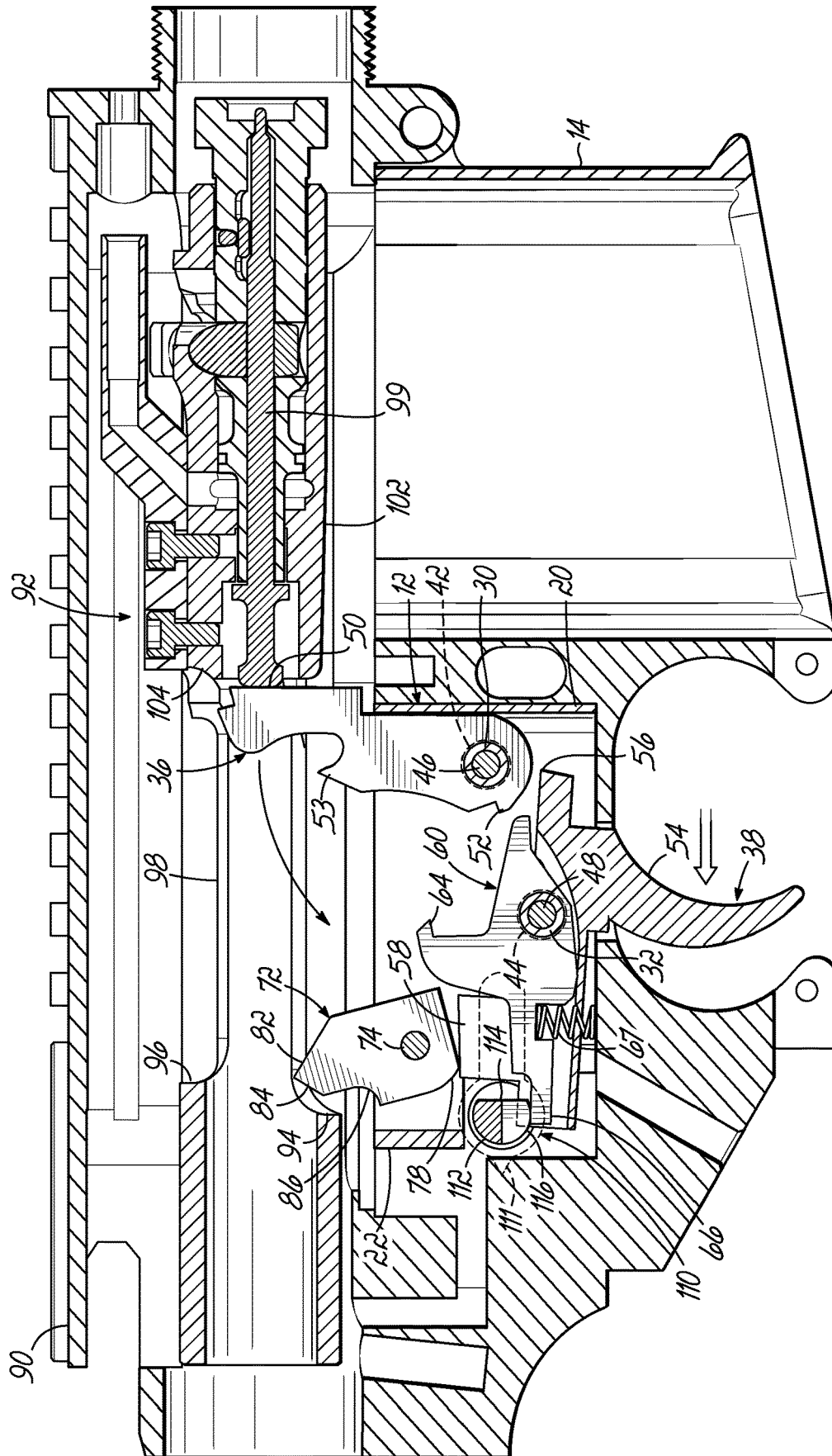


FIG. 9B

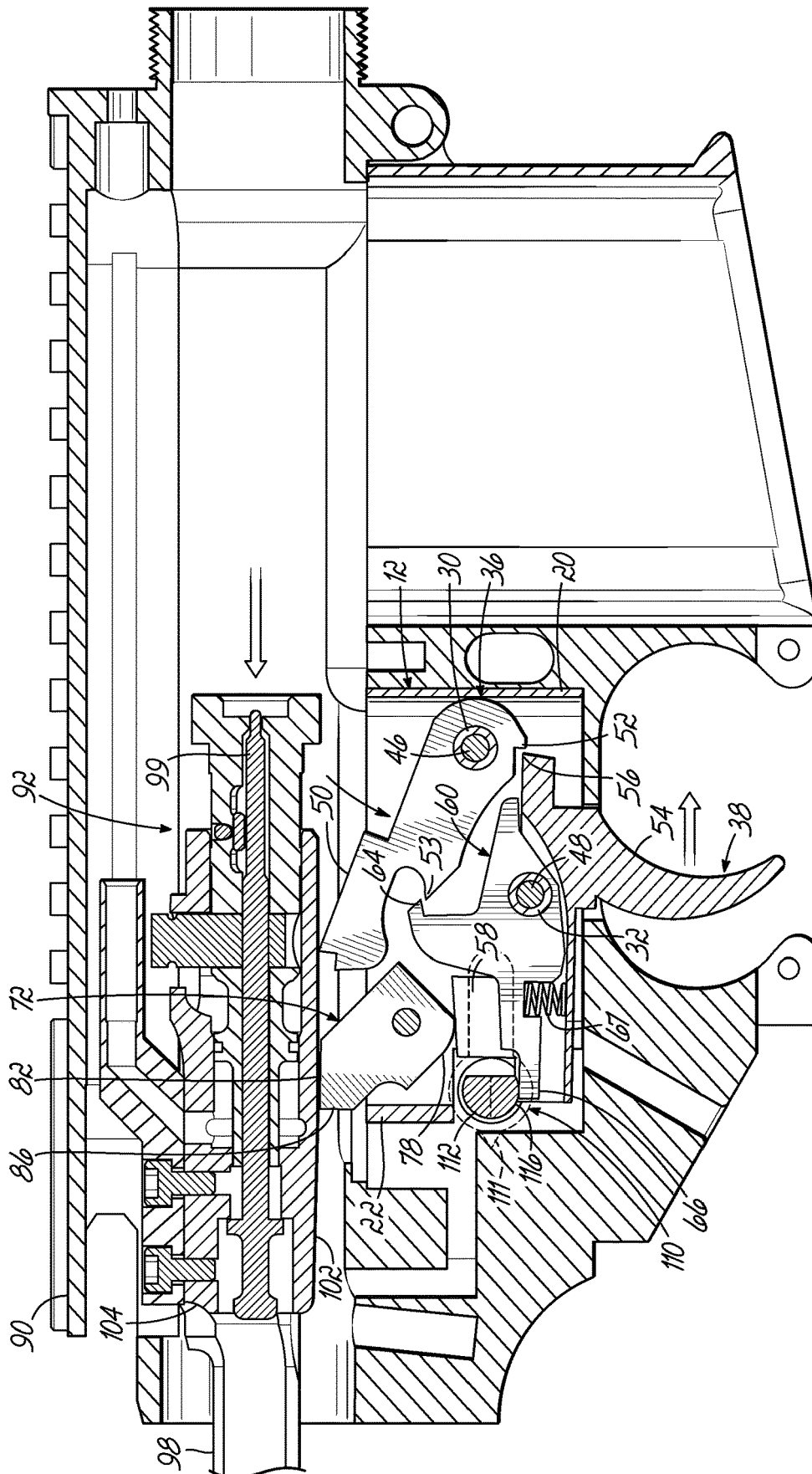


FIG. 9C

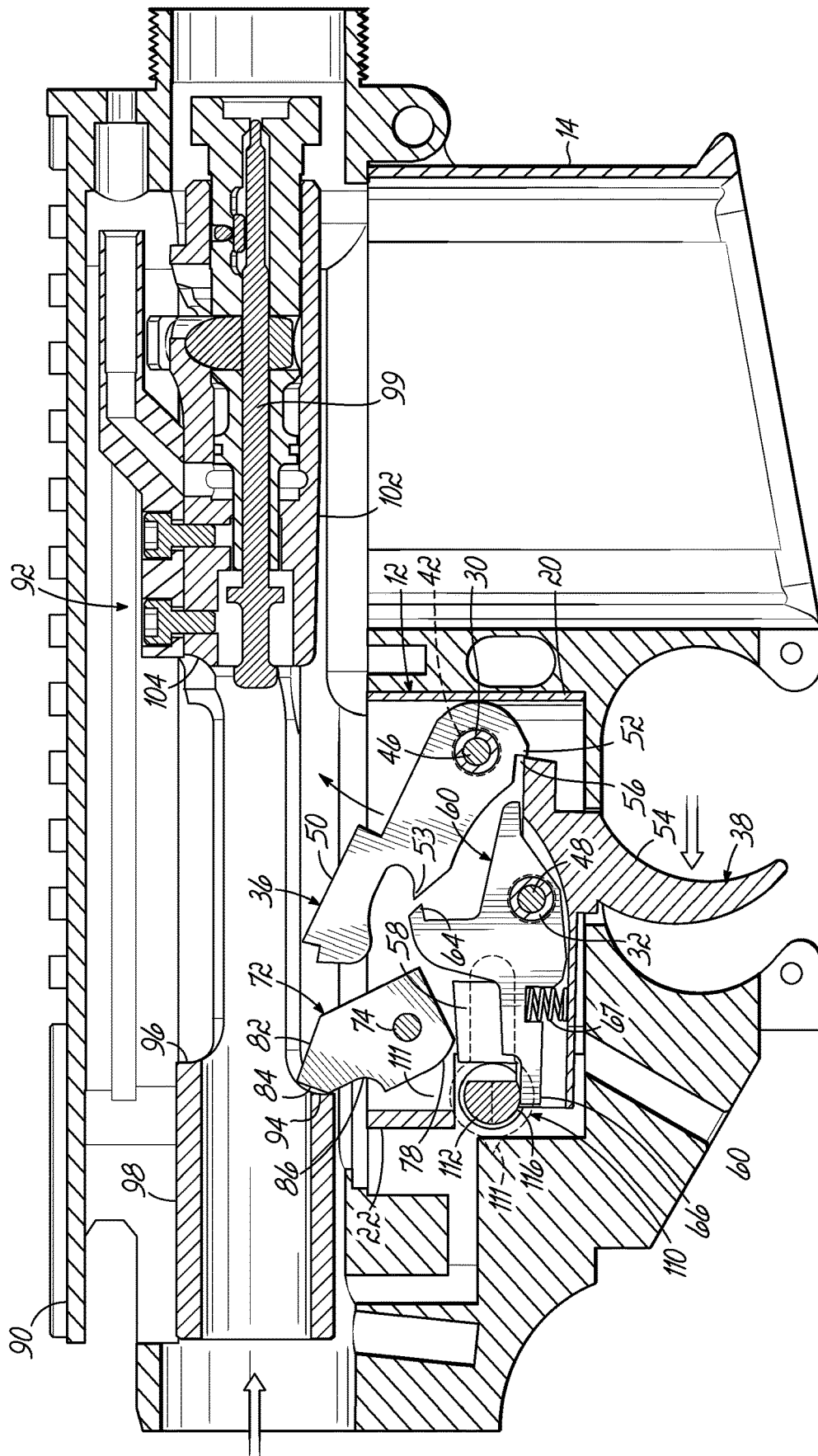


FIG. 9D

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FIREARM TRIGGER MECHANISM**RELATED APPLICATIONS**

This application claims the priority benefit of U.S. Provisional Patent Application No. 63/374,941 filed Sep. 8, 2022, which is hereby incorporated by reference herein as if fully set forth in its entirety.

FIELD OF THE INVENTION

The present invention relates generally to a firearm trigger mechanism, and more particularly to a semiautomatic trigger that is selectively mechanically reset by movement of the bolt carrier.

BACKGROUND OF THE INVENTION

In a standard semiautomatic firearm, actuation of the trigger releases a sear, allowing a hammer or striker to fire a chambered ammunition cartridge. Part of the ammunition's propellant force is used to cycle the action, extracting and ejecting a spent cartridge and replacing it with a loaded cartridge. The cycle includes longitudinal reciprocation of a bolt and/or carrier, which also resets the hammer or striker.

A standard semiautomatic trigger mechanism includes a disconnecter, which holds the hammer or striker in a cocked position until the trigger member is reset to engage the sear. This allows the firearm to be fired only a single time when the trigger is pulled and held, because the user is not typically able to release the trigger rapidly enough so that the sear engages before the bolt or bolt carrier returns to its in-battery position. The disconnecter prevents the firearm from either firing multiple rounds on a single pull of the trigger, or from allowing the hammer or striker to simply "follow" the bolt as it returns to battery without firing a second round, but leaving the hammer or striker uncocked.

For various reasons, shooters desire to increase the rate of semiautomatic fire. Sometimes this is simply for entertainment and the feeling of shooting a machine gun. In the past, users have been known to employ "bump firing" to achieve rapid semiautomatic fire. Bump firing uses the recoil of the semiautomatic firearm to fire shots in rapid succession. The process involves bracing the rifle with the non-trigger hand, loosening the grip of the trigger hand (but leaving the trigger finger in its normal position in front of the trigger), and pushing the rifle forward in order to apply pressure on the trigger from the finger while keeping the trigger finger stationary. When fired with the trigger finger held stationary, the firearm will recoil to the rear and allow the trigger to reset as it normally does. When the non-trigger hand pulls the firearm away from the body and back forward toward the original position, it causes the trigger to be pressed against the stationary finger again, firing another round as the trigger is pushed back.

Devices for increasing the rate of semiautomatic fire are shown in U.S. Pat. Nos. 9,568,264, 9,816,772, and 9,939,221, issued to Thomas Allen Graves. The devices shown in these patents forcefully reset the trigger with rigid mechanical contact between the trigger member and the bolt as the action cycles. To adapt this invention to an AR-pattern firearm, for example, would require not only a modified fire control mechanism, but also a modified bolt carrier.

Other devices for increasing the rate of semiautomatic fire are shown in the assignee's U.S. Pat. Nos. 10,514,223 and 11,346,627 and U.S. patent application Ser. No. 18/048,572 filed Oct. 21, 2022, all of which are hereby incorporated by

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reference as if fully set forth in their entirety. In these devices the hammer forces the trigger to the set position, and a locking bar prevents early hammer release.

Another device for increasing the rate of semiautomatic fire is shown in U.S. Pat. No. 7,398,723, issued on Jul. 15, 2008, to Brian A. Blakley, and is hereby incorporated by reference herein as if fully set forth in its entirety. The device shown in this patent has a pivoting cam which is contacted by the rearwardly traveling bolt carrier, pivoting the cam rearwardly such that the bottom surface of the cam presses downward on the trigger-extension, forcing the rear of the trigger down, and thereby moving forward the surface of the trigger that an operator's finger engages.

Further improvement in forced reset triggers is desired.

SUMMARY OF INVENTION

The present invention provides a semiautomatic trigger mechanism for increasing rate of fire that can be retrofitted into popular existing firearm platforms. In particular, this invention provides a trigger mechanism that can be used in AR-pattern firearms with an otherwise standard M16-pattern bolt carrier assembly. Embodiments of the present invention are particularly adaptable for construction as a "drop-in" replacement trigger module that only requires insertion of two assembly pins and the safety selector. Advantageously, the present invention provides a "three position" trigger mechanism having safe, standard semi-automatic, and forced reset semi-automatic positions.

In one aspect, a firearm trigger mechanism comprises a housing adapted to be installed in a fire control mechanism pocket of a receiver and having a first pair of transversely aligned openings for receiving a hammer pin, a second pair of transversely aligned openings for receiving a trigger pin, and a third pair of transversely aligned openings for receiving a cam pin, a hammer having a sear catch and a hook for engaging a disconnecter and mounted in the housing to pivot on the hammer pin between set and released positions, the hammer adapted to be pivoted rearward by rearward movement of a bolt carrier, a trigger member having a sear and mounted in the housing to pivot on the trigger member pin between set and released positions, wherein the sear and sear catch are in engagement in the set positions of the hammer and trigger member and are out of engagement in the released positions of the hammer and trigger member, a disconnecter having a hook for engaging the hammer and mounted in the housing to pivot on the trigger member pin, a cam having a cam lobe and mounted in the housing to pivot on the cam pin, the cam being pivotable between a first position at which the cam lobe does not force the trigger member towards the set position and a second position at which the cam lobe does force the trigger member towards the set position, and a safety selector adapted to be mounted in the fire control mechanism pocket to pivot between safe, standard semi-automatic, and forced reset semi-automatic positions. In the standard semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and pivoting of the cam from the first position to the second position such that the cam lobe forces the trigger member towards the set position but prior to reaching the set position the disconnecter hook catches the hammer hook, and thereafter forward movement of the bolt carrier causes the cam to pivot to the first position, at which time a user must manually release the trigger member to free the hammer from the disconnecter to permit the hammer and trigger member to pivot to the set positions so that the user can pull the trigger member to fire the firearm. In the forced reset

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semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and pivoting of the cam from the first position to the second position such that the cam lobe forces the trigger member to the set position, the safety selector preventing the disconnecter hook from catching the hammer hook, and thereafter forward movement of the bolt carrier causes the cam to pivot to the first position, at which time the user can pull the trigger member to fire the firearm without manually releasing the trigger member.

The safety selector can have a protuberance thereon which, when the safety selector is in the forced reset semi-automatic position, contacts the disconnecter preventing the disconnecter hook from catching the hammer hook. The trigger mechanism can further include a spring which biases the trigger member towards the set position.

In another aspect, a firearm trigger mechanism comprises a housing adapted to be installed in a fire control mechanism pocket of a receiver and having a first pair of transversely aligned openings for receiving a hammer pin, a second pair of transversely aligned openings for receiving a trigger pin, and a third pair of transversely aligned openings for receiving a cam pin, a hammer having a sear catch and a hook for engaging a disconnecter and mounted in the housing to pivot on the hammer pin between set and released positions, the hammer adapted to be pivoted rearward by rearward movement of a bolt carrier, a trigger member having a sear and mounted in the housing to pivot on the trigger member pin between set and released positions, wherein the sear and sear catch are in engagement in the set positions of the hammer and trigger member and are out of engagement in the released positions of the hammer and trigger member, a disconnecter having a hook for engaging the hammer and mounted in the housing to pivot on the trigger member pin, a cam having a cam lobe and mounted in the housing to pivot on the cam pin, the cam being pivotable between a first position at which the cam lobe does not force the trigger member towards the set position and a second position at which the cam lobe does force the trigger member towards the set position, and a safety selector adapted to be mounted in the fire control mechanism pocket to pivot between safe, standard semi-automatic, and forced reset semi-automatic positions. In the standard semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and pivoting of the cam from the first position to the second position such that the cam lobe forces the trigger member towards the set position but prior to reaching the set position the disconnecter hook catches the hammer hook, and thereafter forward movement of the bolt carrier causes the cam to pivot to the first position, at which time a user must manually release the trigger member to free the hammer from the disconnecter to permit the hammer and trigger member to pivot to the set positions so that the user can pull the trigger member to fire the firearm. In the forced reset semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and pivoting of the cam from the first position to the second position such that the cam lobe forces the trigger member to the set position, the safety selector preventing the disconnecter hook from catching the hammer hook, and thereafter forward movement of the bolt carrier causes the cam to pivot to the first position, at which time the user can pull the trigger member to fire the firearm without manually releasing the trigger member.

The safety selector can have a protuberance thereon which, when the safety selector is in the forced reset semi-automatic position, contacts the disconnecter prevent-

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ing the disconnecter hook from catching the hammer hook. The first and second pairs of transversely aligned openings in the housing can be adapted to be aligned with first and second pairs of transversely aligned assembly pin openings in the fire control mechanism pocket. The trigger mechanism can include a spring which biases the trigger member towards the set position. The spring can be a torsion spring.

In another aspect, a firearm comprises a receiver having a fire control mechanism pocket therein, a reciprocating bolt carrier, a hammer having a sear catch and a hook for engaging a disconnecter and mounted in the fire control mechanism pocket to pivot on a transverse hammer pivot axis between set and released positions, the hammer adapted to be pivoted rearward by rearward movement of the bolt carrier, a trigger member having a sear and mounted in the fire control mechanism pocket to pivot on a transverse trigger member pivot axis between set and released positions, wherein the sear and sear catch are in engagement in the set positions of the hammer and trigger member and are out of engagement in the released positions of the hammer and trigger member, a disconnecter having a hook for engaging the hammer and mounted in the fire control mechanism pocket to pivot on the transverse trigger member pivot axis, a cam having a cam lobe and mounted in the fire control mechanism pocket to pivot on a transverse cam pivot axis, the cam being pivotable between a first position at which the cam lobe does not force the trigger member towards the set position and a second position at which the cam lobe does force the trigger member towards the set position, and a safety selector mounted in the fire control mechanism pocket to pivot between safe, standard semi-automatic, and forced reset semi-automatic positions. In the standard semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and pivoting of the cam from the first position to the second position such that the cam lobe forces the trigger member towards the set position but prior to reaching the set position the disconnecter hook catches the hammer hook, and thereafter forward movement of the bolt carrier causes the cam to pivot to the first position, at which time a user must manually release the trigger member to free the hammer from the disconnecter to permit the hammer and trigger member to pivot to the set positions so that the user can pull the trigger member to fire the firearm. In the forced reset semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and pivoting of the cam from the first position to the second position such that the cam lobe forces the trigger member to the set position, the safety selector preventing the disconnecter hook from catching the hammer hook, and thereafter forward movement of the bolt carrier causes the cam to pivot to the first position, at which time the user can pull the trigger member to fire the firearm without manually releasing the trigger member.

The firearm can further comprise a housing having a first pair of transversely aligned openings with a hammer pin therethrough and a second pair of transversely aligned openings with a trigger member pin therethrough, the hammer mounted on the hammer pin, the trigger member and disconnecter mounted on the trigger member pin. The receiver can have a first pair of transversely aligned assembly pin openings and a second pair of transversely aligned assembly pin openings, the housing first pair of openings coaxial with the receiver first pair of openings and the housing second pair of openings coaxial with the receiver second pair of openings, a first assembly pin passing through the receiver first pair of openings and through the housing first pair of openings, and a second assembly pin passing

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through the receiver second pair of openings and through the housing second pair of openings. The firearm can further comprise a spring which biases the trigger member towards the set position. The spring can be a torsion spring.

In another aspect, a firearm trigger mechanism comprises a hammer having a sear catch and a hook for engaging a disconnecter and adapted to be mounted in a fire control mechanism pocket of a receiver to pivot on a transverse hammer pivot axis between set and released positions, the hammer adapted to be pivoted rearward by rearward movement of a bolt carrier, a trigger member having a sear and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse trigger member pivot axis between set and released positions, wherein the sear and sear catch are in engagement in the set positions of the hammer and trigger member and are out of engagement in the released positions of the hammer and trigger member, a disconnecter having a hook for engaging the hammer and adapted to be mounted in the fire control mechanism pocket to pivot on the transverse trigger member pivot axis, a cam having a cam lobe and adapted to be movably mounted in the fire control mechanism pocket, the cam being movable between a first position at which the cam lobe does not force the trigger member towards the set position and a second position at which the cam lobe does force the trigger member towards the set position, and a safety selector adapted to be mounted in the fire control mechanism pocket to pivot between safe, standard semi-automatic, and forced reset semi-automatic positions. In the standard semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and movement of the cam from the first position to the second position such that the cam lobe forces the trigger member towards the set position but prior to reaching the set position the disconnecter hook catches the hammer hook, and thereafter forward movement of the bolt carrier causes the cam to move to the first position, at which time a user must manually release the trigger member to free the hammer from the disconnecter to permit the hammer and trigger member to pivot to the set positions so that the user can pull the trigger member to fire the firearm. In the forced reset semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and movement of the cam from the first position to the second position such that the cam lobe forces the trigger member to the set position, the safety selector preventing the disconnecter hook from catching the hammer hook, and thereafter forward movement of the bolt carrier causes the cam to move to the first position, at which time the user can pull the trigger member to fire the firearm without manually releasing the trigger member.

Other aspects, features, benefits, and advantages of the present invention will become apparent to a person of skill in the art from the detailed description of various embodiments with reference to the accompanying drawing figures, all of which comprise part of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

Like reference numerals are used to indicate like parts throughout the various drawing figures, wherein:

FIG. 1 is a top front right perspective view of a drop-in trigger module for an AR-pattern firearm according to one embodiment of the invention.

FIG. 2 is a top rear right perspective view thereof.

FIG. 3 is a top rear right exploded perspective view thereof.

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FIG. 4A is a top rear right cross-sectional view thereof with the safety selector in the safe position and with the hammer and trigger member in their set positions.

FIG. 4B is a bottom rear right cross-sectional view thereof with the safety selector in the safe position and with the hammer and trigger member in their set positions.

FIG. 5A is a top rear right cross-sectional view thereof with the safety selector in the standard semi-automatic position and with the hammer and trigger member in their set positions.

FIG. 5B is a bottom rear right cross-sectional view thereof with the safety selector in the standard semi-automatic position and with the hammer and trigger member in their set positions.

FIG. 6A is a top rear right cross-sectional view thereof with the safety selector in the forced reset semi-automatic position and with the hammer and trigger member in their set positions.

FIG. 6B is a bottom rear right cross-sectional view thereof with the safety selector in the forced reset semi-automatic position and with the hammer and trigger member in their set positions.

FIG. 7 is a cross-sectional view showing the trigger module installed in a typical AR15-pattern lower receiver, with the hammer and trigger member in their set positions and with the bolt carrier in an in-battery position, and with the safety selector in the safe position.

FIG. 8A is a view similar to FIG. 7 but with the safety selector in the standard semi-automatic position.

FIG. 8B is a view similar to FIG. 8A but after the trigger has been pulled to drop the hammer.

FIG. 8C is a view similar to FIG. 8B but with the bolt carrier cycling to the rear to pivot the hammer and cam.

FIG. 8D is a view similar to FIG. 8C but with the bolt carrier having returned to battery and the disconnecter having caught the hammer.

FIG. 9A is a view similar to FIG. 7 but with the safety selector in the forced reset semi-automatic position.

FIG. 9B is a view similar to FIG. 9A but after the trigger has been pulled to drop the hammer.

FIG. 9C is a view similar to FIG. 9B but with the bolt carrier cycling to the rear to pivot the hammer and cam.

FIG. 9D is a view similar to FIG. 9C but with the bolt carrier having returned to battery and the hammer and trigger having returned to their set positions.

DETAILED DESCRIPTION OF THE DRAWINGS

With reference to the drawing figures, this section describes particular embodiments and their detailed construction and operation. Throughout the specification, reference to “one embodiment,” “an embodiment,” or “some embodiments” means that a particular described feature, structure, or characteristic may be included in at least one embodiment. Thus, appearances of the phrases “in one embodiment,” “in an embodiment,” or “in some embodiments” in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the described features, structures, and characteristics may be combined in any suitable manner in one or more embodiments. In view of the disclosure herein, those skilled in the art will recognize that the various embodiments can be practiced without one or more of the specific details or with other methods, components, materials, or the like. In some instances, well-known structures, materials, or operations are not shown or not described in detail to avoid obscuring aspects of the embodiments. “Forward” will indi-

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cate the direction of the muzzle and the direction in which projectiles are fired, while “rearward” will indicate the opposite direction. “Lateral” or “transverse” indicates a side-to-side direction generally perpendicular to the axis of the barrel. Although firearms may be used in any orientation, “left” and “right” will generally indicate the sides according to the user’s orientation, “top” or “up” will be the upward direction when the firearm is gripped in the ordinary manner. QAs used herein, “transverse” means a side-to-side direction generally perpendicular to the longitudinal axis of the barrel.

Referring first to FIGS. 1-6B, there is illustrated a “drop-in” trigger module 10 adapted for use in an AR-pattern firearm according to a first embodiment of the present invention. As used herein, “AR-pattern” firearm includes the semiautomatic versions of the AR10 and AR15 firearms and variants thereof of any caliber, including pistol caliber carbines or pistols using a blow-back bolt. While select fire (fully automatic capable) versions of this platform, such as the M16 and M4, are also AR-pattern firearms, this invention only relates to semiautomatic firearm actions. The concepts of this invention may be adaptable to other popular semiautomatic firearm platforms, such as the Ruger 10/22™, AK-pattern firearms, and HK-pattern firearms.

The module 10 includes a frame or housing 12 sized and shaped to fit within the internal fire control pocket of an AR-pattern lower receiver 14. Lower receiver parts not important to the present invention are well-known in the art and are omitted from the figures for clarity. The housing 12 includes left and right sidewalls 16, 18 which extend substantially vertically and parallel to one another in a laterally spaced-apart relationship. The sidewalls 16, 18 may be interconnected by front and rear sidewalls 20, 22. The sidewalls 16, 18 include first and second pairs of aligned openings 24, 26 for receiving hollow transverse pins 30, 32 upon which a hammer 36 and trigger member 38 pivot. The openings 24, 26 are located coaxially with openings 42, 44 in the lower receiver 14. Standard AR-pattern hammer and trigger pins 46, 48 pass through the openings 42, 44 in the lower receiver 14 and through the hollow transverse pins 30, 32 to assemble the housing 12 into the lower receiver 14. Thus, the pins 30, 32 retain the hammer 36 and trigger member 38 in the housing 12 in modular fashion, whereas the pins 46, 48 retain the trigger module 10 in the lower receiver 14.

The hammer 36 has a hammer head 50, a sear catch 52, and a hammer hook 53. The hammer 36 is spring biased towards a forward position by a standard AR-pattern hammer torsion spring (not shown).

The trigger member 38 has a trigger blade 54 that extends downwardly. The trigger blade 54 is the part of the trigger member 38 contacted by a user’s finger to actuate the trigger mechanism. The trigger blade 54 may be curved (as shown) or straight, as desired. The trigger member 38 has a sear 56. When the sear 56 and the sear catch 52 are engaged, the hammer 36 and trigger member 38 are in their set positions. When the sear 56 and sear catch 52 are not engaged, the hammer 36 and trigger member 38 are in their released positions. The trigger member 38 also has a cam follower 58. The trigger member 38 is spring biased by a standard AR-pattern trigger member torsion spring (not shown) so that the trigger blade 54 is spring biased towards a forward position.

A disconnecter 60 is pivoted on the hollow transverse pin 32 upon which the trigger member 38 pivots. The disconnecter 60 has a disconnecter hook 64 and a tail 66. The tail 66 of the disconnecter 60 is spring biased upwardly away

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from a tail 68 of the trigger member 38 by a standard AR-pattern disconnecter compression spring 67.

A cam 72 is movably mounted to the housing 12. For example, the cam 72 can be pivoted on a cam pin 74 that is installed in aligned openings 76 in the sidewalls 16, 18 of the housing 12. The cam 72 has a cam lobe 78 that interacts with the cam follower 58, in a manner to be described below. The cam 72 has a first contact surface 82 on an upper forward portion thereof and a second contact surface 84 on an upper rearward portion thereof. The cam 72 has a notch 86 below the second contact surface 84 to provide clearance for the rear wall 22 of the housing 12. Alternatively, the cam 72 can be slidably mounted to the housing 12 with or without spring bias.

An upper receiver 90 houses a bolt carrier assembly 92. As is well-known in the art, the bolt carrier assembly 92 (or blow-back bolt) slidably reciprocates in the upper receiver 90 and engages the breach of a barrel or barrel extension. As used herein, “bolt carrier” and “bolt carrier assembly” may be used interchangeably and include a blow-back type bolt used in pistol caliber carbine configurations of the AR-platform. The bolt carrier assembly 92 used with the embodiments of this invention can have either a standard mil-spec M16-pattern bolt carrier, a standard AR15-pattern bolt carrier, or some variation of the two, depending on the design of the cam 72, and whether operated by a gas direct impingement system or a gas piston system. The bolt carrier assembly 92 has an engagement surface 94 in a rear portion 96 of the bolt carrier body 98. As in an ordinary AR15-pattern configuration, during rearward travel of the bolt carrier assembly 92 a lower surface 102 in a forward portion 104 of the bolt carrier body 98 contacts the face of the hammer head 50 causing the hammer 36 to pivot rearward. During further rearward travel of bolt carrier assembly 92 the lower surface 102 of the bolt carrier body 98 contacts the surface 82 of the cam 72 to the pivot cam 72 in a first direction from a first position to a second position. During forward travel of the bolt carrier assembly 92 the engagement surface 94 of the bolt carrier body 98 contacts the surface 84 of the cam 72 to pivot the cam 72 in a second opposite direction from the second position to the first position.

A three position safety selector 110 has safe, standard semi-automatic, and forced reset semi-automatic positions. When in the safe position (safety selector indicator 111 pointing forward), a wide semi-circular portion 112 of the safety selector 110 prevents the trigger blade 54 from being pulled (FIGS. 4A, 4B, and 7). When in the standard semi-automatic position (safety selector indicator 111 pointing upward), a flat portion 114 of the safety selector 110 permits the trigger blade 54 to be pulled. The disconnecter 60 can pivot with the trigger member 38 and the disconnecter hook 64 can catch the hammer hook 53 during rearward pivoting travel of the hammer head 50. (FIGS. 5A and 5B). When in the forced reset semi-automatic position (safety selector indicator 111 pointing rearward), a narrow semi-circular portion 116 permits the trigger blade 54 to be pulled but prevents the disconnecter 60 from pivoting with the trigger member 38 thus preventing the disconnecter hook 64 from catching the hammer hook 53 during rearward pivoting travel of the hammer head 50. (FIGS. 6A and 6B). In other words, in the forced reset semi-automatic position, the disconnecter 60 is “disabled” in that the disconnecter hook 64 is unable to catch the hammer hook 53 during cycling of the bolt carrier assembly 92.

Referring now to FIGS. 8A-8D, with the safety selector 110 set in the standard semi-automatic position, rearward

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finger pressure on the trigger blade 54 causes the trigger member 38 to rotate clockwise. Depending on the position of the cam 72, the cam follower 58 may or may not act upon the cam lobe 78 to pivot the cam 72 clockwise. Rotation of the trigger member 38 causes the sear 56 to disengage from the sear catch 52 of the hammer 36. This allows the hammer 36 to drop by spring force onto the firing pin 99 of the bolt carrier assembly 92, discharging an ammunition cartridge (not shown), and causing the action to cycle by moving the bolt carrier assembly 92 rearward. Rearward travel of the bolt carrier assembly 92 causes the lower surface 102 to contact the face of the hammer head 50 and pivot the hammer 36 counter-clockwise. During pivoting travel of the hammer 36 the disconnecter hook 64 catches the hammer hook 53. During further rearward travel of the bolt carrier assembly 92 the lower surface 102 contacts the surface 82 of the cam 72 to pivot the cam 72 counter-clockwise. As the cam 72 pivots counter-clockwise, the cam lobe 78 may act upon the cam follower 58 to pivot the trigger member 38 counter-clockwise. Forward travel of the bolt carrier assembly 92 returning to battery causes the surface 94 to contact the surface 84 of the cam 72 to pivot the cam 72 clockwise. At this point rearward finger pressure on the trigger blade 54 must be released to allow the sear 56 to engage the sear catch 52, returning the hammer 36 and trigger member 38 to their set positions. Thereafter the user can reapply rearward finger pressure on the trigger blade 54 to fire another round.

Referring now to FIGS. 9A-9D, with the safety selector 110 set in the forced reset semi-automatic position, rearward finger pressure on the trigger blade 54 causes the trigger member 38 to rotate clockwise. The narrow semi-circular portion 116 of the safety selector 110 prevents the disconnecter 60 from rotating with the trigger member 38, thus "disabling" the disconnecter 60, preventing the disconnecter hook 64 from catching the hammer hook 53. Depending on the position of the cam 72, the cam follower 58 may or may not act upon the cam lobe 78 to pivot the cam 72 clockwise. Rotation of the trigger member 38 causes the sear 56 to disengage from the sear catch 52 of the hammer 36. This allows the hammer 36 to drop by spring force onto the firing pin 99 of the bolt carrier assembly 92, discharging an ammunition cartridge, and causing the action to cycle by moving the bolt carrier assembly 92 rearward. Rearward travel of the bolt carrier assembly 92 causes the lower surface 102 to contact the face of the hammer head 50 and pivot the hammer 36 counter-clockwise. During further rearward travel of the bolt carrier assembly 92 the lower surface 102 contacts the surface 82 of the cam 72 to pivot the cam 72 counter-clockwise. As the cam 72 pivots counter-clockwise, the cam lobe 78 acts upon the cam follower 58 to pivot the trigger member 38 counter-clockwise. The bolt carrier assembly 92 thereby forces the hammer 36 and trigger member 38 to their set positions wherein the sear 56 engages the sear catch 52. Forward travel of the bolt carrier assembly 92 returning to battery causes the surface 94 to contact the surface 84 of the cam 72 to pivot the cam 72 clockwise. At this point the user can reapply rearward finger pressure on the trigger blade 54 to fire another round, without first manually releasing rear finger pressure on the trigger blade 54.

Thus, as the bolt carrier assembly 92 returns forward, the trigger member 38 is held in its set position by cam 72. The trigger member 38 cannot be pulled to release the sear/sear catch engagement, thus precluding early hammer release or "hammer follow" against the bolt carrier assembly 92 and firing pin 99 as the bolt carrier assembly 92 is returning to battery. When the bolt carrier assembly 92 has reached (or

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nearly reached) its closed, in-battery position, the engagement surface 94 contacts and forwardly displaces the contact surface 84 of cam 72, disengaging the cam lobe 78 from the cam follower 58, allowing the trigger blade 54 to be pulled. Again, this prevents early hammer release and contact of the hammer against the firing pin before the bolt is completely locked and in-battery.

While various embodiments of the present invention have been described in detail, it should be apparent that modifications and variations thereto are possible, all of which fall within the true spirit and scope of the invention. Therefore, the foregoing is intended only to be illustrative of the principles of the invention. The invention resides in each individual feature described herein, alone, and in any and all combinations and subcombinations of any and all of those features. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not intended to limit the invention to the exact construction and operation shown and described. Accordingly, all suitable modifications and equivalents may be included and considered to fall within the scope of the invention, defined by the following claim or claims.

What is claimed is:

1. A firearm trigger mechanism comprising:

a hammer having a sear catch and a hook for engaging a disconnecter and adapted to be mounted in a fire control mechanism pocket of a receiver to pivot on a transverse hammer pivot axis between set and released positions, said hammer adapted to be pivoted rearward by rearward movement of a bolt carrier,

a trigger member having a sear and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse trigger member pivot axis between set and released positions,

wherein said sear and sear catch are in engagement in said set positions of said hammer and trigger member and are out of engagement in said released positions of said hammer and trigger member,

a disconnecter having a hook for engaging said hammer and adapted to be mounted in the fire control mechanism pocket to pivot on said transverse trigger member pivot axis,

a cam having a cam lobe and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse cam pivot axis, said cam being pivotable between a first position at which said cam lobe does not force said trigger member towards said set position and a second position at which said cam lobe does force said trigger member towards said set position, and

a safety selector adapted to be mounted in the fire control mechanism pocket to pivot between safe, standard semi-automatic, and forced reset semi-automatic positions,

whereupon in said standard semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of said hammer and pivoting of said cam from said first position to said second position such that said cam lobe forces said trigger member towards said set position but prior to reaching said set position said disconnecter hook catches said hammer hook, and thereafter forward movement of the bolt carrier causes said cam to pivot to said first position, at which time a user must manually release said trigger member to free said hammer from said disconnecter to permit said hammer and trigger member to pivot to said set positions so that the user can pull said trigger member to fire the firearm, and

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whereupon in said forced reset semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of said hammer and pivoting of said cam from said first position to said second position such that said cam lobe forces said trigger member to said set position, said safety selector preventing said disconnecter hook from catching said hammer hook, and thereafter forward movement of the bolt carrier causes said cam to pivot to said first position, at which time the user can pull said trigger member to fire the firearm without manually releasing said trigger member.

2. The trigger mechanism of claim 1, wherein said safety selector has a protuberance thereon which, when said safety selector is in said forced reset semi-automatic position, contacts said disconnecter preventing said disconnecter hook from catching said hammer hook.

3. The trigger mechanism of claim 1 further including a spring which biases said trigger member towards said set position.

4. A firearm trigger mechanism comprising:

a housing adapted to be installed in a fire control mechanism pocket of a receiver and having a first pair of transversely aligned openings for receiving a hammer pin, a second pair of transversely aligned openings for receiving a trigger pin, and a third pair of transversely aligned openings for receiving a cam pin,

a hammer having a sear catch and a hook for engaging a disconnecter and mounted in said housing to pivot on said hammer pin between set and released positions, said hammer adapted to be pivoted rearward by rearward movement of a bolt carrier,

a trigger member having a sear and mounted in said housing to pivot on said trigger member pin between set and released positions,

wherein said sear and sear catch are in engagement in said set positions of said hammer and trigger member and are out of engagement in said released positions of said hammer and trigger member,

a disconnecter having a hook for engaging said hammer and mounted in said housing to pivot on said trigger member pin,

a cam having a cam lobe and mounted in said housing to pivot on said cam pin, said cam being pivotable between a first position at which said cam lobe does not force said trigger member towards said set position and a second position at which said cam lobe does force said trigger member towards said set position, and

a safety selector adapted to be mounted in the fire control mechanism pocket to pivot between safe, standard semi-automatic, and forced reset semi-automatic positions,

whereupon in said standard semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of said hammer and pivoting of said cam from said first position to said second position such that said cam lobe forces said trigger member towards said set position but prior to reaching said set position said disconnecter hook catches said hammer hook, and thereafter forward movement of the bolt carrier causes said cam to pivot to said first position, at which time a user must manually release said trigger member to free said hammer from said disconnecter to permit said hammer and trigger member to pivot to said set positions so that the user can pull said trigger member to fire the firearm, and

whereupon in said forced reset semi-automatic position, rearward movement of the bolt carrier causes rearward

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pivoting of said hammer and pivoting of said cam from said first position to said second position such that said cam lobe forces said trigger member to said set position, said safety selector preventing said disconnecter hook from catching said hammer hook, and thereafter forward movement of the bolt carrier causes said cam to pivot to said first position, at which time the user can pull said trigger member to fire the firearm without manually releasing said trigger member.

5. The trigger mechanism of claim 4, wherein said safety selector has a protuberance thereon which, when said safety selector is in said forced reset semi-automatic position, contacts said disconnecter preventing said disconnecter hook from catching said hammer hook.

6. The trigger mechanism of claim 4, wherein said first and second pairs of transversely aligned openings in said housing are adapted to be aligned with first and second pairs of transversely aligned assembly pin openings in the fire control mechanism pocket.

7. The trigger mechanism of claim 4 further including a spring which biases said trigger member towards said set position.

8. The trigger mechanism of claim 7 wherein said spring is a torsion spring.

9. A firearm comprising:

a receiver having a fire control mechanism pocket therein, a reciprocating bolt carrier,

a hammer having a sear catch and a hook for engaging a disconnecter and mounted in said fire control mechanism pocket to pivot on a transverse hammer pivot axis between set and released positions, said hammer adapted to be pivoted rearward by rearward movement of said bolt carrier,

a trigger member having a sear and mounted in said fire control mechanism pocket to pivot on a transverse trigger member pivot axis between set and released positions,

wherein said sear and sear catch are in engagement in said set positions of said hammer and trigger member and are out of engagement in said released positions of said hammer and trigger member,

a disconnecter having a hook for engaging said hammer and mounted in said fire control mechanism pocket to pivot on said transverse trigger member pivot axis,

a cam having a cam lobe and mounted in said fire control mechanism pocket to pivot on a transverse cam pivot axis, said cam being pivotable between a first position at which said cam lobe does not force said trigger member towards said set position and a second position at which said cam lobe does force said trigger member towards said set position, and

a safety selector mounted in said fire control mechanism pocket to pivot between safe, standard semi-automatic, and forced reset semi-automatic positions,

whereupon in said standard semi-automatic position, rearward movement of said bolt carrier causes rearward pivoting of said hammer and pivoting of said cam from said first position to said second position such that said cam lobe forces said trigger member towards said set position but prior to reaching said set position said disconnecter hook catches said hammer hook, and thereafter forward movement of said bolt carrier causes said cam to pivot to said first position, at which time a user must manually release said trigger member to free said hammer from said disconnecter to permit said

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hammer and trigger member to pivot to said set positions so that the user can pull said trigger member to fire said firearm, and
 whereupon in said forced reset semi-automatic position, rearward movement of said bolt carrier causes rearward pivoting of said hammer and pivoting of said cam from said first position to said second position such that said cam lobe forces said trigger member to said set position, said safety selector preventing said disconnecter hook from catching said hammer hook, and thereafter forward movement of said bolt carrier causes said cam to pivot to said first position, at which time the user can pull said trigger member to fire said firearm without manually releasing said trigger member.

10. The firearm of claim 9 further comprising:
 a housing having a first pair of transversely aligned openings with a hammer pin therethrough and a second pair of transversely aligned openings with a trigger member pin therethrough,
 said hammer mounted on said hammer pin, said trigger member and disconnecter mounted on said trigger member pin.

11. The firearm of claim 10 further comprising:
 said receiver having a first pair of transversely aligned assembly pin openings and a second pair of transversely aligned assembly pin openings,
 said housing first pair of openings coaxial with said receiver first pair of openings and said housing second pair of openings coaxial with said receiver second pair of openings,
 a first assembly pin passing through said receiver first pair of openings and through said housing first pair of openings, and
 a second assembly pin passing through said receiver second pair of openings and through said housing second pair of openings.

12. The firearm of claim 10 further comprising a spring which biases said trigger member towards said set position.

13. The firearm of claim 12 wherein said spring is a torsion spring.

14. A firearm trigger mechanism comprising:
 a hammer having a sear catch and a hook for engaging a disconnecter and adapted to be mounted in a fire control mechanism pocket of a receiver to pivot on a transverse hammer pivot axis between set and released positions, said hammer adapted to be pivoted rearward by rearward movement of a bolt carrier,
 a trigger member having a sear and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse trigger member pivot axis between set and released positions,
 wherein said sear and sear catch are in engagement in said set positions of said hammer and trigger member and are out of engagement in said released positions of said hammer and trigger member,
 a disconnecter having a hook for engaging said hammer and adapted to be mounted in the fire control mechanism pocket to pivot on said transverse trigger member pivot axis,
 a cam having a cam lobe and adapted to be movably mounted in the fire control mechanism pocket, said cam being movable between a first position at which said cam lobe does not force said trigger member towards said set position and a second position at which said cam lobe does force said trigger member towards said set position, and

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a safety selector adapted to be mounted in the fire control mechanism pocket to pivot between safe, standard semi-automatic, and forced reset semi-automatic positions,
 whereupon in said standard semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of said hammer and movement of said cam from said first position to said second position such that said cam lobe forces said trigger member towards said set position but prior to reaching said set position said disconnecter hook catches said hammer hook, and thereafter forward movement of the bolt carrier causes said cam to move to said first position, at which time a user must manually release said trigger member to free said hammer from said disconnecter to permit said hammer and trigger member to pivot to said set positions so that the user can pull said trigger member to fire the firearm, and
 whereupon in said forced reset semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of said hammer and movement of said cam from said first position to said second position such that said cam lobe forces said trigger member to said set position, said safety selector preventing said disconnecter hook from catching said hammer hook, and thereafter forward movement of the bolt carrier causes said cam to move to said first position, at which time the user can pull said trigger member to fire the firearm without manually releasing said trigger member.

15. A firearm trigger mechanism comprising:
 a hammer having a sear catch and a hook for engaging a disconnecter and adapted to be mounted in a fire control mechanism pocket of a receiver to pivot on a transverse hammer pivot axis between set and released positions, said hammer adapted to be pivoted rearward by rearward movement of a bolt carrier,
 a trigger member having a sear and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse trigger member pivot axis between set and released positions,
 wherein said sear and sear catch are in engagement in said set positions of said hammer and trigger member and are out of engagement in said released positions of said hammer and trigger member,
 said disconnecter having a hook for engaging said hammer and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse disconnecter pivot axis, and
 a cam having a cam lobe and adapted to be movably mounted in the fire control mechanism pocket, said cam being movable between a first position and a second position, in said second position said cam lobe forces said trigger member towards said set position,
 whereupon in a standard semi-automatic mode, said cam is in said first position, rearward movement of the bolt carrier causes rearward pivoting of said hammer such that said disconnecter hook catches said hammer hook, and thereafter the bolt carrier moves forward into battery, at which time a user must manually release said trigger member to free said hammer from said disconnecter to permit said hammer and trigger member to pivot to said set positions so that the user can pull said trigger member to fire the firearm, and
 whereupon in a forced reset semi-automatic mode, said cam is in said second position, rearward movement of the bolt carrier causes rearward pivoting of said hammer such that said disconnecter hook is prevented from

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catching said hammer hook, and thereafter the bolt carrier moves forward into battery, at which time the user can pull said trigger member to fire the firearm.

16. The trigger mechanism of claim 15, further comprising:

a housing having a first pair of transversely aligned openings with a hammer pin therethrough and a second pair of transversely aligned openings with a trigger member pin therethrough,

said hammer mounted on said hammer pin, said trigger member and disconnector mounted on said trigger member pin.

17. The trigger mechanism of claim 15, further comprising a spring which biases said trigger member towards said set position.

18. The trigger mechanism of claim 17, wherein said spring is a torsion spring.

19. The trigger mechanism of claim 15, wherein the trigger member pivot axis and disconnector pivot axis are coaxial.

20. A firearm trigger mechanism comprising:

a hammer having a sear catch and a hook for engaging a disconnector and adapted to be mounted in a fire control mechanism pocket of a receiver to pivot on a transverse hammer pivot axis between set and released positions, said hammer adapted to be pivoted rearward by rearward movement of a bolt carrier,

a trigger member having a sear and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse trigger member pivot axis between set and released positions,

wherein said sear and sear catch are in engagement in said set positions of said hammer and trigger member and are out of engagement in said released positions of said hammer and trigger member,

a disconnector having a hook for engaging said hammer and adapted to be mounted in the fire control mechanism pocket to pivot on said transverse disconnector pivot axis,

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a cam having a cam lobe and adapted to be movably mounted in the fire control mechanism pocket, said cam being movable between a first position at which said cam lobe does not force said trigger member into said set position and a second position at which said cam lobe does force said trigger member into said set position, and

a safety selector adapted to be movably mounted in the fire control mechanism pocket to move between safe, standard semi-automatic, and forced reset semi-automatic positions,

whereupon in said standard semi-automatic position, said cam is in said first position, rearward movement of the bolt carrier causes rearward pivoting of said hammer such that said disconnector hook catches said hammer hook, and thereafter the bolt carrier moves forward into battery, at which time a user must manually release said trigger member to free said hammer from said disconnector to permit said hammer and trigger member to pivot to said set positions so that the user can pull said trigger member to fire the firearm, and

whereupon in said forced reset semi-automatic position, said cam is in said second position, rearward movement of the bolt carrier causes rearward pivoting of said hammer such that said disconnector hook is prevented from catching said hammer hook, and thereafter the bolt carrier moves forward into battery, at which time the user can pull said trigger member to fire the firearm.

21. The trigger mechanism of claim 20, wherein said cam is not a part of said safety selector.

22. The trigger mechanism of claim 20, wherein said safety selector moves between safe, standard semi-automatic, and forced reset semi-automatic positions by rotation.

23. The trigger mechanism of claim 20, wherein the trigger member pivot axis and disconnector pivot axis are coaxial.

* * * * *

EXHIBIT B

US012031784B1

(12) **United States Patent**
DeMonico(10) **Patent No.:** **US 12,031,784 B1**
(45) **Date of Patent:** **Jul. 9, 2024**(54) **ADAPTED FORCED RESET TRIGGER**(71) Applicant: **ABC IP, LLC**, Dover, DE (US)(72) Inventor: **Lawrence DeMonico**, Austin, TX (US)(73) Assignee: **ABC IP, LLC**, Dover, DE (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **18/052,606**(22) Filed: **Nov. 4, 2022****Related U.S. Application Data**

(60) Provisional application No. 63/276,090, filed on Nov. 5, 2021.

(51) **Int. Cl.****F41A 17/46** (2006.01)**F41A 19/10** (2006.01)**F41A 19/43** (2006.01)(52) **U.S. Cl.**CPC **F41A 17/46** (2013.01); **F41A 19/10** (2013.01); **F41A 19/43** (2013.01)(58) **Field of Classification Search**CPC **F41A 17/46**; **F41A 19/10**; **F41A 19/43**
See application file for complete search history.(56) **References Cited****U.S. PATENT DOCUMENTS**3,318,192 A 5/1967 Miller et al.
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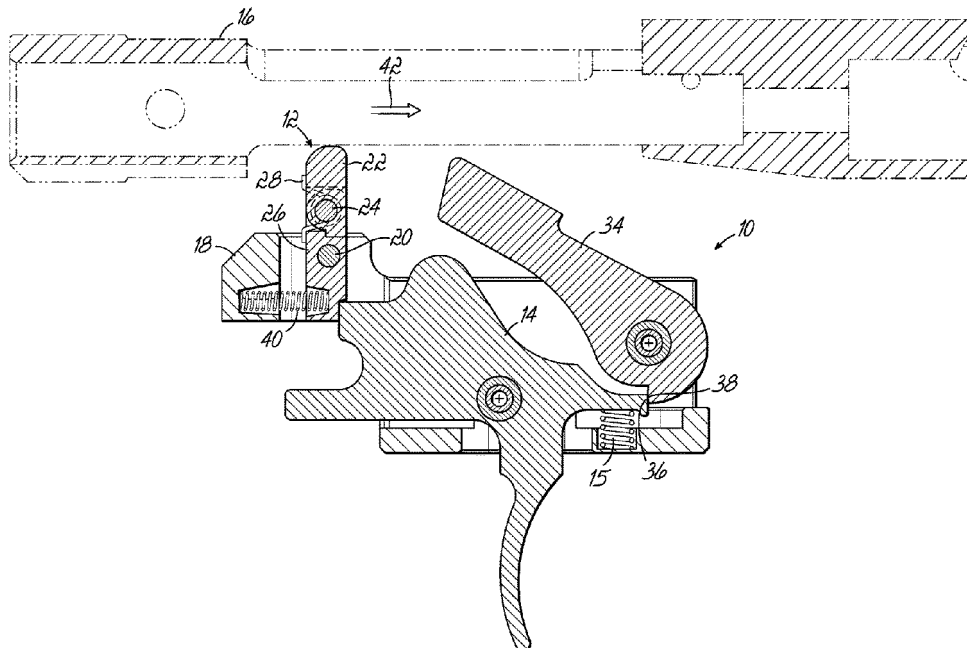
* cited by examiner

Primary Examiner — Michelle Clement(74) *Attorney, Agent, or Firm* — Wood Herron & Evans LLP

(57)

ABSTRACT

In a forced reset trigger mechanism, provided is an extended trigger member locking device having a locking member that is movable between a first position in which it locks a trigger member against pulling movement and a second position where it does not restrict movement of the trigger member. The locking member is configured to be movably supported by a frame and includes a generally upward extension portion configured to make actuating contact with a surface of a bolt carrier. The locking member has a body portion that is movably supported and an upward extension portion that is separately movable relative to the body portion between an extended position and a deflected position.

6 Claims, 5 Drawing Sheets**Exhibit B**

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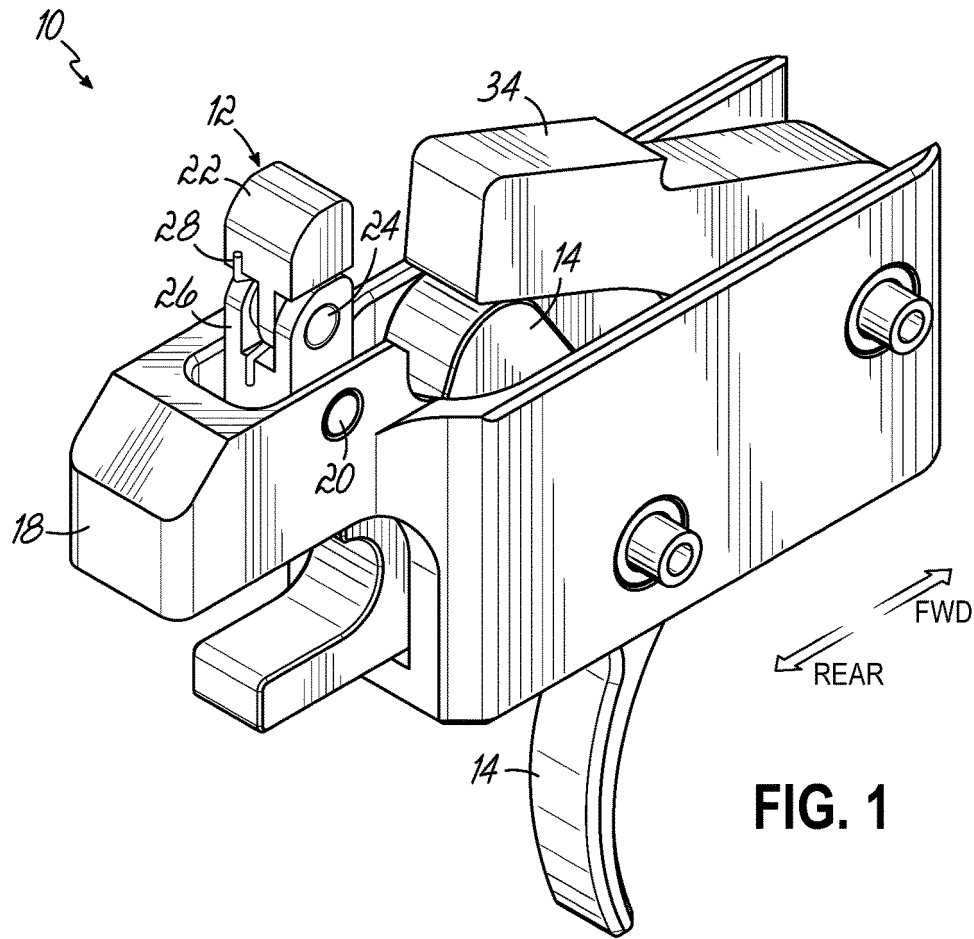


FIG. 1

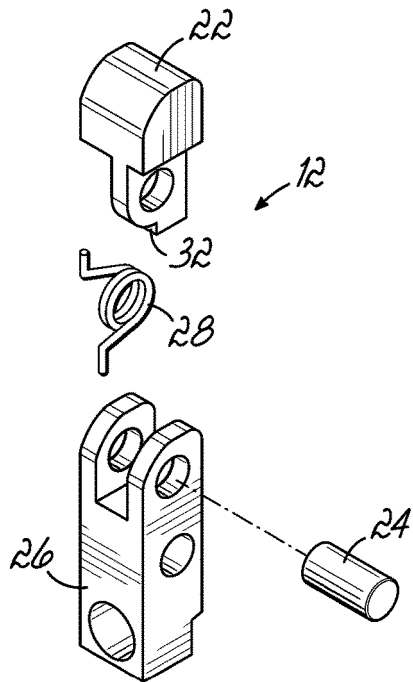


FIG. 2

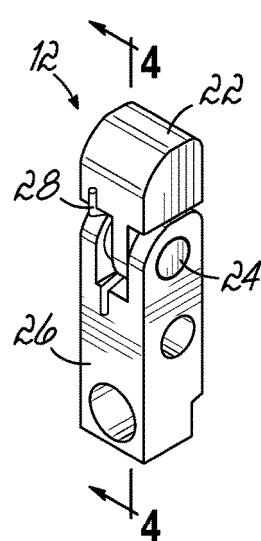


FIG. 3

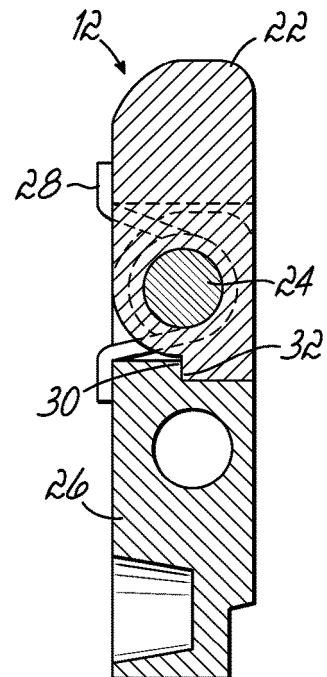
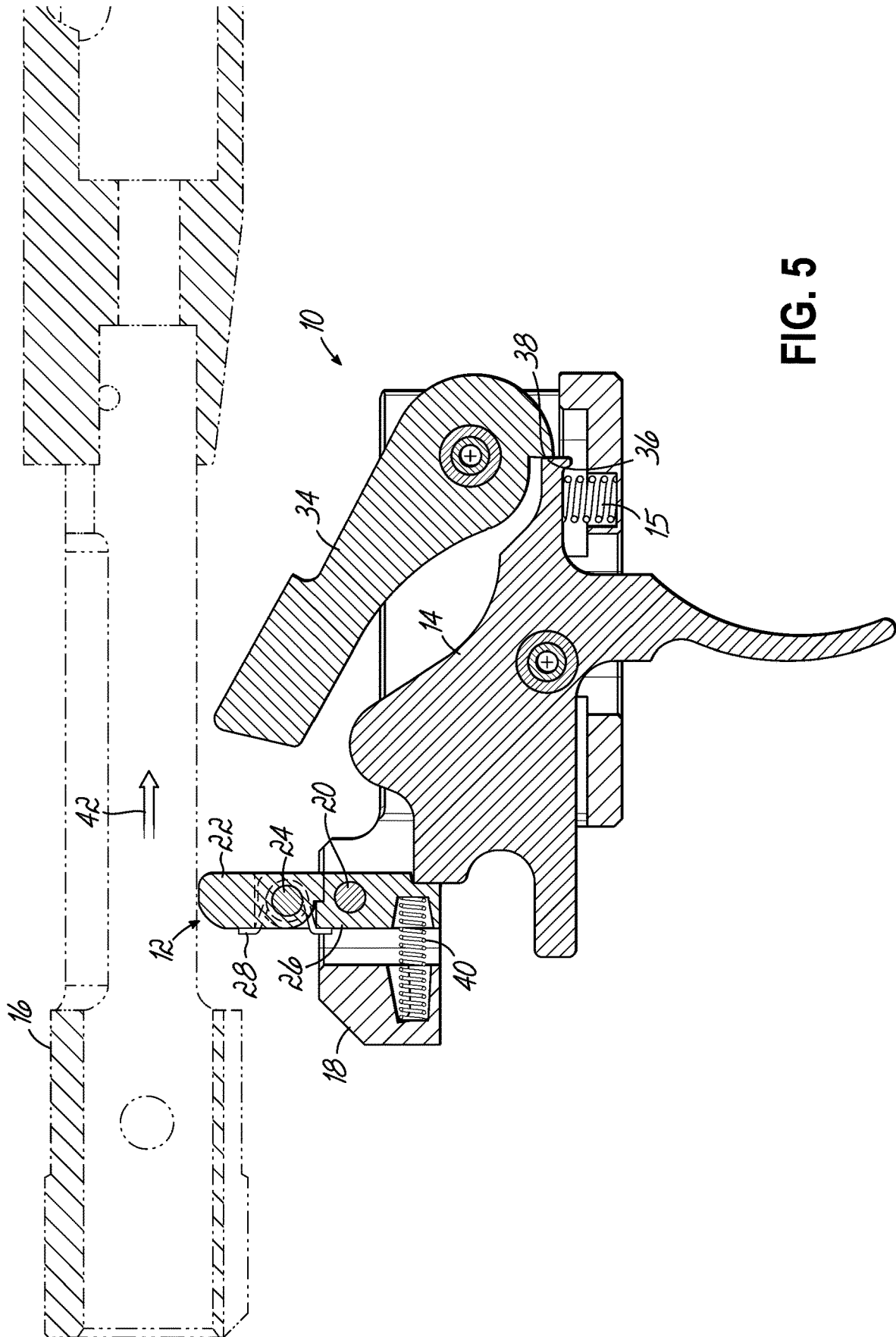
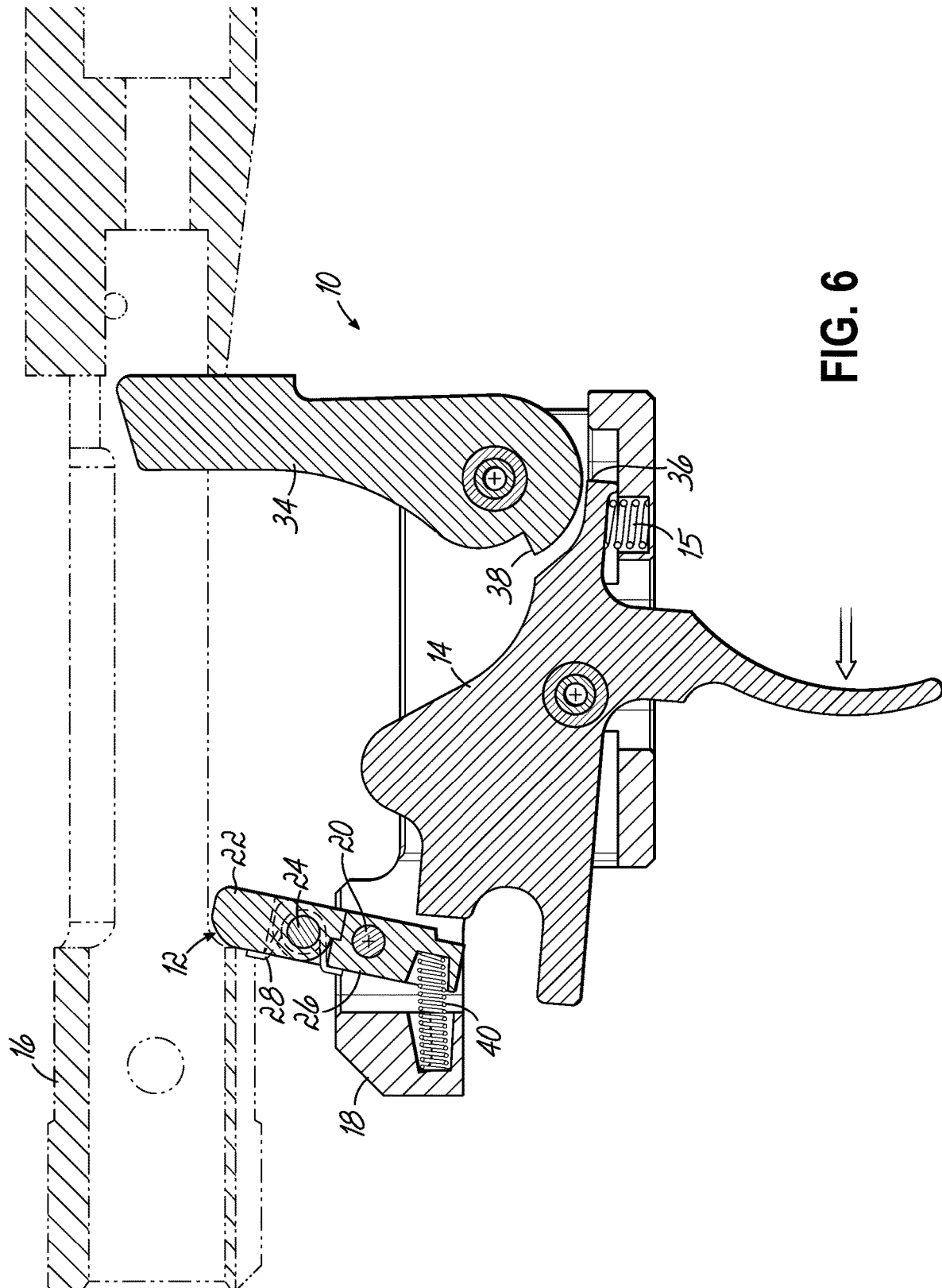
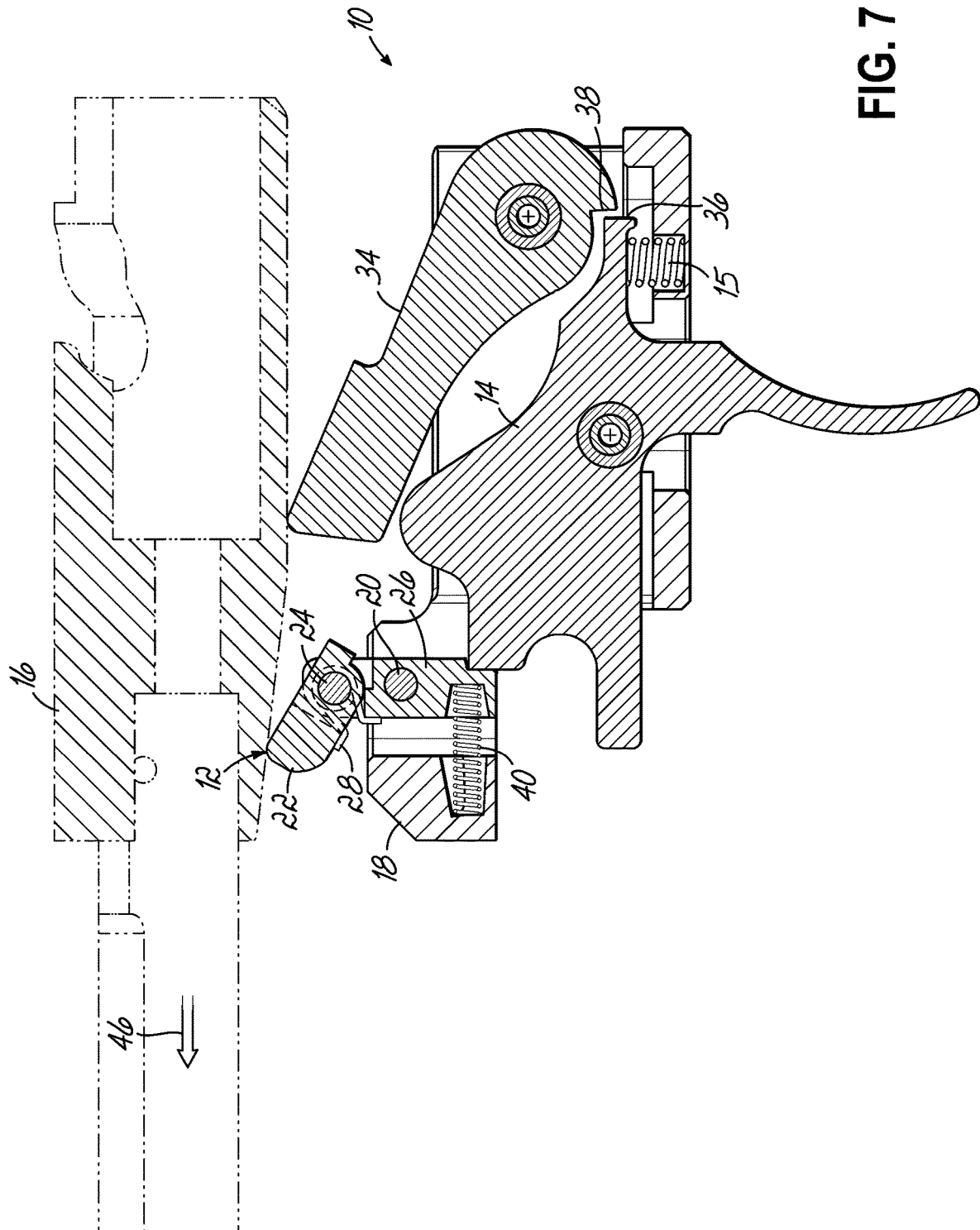


FIG. 4







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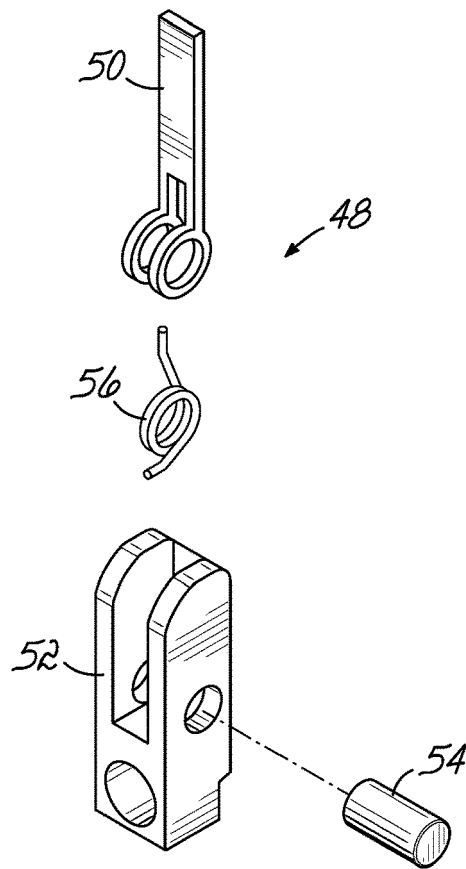


FIG. 8

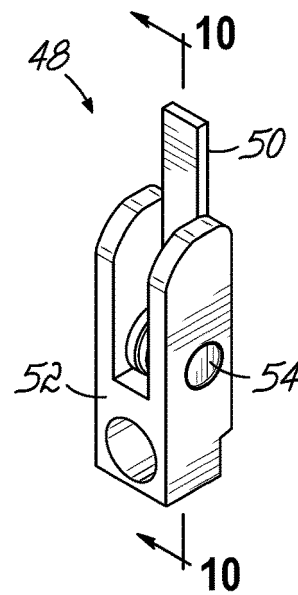


FIG. 9

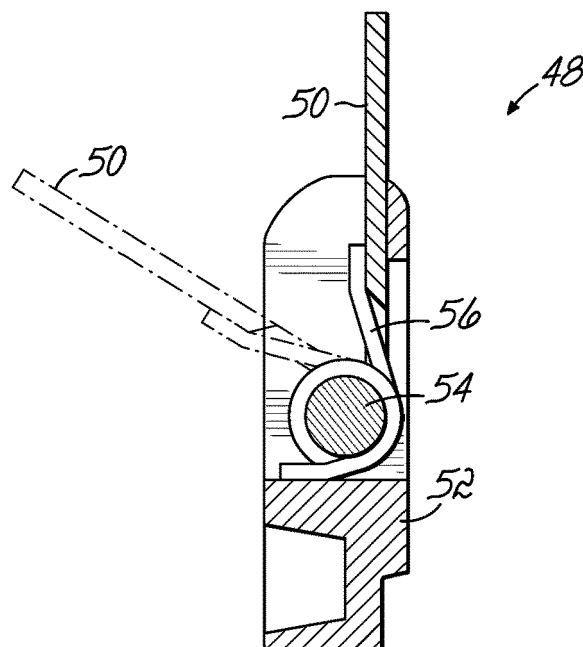


FIG. 10

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ADAPTED FORCED RESET TRIGGER**TECHNICAL FIELD**

This invention relates to a semiautomatic firearm trigger adapted for use in certain weapons platforms or calibers. In particular, it relates to a forced reset trigger assembly having a trigger locking member with a one-way folding capability to be actuated by forward movement of a bolt carrier assembly while allowing the bolt carrier to pass while cycling to the rear.

BACKGROUND

A forced reset semiautomatic trigger is described and shown in U.S. Pat. No. 10,514,223, issued Dec. 24, 2019, the contents of which are hereby incorporated herein in its entirety by this reference. Its structure and function are fully described therein. The embodiment illustrated in that patent is particularly adapted for use in an AR15-pattern firearm.

The AR10 firearm pattern is similar in design, concept, and function to the AR15, but fires the larger 7.62 mm NATO (.308 Winchester) caliber cartridge and some dimensional specifications are somewhat less standardized. The larger caliber requires certain parts to be scaled differently from the AR15 pattern, resulting, for example, in a different profile of the bolt carrier body and spacing relative to the lower receiver and trigger mechanism. In particular, the rear or tail portion of the AR10-pattern bolt carrier is positioned vertically further from the lower receiver and trigger assembly parts, while a forward portion of the AR10-pattern bolt carrier is situated lower.

The embodiment illustrated in U.S. Pat. No. 10,514,223 could be installed in an AR10-pattern lower receiver (because the assembly/pivot pin locations are substantially the same), but it would not be operable because the upward extension of the locking member (bar) would be too short to be contacted and actuated (to release the trigger member) by the rear/tail portion of the bolt carrier as it reaches the in-battery position. However, if the upward length/height of the locking member is extended sufficiently to be actuated, it would then interfere with a lower surface of a forward portion of the bolt carrier as it cycles rearward, again making the device inoperable.

SUMMARY OF THE INVENTION

The present invention provides a deflectable extension of the locking member that is actuated by forward movement of the bolt carrier, but deflects or folds to avoid interfering contact with the forward portion of the bolt carrier as the bolt carrier cycles to the rear.

In a forced reset trigger mechanism a trigger member locking device has a locking member that is movable between a first position in which it locks a trigger member against pulling movement and a second position where it does not restrict movement of the trigger member. The locking member is configured to be movably supported by a frame and includes a generally upward extension portion configured to make actuating contact with a surface of a bolt carrier. According to an aspect of the invention, the locking member has a body portion that is movably supported and an upward extension portion that is separately movable relative to the body portion between an extended position and a deflected position.

Two example embodiments are illustrated having a one-way hinge feature that causes the locking member to pivot

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in one direction when actuated by a rear portion of the bolt carrier as it returns to the in-battery position, and to give way (i.e., deflect or fold) without pivoting the remainder of the locking member when contacted by the forward portion of the bolt carrier as it cycles to the rear.

Other aspects, features, benefits, and advantages of the present invention will become apparent to a person of skill in the art from the detailed description of various embodiments with reference to the accompanying drawing figures, all of which comprise part of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

Like reference numerals are used to indicate like parts throughout the various drawing figures, wherein:

FIG. 1 is an isometric view of a trigger mechanism incorporating one embodiment of the present invention;

FIG. 2 is an exploded isometric view of the locking member according to this embodiment of the invention;

FIG. 3 is an assembled isometric view thereof;

FIG. 4 is a cross-sectional view taken substantially along line 4-4 of FIG. 3;

FIG. 5 is a side sectional view of a trigger mechanism with a locking member according to this embodiment of the invention and a bolt carrier, in phantom lines, showing the bolt carrier moving forward toward the in-battery position

FIG. 6 is a similar view showing the bolt carrier in an in-battery position with the blocking member displaced (actuated) by the bolt carrier, the trigger member pulled, and the hammer released;

FIG. 7 is a similar view showing the bolt carrier moving toward its rearward cycled position in which it has pivoted the hammer against the trigger member to force the trigger member to the reset position and the upper extension of the locking member is pivoted to allow passage of the bolt carrier without interference or affecting the locking status of the locking member;

FIG. 8 is an exploded isometric view of an alternative embodiment locking member;

FIG. 9 is an assembled view thereof; and

FIG. 10 is a side sectional view taken substantially along line 10-10 of FIG. 9, showing the displaced position of the hinged extension in phantom line.

DETAILED DESCRIPTION

With reference to the drawing figures, this section describes particular embodiments and their detailed construction and operation. Throughout the specification, reference to “one embodiment,” “an embodiment,” or “some embodiments” means that a particular described feature, structure, or characteristic may be included in at least one embodiment. Thus, appearances of the phrases “in one embodiment,” “in an embodiment,” or “in some embodiments” in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the described features, structures, and characteristics may be combined in any suitable manner in one or more embodiments. In view of the disclosure herein, those skilled in the art will recognize that the various embodiments can be practiced without one or more of the specific details or with other methods, components, materials, or the like. In some instances, well-known structures, materials, or operations are not shown or not described in detail to avoid obscuring aspects of the embodiments. “Forward” will indicate the direction of the muzzle and the direction in which projectiles are fired, while “rearward” will indicate the

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opposite direction. “Lateral” or “transverse” indicates a side-to-side direction generally perpendicular to the axis of the barrel. Although firearms may be used in any orientation, “left” and “right” will generally indicate the sides according to the user’s orientation, “top” or “up” will be the upward direction when the firearm is gripped in the ordinary manner.

Referring first to FIG. 1, therein is shown a forced reset semiautomatic trigger assembly 10 with a locking member 12 according to a first embodiment of the present invention. As described in the aforementioned U.S. Pat. No. 10,514, 223, the locking member (bar) 12 locks the trigger member 14 and prevents it from being pulled any time the bolt carrier assembly 16 is not in the substantially in-battery position. The bolt, firing pin, and other parts of the bolt carrier, the operation of which are well known to a person of ordinary skill in the art, are omitted from the illustrations for clarity. The trigger assembly can also include a trigger spring 15 that determines the pull force needed to pull the trigger member 14, but the force of the spring 15 may be insignificant in returning the trigger member 14 to the reset position relative to the force of the hammer 34. As used herein, “bolt,” “bolt carrier,” “bolt carrier body,” and/or “bolt carrier assembly” may be used interchangeably to refer to the part of the firearm action that reciprocates as the action cycles. The locking member 12 of the present invention includes a deflectable portion that moves to allow passage of the forward portion of the bolt carrier 16 as it cycles to the rear, which can include a hinging structure, as will be described in greater detail below.

The locking member 12 is supported to move (in this case, pivot, on a transverse axis) by the trigger housing 18. It may be carried, for example on a substantially transverse pivot pin 20, which allows the locking member 12, to pivot as a whole unit. Likewise, the locking member could be supported by a frame other than a trigger housing, such as a separate frame or the receiver of the firearm (not shown).

Referring now also to FIGS. 2-4, the locking member 12 acts as a pivot lever with lever arms extending substantially upwardly and downwardly from a substantially central pivot axis. The upper lever arm portion includes a foldable extension portion 22 that pivots on, for example a transverse pivot pin 24 relative to the locking bar body 26. A spring means is provided to maintain the foldable extension 22 in the extended position. The spring means may be a torsion spring 28, as illustrated, or may be some other type of spring, such as a leaf spring, etc. the extension portion 22 could be made from a resilient material configured to deflectably bend in one direction while retaining rigidity in an opposite direction.

As best indicated in FIG. 4, the locking member body 26 and foldable extension 22 may include corresponding abutment surfaces 30, 32 configured to limit the movement of the foldable extension 22 in one direction. Thus, force applied from a rearward direction toward the front to the foldable extension 22 causes the entire locking member 12 to pivot on the pivot pin 20 relative to the housing 18. Rearward force applied to the foldable extension 22 from the front toward the rear causes the foldable extension 22 to fold on the pivot pin 24 and allow the bolt carrier 16 to pass without causing pivotal movement of the locking member body 26.

Referring now to FIG. 5, therein is shown in a sectional side view the relative positions of the trigger assembly 10 and bolt carrier body 16. As shown in FIG. 5, the hammer 34 has been reset by prior rearward reciprocating movement of the bolt carrier 16. The pivotal reset of the hammer 34 has forced the trigger member 14 to its reset position, at which the sear 36 engages and holds the sear notch 38 of the

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hammer 34. Likewise in this position, the locking member 12 is biased to the locked position by a spring 40 and prevents the trigger member 14 from being pulled by the user. This function is described in the aforementioned U.S. Pat. No. 10,514,223. As depicted by arrow 42 in FIG. 5, the bolt carrier 16 is reciprocating forwardly toward the in-battery position.

Referring now to FIG. 6, therein the bolt carrier 16 has returned to the substantially in-battery position, contacting the deflectable extension portion 22 of the locking member 12 from the rear and causing the locking bar 12 to deflect (e.g., pivot) as a whole about transverse pivot pin 20 against the bias of the spring 40. As understood by a person of ordinary skill in the art, the bolt carrier 16 first contacts the locking member 12 before it reaches the fully in-battery position and then continues to travel forward the remaining distance as it moved the locking member 12 from one position to another. In this position, the locking member 12 has released the trigger member 14, allowing the user to pull the trigger member 14 (see arrow 44), releasing the hammer 34, and allowing it to be spring biased into contact with the firing pin (not shown).

Referring now to FIG. 7, therein is shown the trigger assembly 10 with the hammer 34 and trigger member 14 forced to the reset position in which the sear 36 is engaged with the sear notch 38. As the bolt carrier 16 reciprocates to the rear (arrow 44 in FIG. 7), a lower side surface of the bolt carrier 16 contacts the foldable extension portion 22, causing it to pivot toward the rear on the pivot pin 24 and against the bias of the spring 28 without displacing the locking bar body 26 or affecting its locking of the trigger member 14. In this manner, the locking member 12 can be of sufficient of upward extension length to be engaged by the bolt carrier 14 when it reaches its substantially in-battery position (FIG. 6), while allowing rearward reciprocation of the bolt carrier 16 without causing damage to the locking member 12 or inducing an interference malfunction.

Referring now to FIGS. 8-10, therein is shown a locking member 48 according to an alternate embodiment of the present invention. According to this embodiment, a foldable extension portion 50 is pivotable in one direction relative to the locking bar body 52 and both parts 50, 52 pivot along a single substantially transverse pivot axis provided by pivot pin 54. Again, the foldable extension portion 50 may be biased toward the extended position by a spring 56 and, as shown in FIG. 10, the hinging movement of the foldable extension portion is operable separate from the locking bar body 52 in a rearward direction but engages an abutment surface 58 for unitary movement when the foldable extension portion 50 is actuated toward a forward direction.

The deflectable extension portion 22, 50 of any embodiment can include a feature to reduce contact friction as the bolt carrier 16 slides rearwardly over it. For example, the contact surface would include a coating or treatment, it would include a friction-reducing material, such as ultra-high-molecular-weight (UHMW) polyurethane, or could include a rolling member, like a wheel.

The present invention can be adapted to other embodiments. For example, it can be adapted to sliding locking member, such as that shown in U.S. Pat. No. 11,346,627, issued May 31, 2022. A sliding locking member (not shown) can include an upward extension that is engaged by the bolt carrier 16 to slide the locking member to the unlocked position, but that also is deflectable to allow passage of the retracting forward portion of the bolt carrier 16.

While one or more embodiments of the present invention have been described in detail, it should be apparent that

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modifications and variations thereto are possible, all of which fall within the true spirit and scope of the invention. Therefore, the foregoing is intended only to be illustrative of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not intended to limit the invention to the exact construction and operation shown and described. Accordingly, all suitable modifications and equivalents may be included and considered to fall within the scope of the invention, defined by the following claim or claims.

What is claimed is:

1. In a forced rest trigger mechanism, an extended trigger member locking device, comprising:

a locking member that is movable between a first position in which it locks a trigger member against pulling movement and a second position where it does not restrict movement of the trigger member, the locking member configured to be movably supported by a frame and including a generally upward extension portion configured to make actuating contact with a

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surface of a bolt carrier, such actuating contact causing the locking member to move from the first position to the second position, the locking member having a body portion that is movably supported and an upwardly extending deflectable portion that is separately movable relative to the body portion between an extended position and a deflected position.

2. The device of claim 1, wherein the locking member is supported by a trigger housing.

3. The device of claim 1, wherein the locking member body portion pivots between the first and second positions.

4. The device of claim 1, wherein the locking member deflectable portion pivots relative to the body portion.

5. The device of claim 3, wherein the locking member deflectable portion pivots relative to the body portion on a pivot axis coaxial with that of the body portion.

6. The device of claim 1, wherein the locking member deflectable portion is spring biased toward the extended position.

* * * * *

EXHIBIT C

(12) **United States Patent
Smith**

(10) **Patent No.: US 12,529,538 B2**
(45) **Date of Patent: Jan. 20, 2026**

(54) **SAFETY MECHANISM FOR FIREARM**

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(73) Assignee: **ABC IP, LLC**, Dover, DE (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(21) Appl. No.: **18/968,984**

(22) Filed: **Dec. 4, 2024**

(65) **Prior Publication Data**

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Related U.S. Application Data

(60) Provisional application No. 63/605,793, filed on Dec. 4, 2023.

(51) **Int. Cl.**
F41A 17/46 (2006.01)

(52) **U.S. Cl.**
CPC **F41A 17/46** (2013.01)

(58) **Field of Classification Search**
CPC F41A 17/46; F41A 19/02; F41A 19/10
USPC 42/70.06; 89/142, 132
See application file for complete search history.

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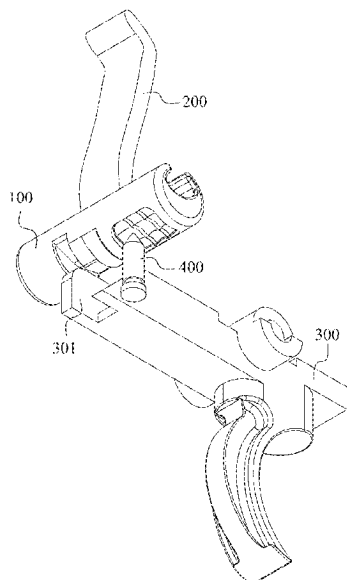
Primary Examiner — Reginald S Tillman, Jr.

(74) *Attorney, Agent, or Firm* — Wood Herron & Evans LLP

(57) **ABSTRACT**

A safety mechanism for a firearm includes a cam selector, a lever, and a trigger. The cam selector comprises a first end, a second end, a top side, and a bottom side. The cam selector comprises a longitudinal slot positioned on the top side of the cam selector. The lever comprises a proximal end and a distal end. The longitudinal slot is configured to receive the lever. The cam selector further comprises a first recess and a second recess on the bottom side of the cam selector. The trigger comprises a first trigger tail portion. In addition to the standard semi-automatic and safe modes, the present invention provides an additional active reset mode in which the cam selector is configured to allow the first trigger tail portion to engage the second recess and be moved down by a cam portion of the second recess when the cam selector rotates.

13 Claims, 15 Drawing Sheets



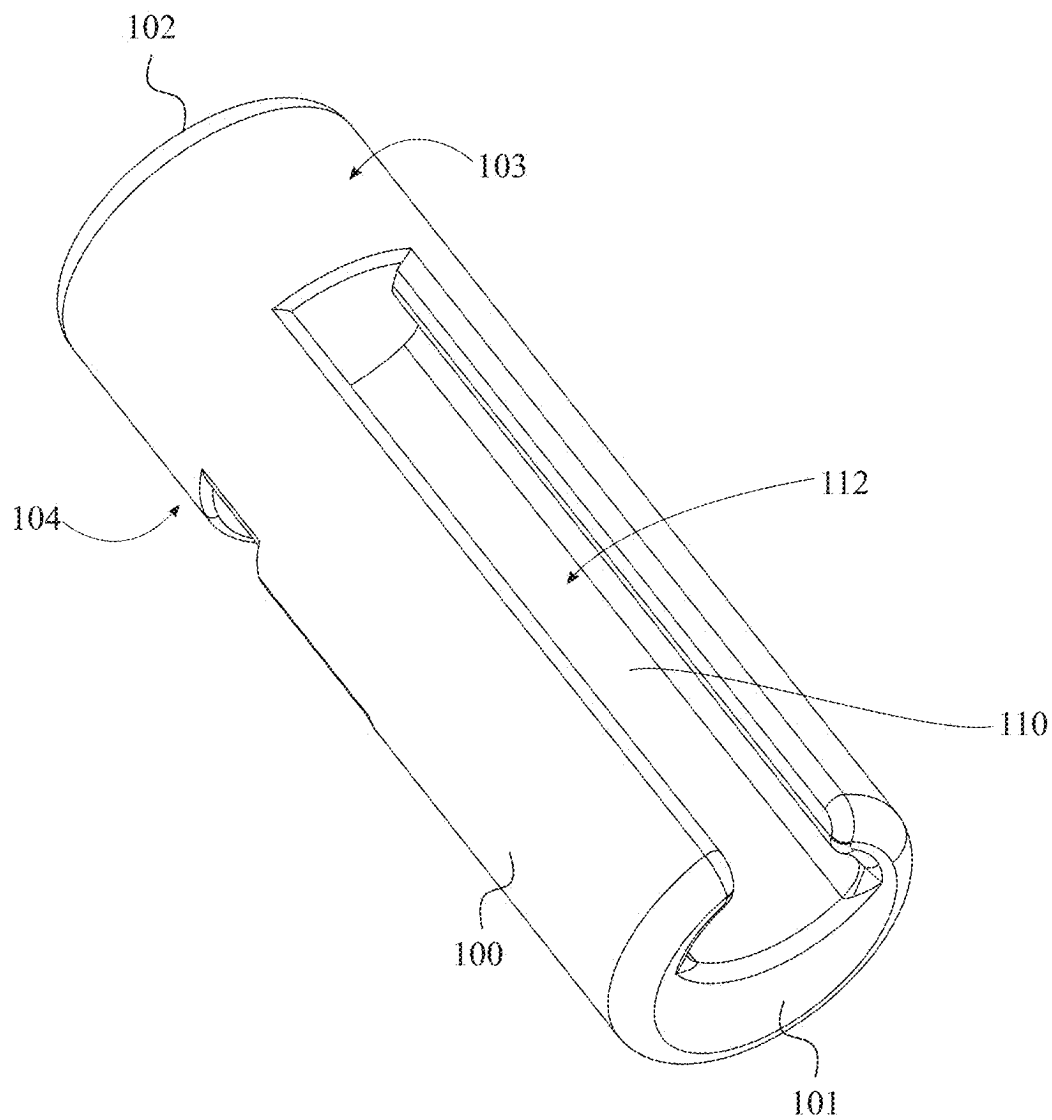


FIG. 1

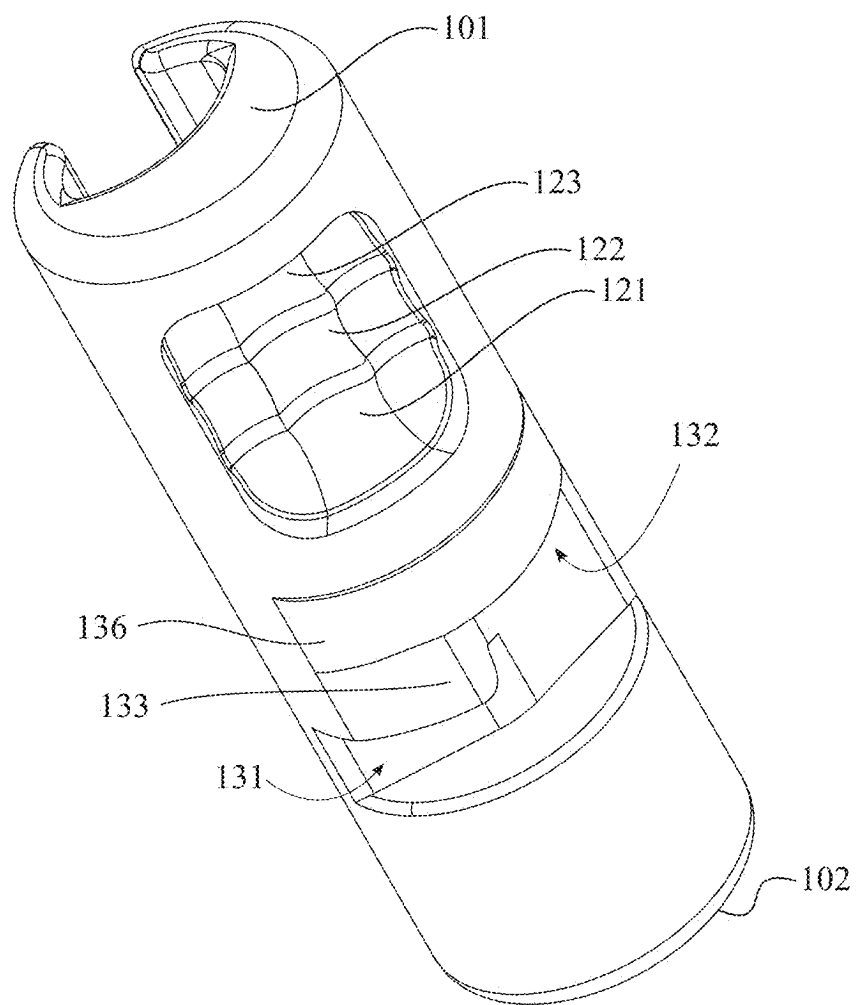


FIG. 2

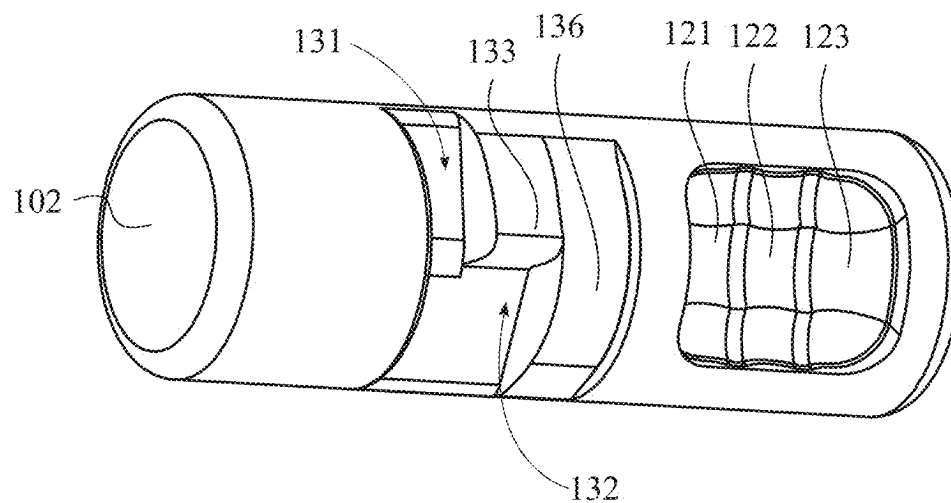


FIG. 3

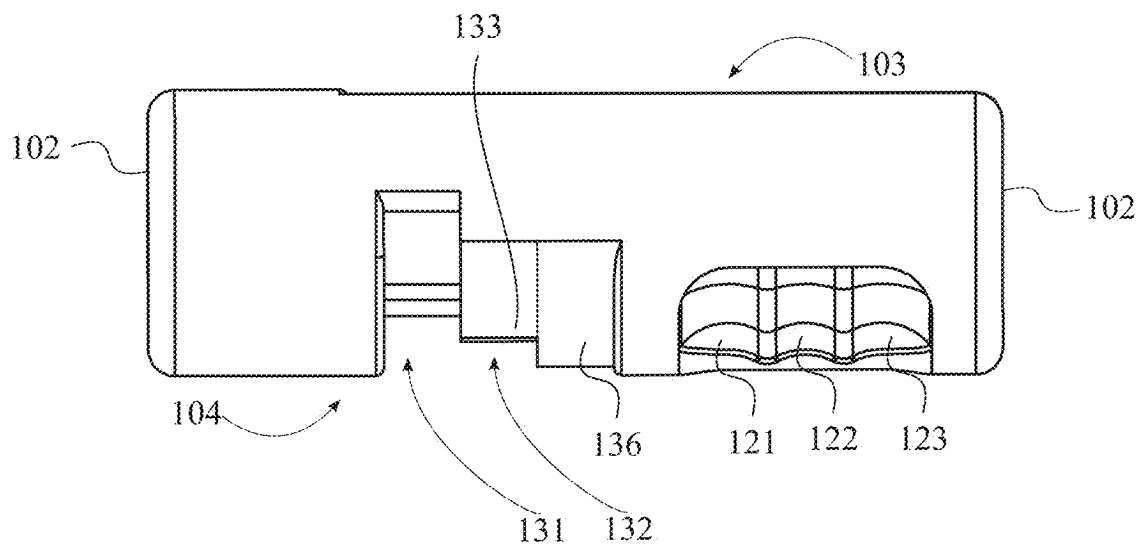


FIG. 4

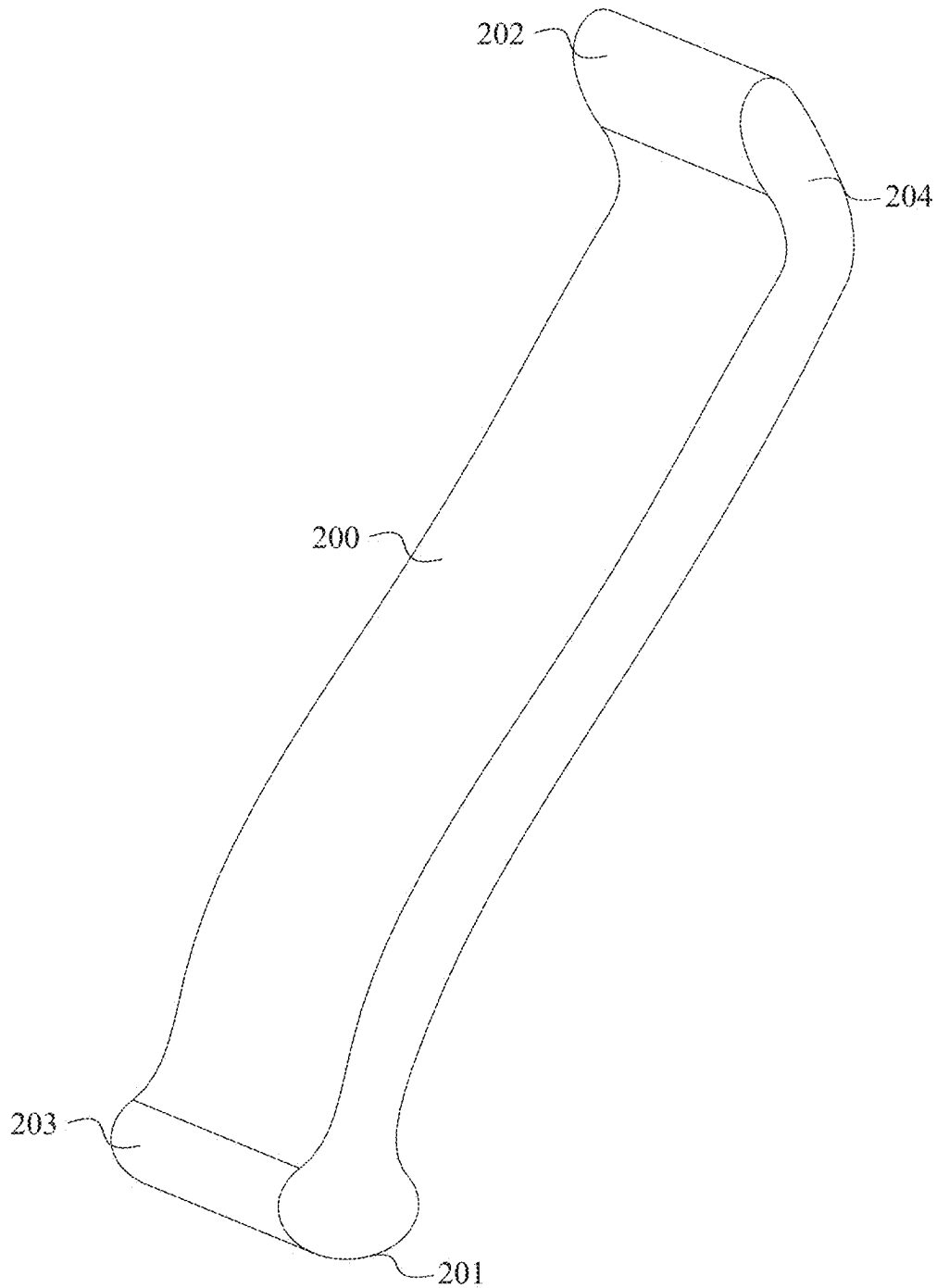


FIG. 5

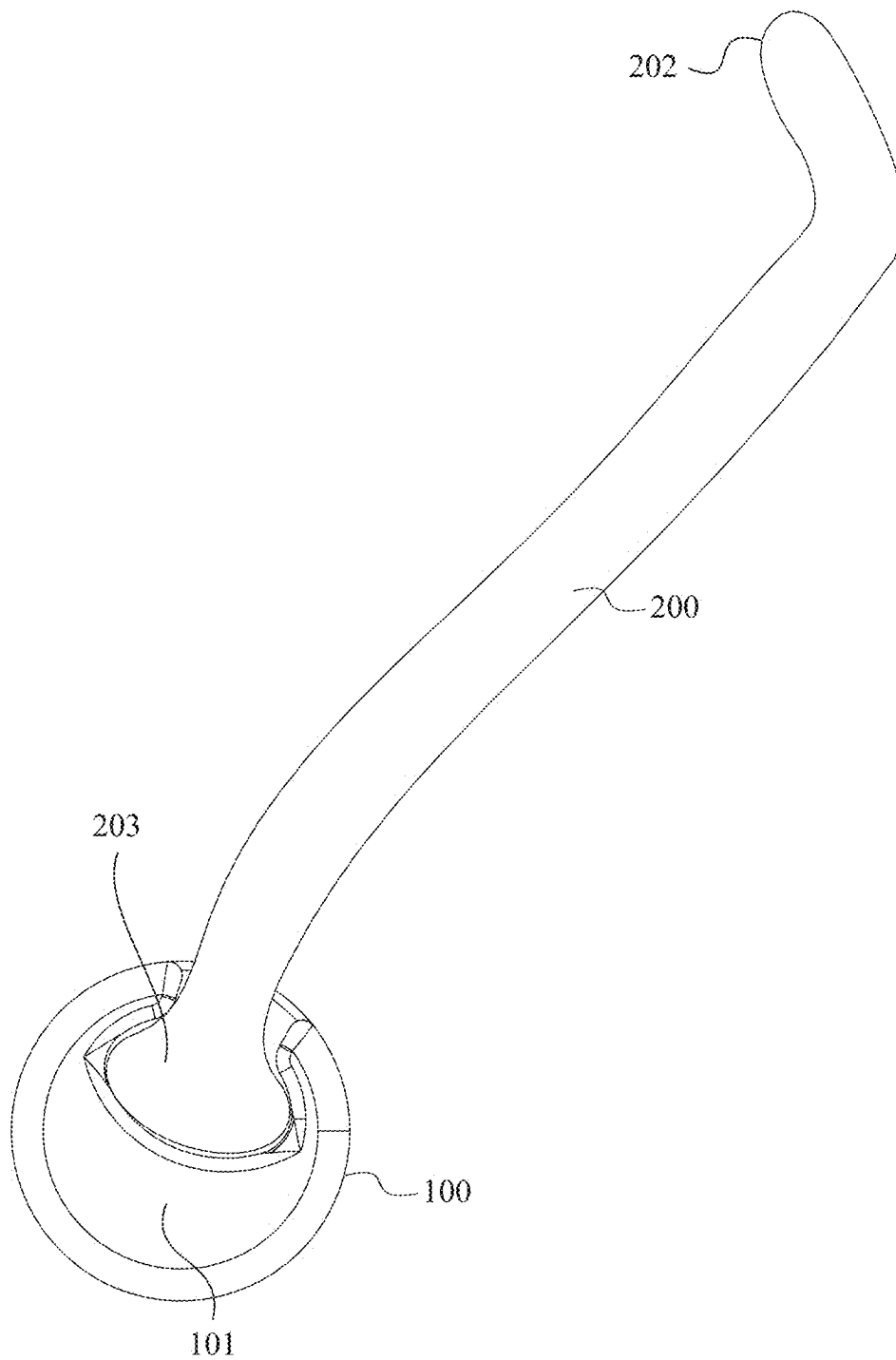


FIG. 6

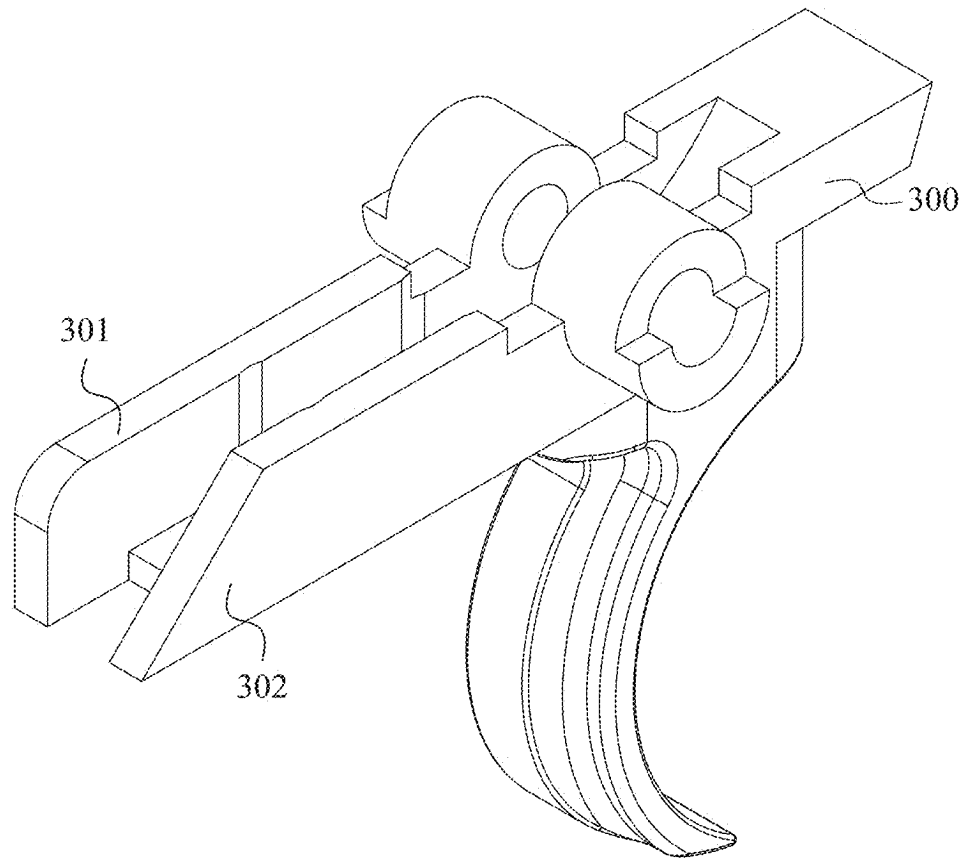


FIG. 7

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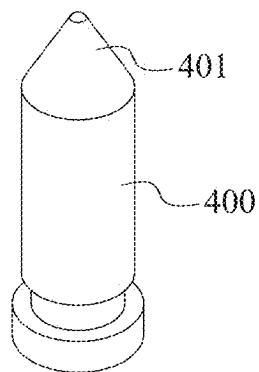


FIG. 8

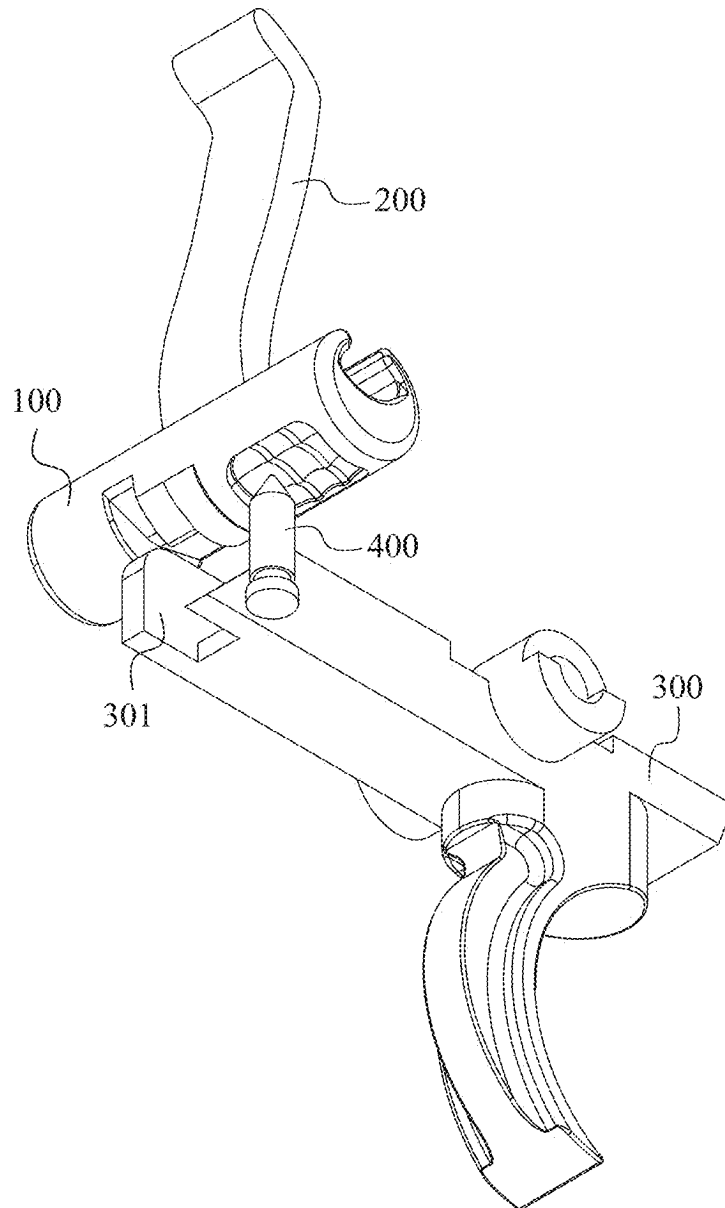


FIG. 9

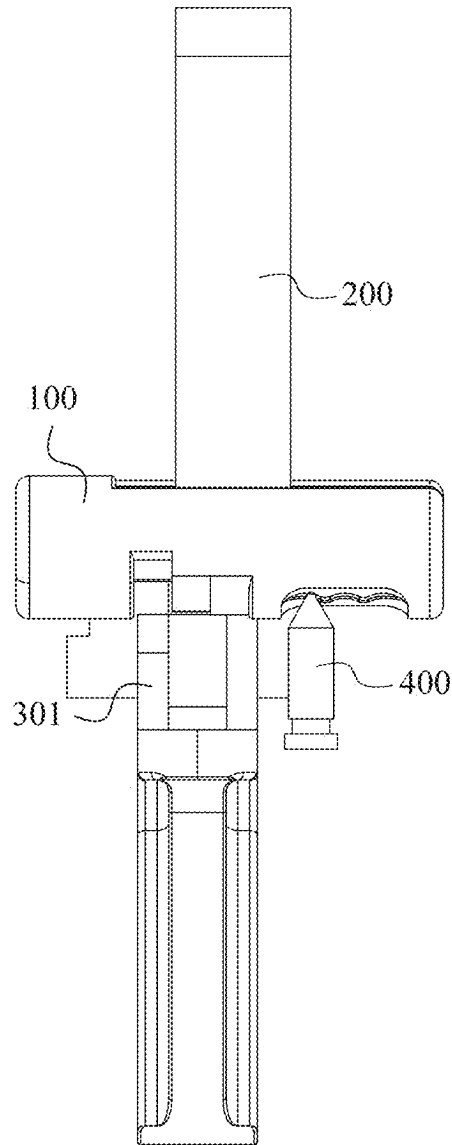


FIG. 10

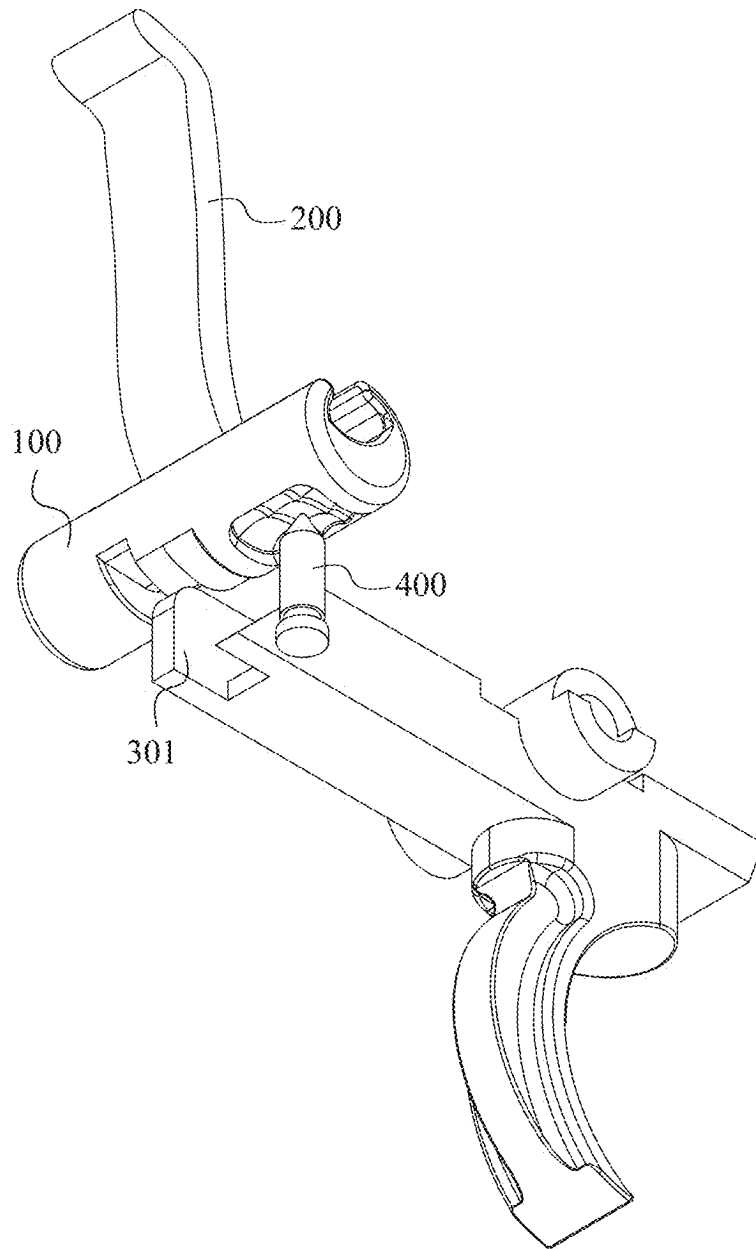


FIG. 11

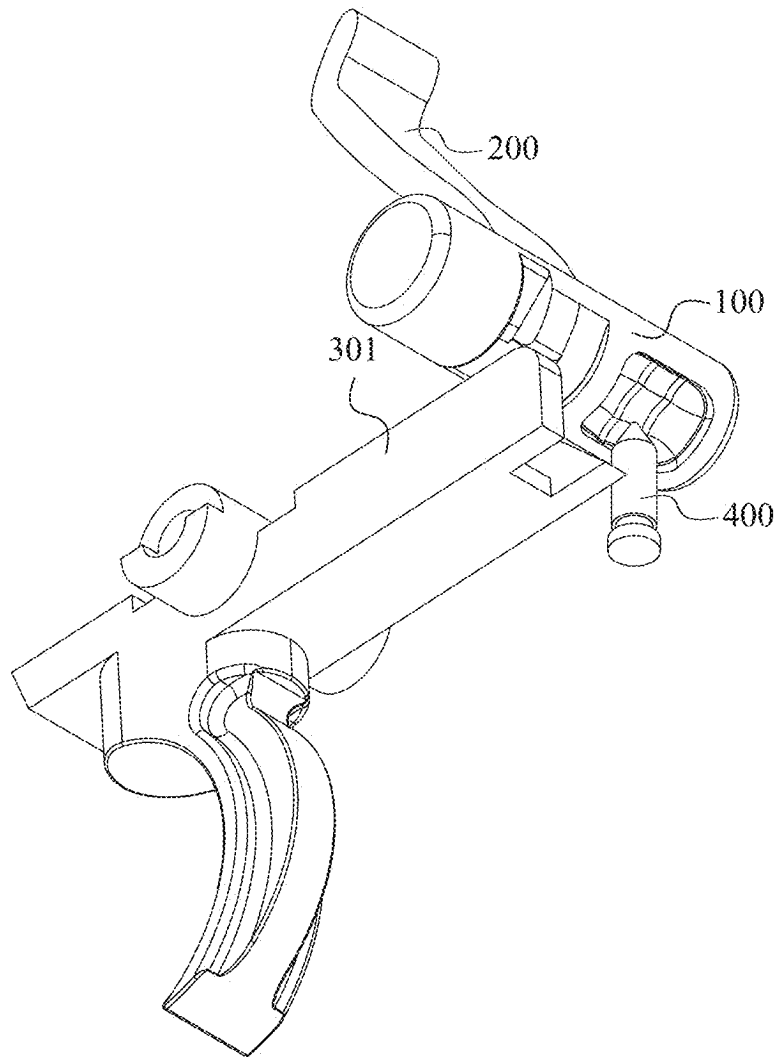


FIG. 12

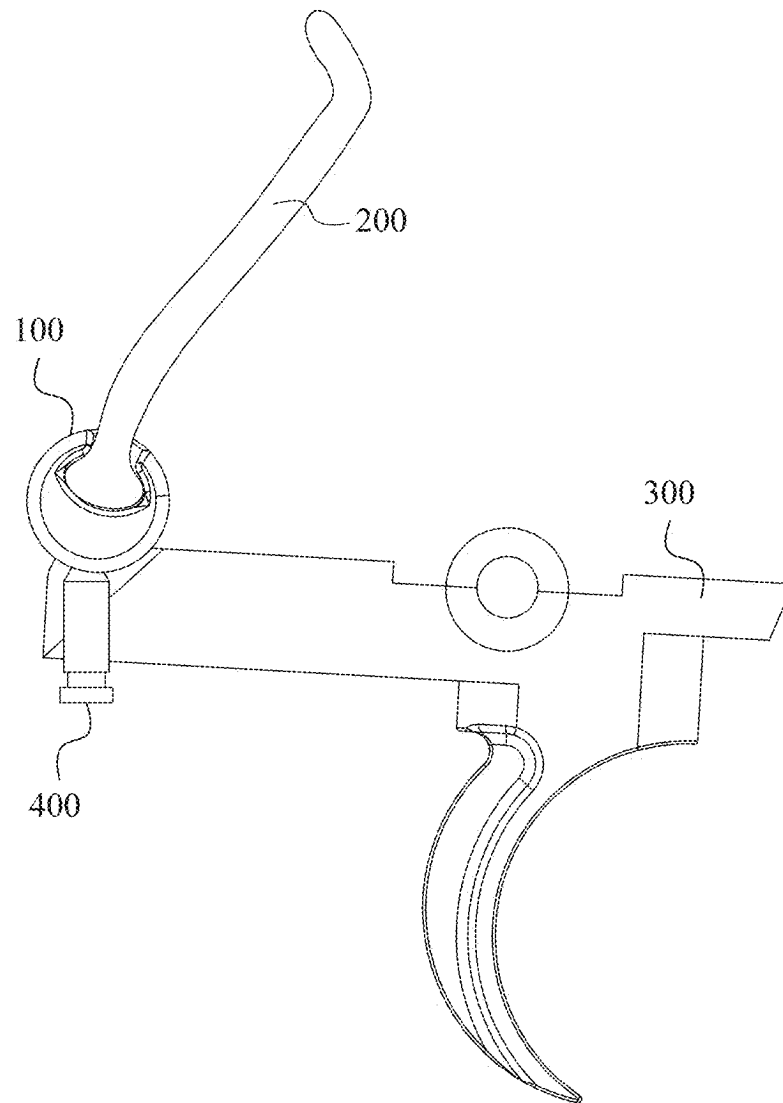


FIG. 13

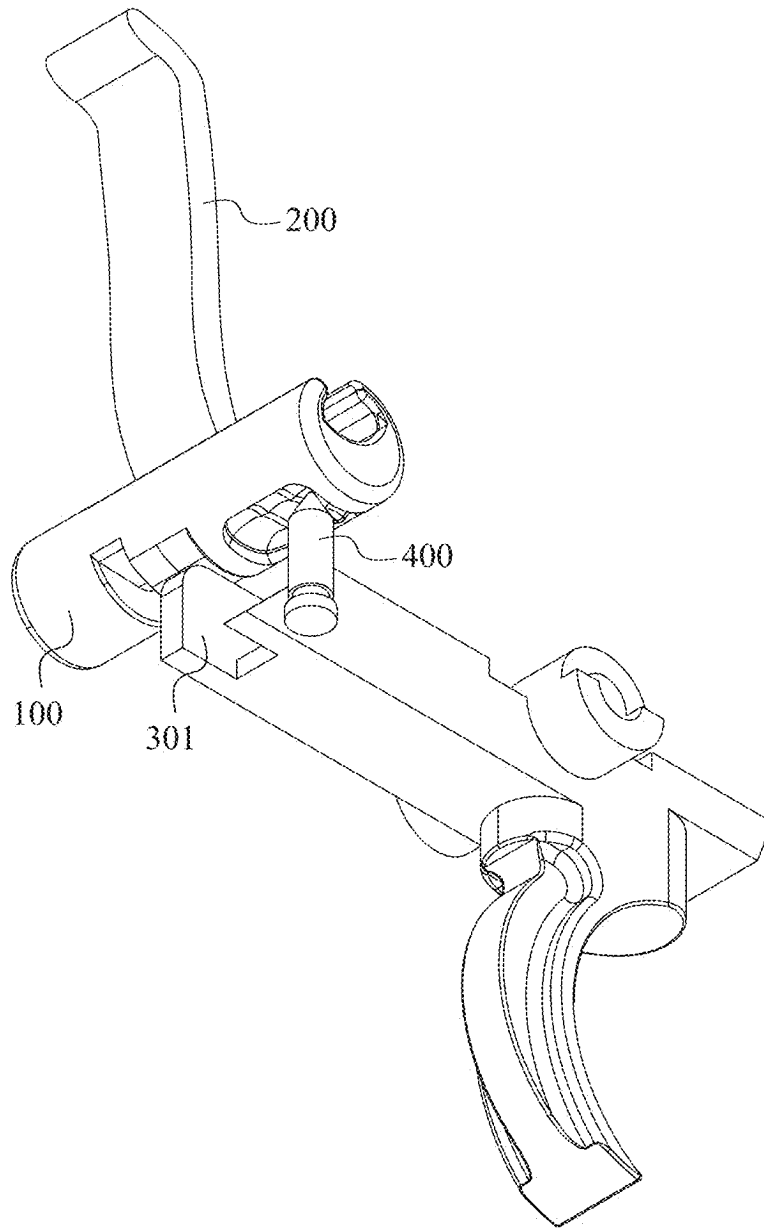


FIG. 14

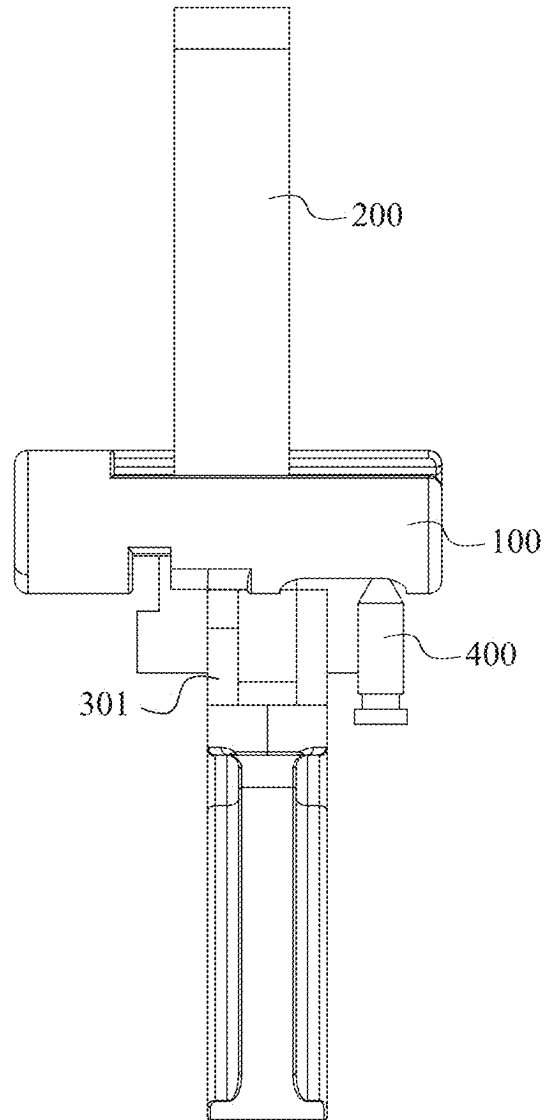


FIG. 15

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SAFETY MECHANISM FOR FIREARM**FIELD OF THE INVENTION**

The present invention relates generally to a safety selector mechanism. More specifically, the present invention is a safety selector mechanism suitable for semi-auto firearms and rifles.

BACKGROUND OF THE INVENTION

A firearm safety catch encompasses various safety mechanisms integral to responsible gun design, aimed at preventing accidental discharges and ensuring overall safety. One common type is the manual safety switch, typically located near the trigger or on the firearm's frame, which physically obstructs the firing mechanism when engaged. Trigger safety, integrated directly into the trigger, requires a specific action for the trigger to move, preventing unintentional pulls. A grip safety, found in certain handguns, necessitates depression by the shooter's hand for the firearm to fire. Other safety features include a drop safety or firing pin block to prevent accidental discharges if the firearm is dropped, and a magazine disconnect safety that inhibits firing when the magazine is removed. These safety catches collectively contribute to responsible firearm handling, and users are encouraged to familiarize themselves with these features, adhering to proper procedures to ensure safe gun ownership.

SUMMARY OF THE INVENTION

The present invention discloses a safety mechanism for a firearm. It comprises a cam selector, a lever, and a trigger. The cam selector comprises a first end, a second end, a top side, and a bottom side. The cam selector comprises a longitudinal slot positioned on the top side of the cam selector. The lever comprises a proximal end and a distal end. The longitudinal slot is configured to receive the proximal end of the lever. The cam selector further comprises a first recess and a second recess on the bottom side of the cam selector. The trigger comprises a first trigger tail portion. The cam selector is configured to operate between a first mode, a second mode, and a third mode. The first mode of the cam selector is configured to allow the first trigger tail portion to be movable within the first recess. The second mode of the cam selector is configured to allow the first trigger tail portion to engage the second recess and be moved down by a cam portion of the second recess when the cam selector rotates. The third mode of the cam selector is configured to prevent the trigger from being pulled.

In one embodiment, the cam selector has a substantially cylindrical shape.

In one embodiment, the present invention further comprises a detent. The cam selector further comprises a first detent track, a second detent track and a third detent track. The detent is configured to move between the first detent track, the second detent track and the third detent track to select between the first mode, the second mode, and the third mode of the cam selector.

In one embodiment, the first detent track, the second detent track, and the third detent track are configured to allow the detent to move along the first detent track, the second detent track, and the third detent track, respectively.

In one embodiment, the first detent track, the second detent track, and the third detent track are transverse grooves on the bottom side of the cam selector.

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In one embodiment, the first detent track, the second detent track and the third detent track are positioned adjacent to the first end of the cam selector.

In one embodiment, the detent comprises a rounded top end.

In one embodiment, the longitudinal slot extends from the first end of the cam selector.

In one embodiment, the longitudinal slot is ovalar shaped and comprises an opening to allow the lever to travel through.

In one embodiment, the lever comprises a dovetail portion at the proximal end.

In one embodiment, the lever further comprises a bent portion adjacent to the distal end.

In one embodiment, the first trigger tail portion of the trigger is rounded.

In one embodiment, the trigger further comprises a second trigger tail portion that has a corner cutout.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention are incorporated in and constitute a part of this specification, illustrate an embodiment of the invention and together with the description serve to explain the principles of the invention. They are meant to be exemplary illustrations provided to enable persons skilled in the art to practice the disclosure and are not intended to limit the scope of the present invention. That is, the dimensions of the components of the present invention, independently and in relation to each other can be different. It should be noted that the drawings are schematic and not necessarily drawn to scale. Some drawings are enlarged or reduced to improve drawing legibility.

FIG. 1 depicts a top perspective view of a cam selector of the present invention.

FIG. 2 depicts a bottom perspective view of the cam selector of the present invention.

FIG. 3 depicts another bottom perspective view of the cam selector of the present invention.

FIG. 4 depicts another perspective view of the cam selector of the present invention.

FIG. 5 depicts a perspective view of a lever of the present invention.

FIG. 6 depicts a left-side view of the cam and lever assembled together.

FIG. 7 depicts a perspective view of a trigger of the present invention.

FIG. 8 depicts a perspective view of a detent of the present invention.

FIG. 9 depicts a perspective view of the present invention in its semi-automatic position.

FIG. 10 depicts a rear view of the present invention in its semi-automatic position.

FIG. 11 depicts a perspective view of the present invention in its active reset position.

FIG. 12 depicts a perspective view of the present invention in its active reset position, wherein the trigger is pulled.

FIG. 13 depicts a side view of the present invention in its active reset position, wherein the trigger is pulled.

FIG. 14 depicts a perspective view of the present invention in its safe position.

FIG. 15 depicts a rear view of the present invention in its safe position.

DETAIL DESCRIPTIONS OF THE INVENTION

As a preliminary matter, it will readily be understood by one having ordinary skill in the relevant art that the present

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disclosure has broad utility and application. As should be understood, any embodiment may incorporate only one or a plurality of the above-disclosed aspects of the disclosure and may further incorporate only one or a plurality of the above-disclosed features. Furthermore, any embodiment discussed and identified as being “preferred” is considered to be part of a best mode contemplated for carrying out the embodiments of the present disclosure. Other embodiments also may be discussed for additional illustrative purposes in providing a full and enabling disclosure. Moreover, many embodiments, such as adaptations, variations, modifications, and equivalent arrangements, will be implicitly disclosed by the embodiments described herein and fall within the scope of the present disclosure.

Accordingly, while embodiments are described herein in detail in relation to one or more embodiments, it is to be understood that this disclosure is illustrative and exemplary of the present disclosure and is made merely for the purposes of providing a full and enabling disclosure. The detailed disclosure herein of one or more embodiments is not intended, nor is to be construed, to limit the scope of patent protection afforded in any claim of a patent issuing here from, which scope is to be defined by the claims and the equivalents thereof. It is not intended that the scope of patent protection be defined by reading into any claim a limitation found herein that does not explicitly appear in the claim itself. Accordingly, it is intended that the scope of patent protection is to be defined by the issued claim(s) rather than the description set forth herein.

Additionally, it is important to note that each term used herein refers to that which an ordinary artisan would understand such term to mean based on the contextual use of such term herein. When not explicitly defined herein, to the extent that the meaning of a term used herein—as understood by the ordinary artisan based on the contextual use of such term—differs in any way from any particular dictionary definition of such term, it is intended that the meaning of the term as understood by the ordinary artisan should prevail.

Furthermore, it is important to note that, as used herein, “a” and “an” each generally denotes “at least one,” but does not exclude a plurality unless the contextual use dictates otherwise. When used herein to join a list of items, “or” denotes “at least one of the items,” but does not exclude a plurality of items of the list. Finally, when used herein to join a list of items, “and” denotes “all of the items of the list.”

The following detailed description refers to the accompanying drawings. Wherever possible, the same reference numbers are used in the drawings and the following description to refer to the same or similar elements. While many embodiments of the disclosure may be described, modifications, adaptations, and other implementations are possible. For example, substitutions, additions, or modifications may be made to the elements illustrated in the drawings, and the methods described herein may be modified by substituting, reordering, or adding stages to the disclosed methods. Accordingly, the following detailed description does not limit the disclosure. Instead, the proper scope of the disclosure is defined by the appended claims. The present disclosure contains headers. It should be understood that these headers are used as references and are not to be construed as limiting upon the subject matter disclosed under the header.

Other technical advantages may become readily apparent to one of ordinary skill in the art after review of the following figures and description. It should be understood at the outset that, although exemplary embodiments are illustrated in the figures and described below, the principles of the present disclosure may be implemented using any num-

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ber of techniques, whether currently known or not. The present disclosure should in no way be limited to the exemplary implementations and techniques illustrated in the drawings and described below.

Unless otherwise indicated, the drawings are intended to be read together with the specification and are to be considered a portion of the entire written description of this invention. As used in the following description, the terms “horizontal”, “vertical”, “left”, “right”, “up”, “down” and the like, as well as adjectival and adverbial derivatives thereof (e.g., “horizontally”, “rightwardly”, “upwardly”, “radially”, etc.), simply refer to the orientation of the illustrated structure as the particular drawing figure faces the reader. Similarly, the terms “inwardly”, “outwardly” and “radially” generally refer to the orientation of a surface relative to its axis of elongation, or axis of rotation, as appropriate. As used herein, the term “proximate” refers to positions that are situated close/near in relationship to a structure. As used in the following description, the term “distal” refers to positions that are situated away from positions.

The present disclosure includes many aspects and features. Moreover, while many aspects and features relate to, and are described in the context of safety mechanisms for a firearm, embodiments of the present disclosure are not limited to use only in this context.

The present invention is a safety mechanism for a firearm, in particular an AR-15. It is an aim of the present invention to turn a standard AR-15 into a three-position fire control unit (i.e., semi-automatic, active reset and safe positions). It is another aim of the present invention to provide a safety mechanism that can rotate within the firearm to engage various firing modes.

Referring now to the figures of the present disclosure. The safety mechanism of the present invention comprises a cam selector **100**, a lever **200**, and a trigger **300**.

The cam selector **100** of the present invention is designed to replace a standard safety selector in the firearm. It should be noted that the cam selector **100** can be of any shape, size, material, features, type or kind, orientation, location, quantity, components, and arrangements of components that would allow the present invention to fulfill the objectives and intents of the present invention. In one embodiment, the cam selector **100** comprises a first end **101**, a second end **102**, a top side **103**, and a bottom side **104**. Preferably, the cam selector **100** has a substantially cylindrical shape. It should be noted that the cam selector **100** may be made of any suitable material but is preferably made of stainless steel. The cam selector **100** comprises a longitudinal slot **110** positioned on the top side of the cam selector **100**. The longitudinal slot **110** is configured to receive a proximal end **201** of the lever **200**. In one embodiment, the longitudinal slot **110** extends from the first end **101** of the cam selector **100**. Preferably, the longitudinal slot **110** is oval shaped and comprises an opening **112** to allow the lever **200** to travel through. The lever **200**, which will be described in more detail hereinafter, will interact with other components of the firearm, such as the hammer or the bolt carrier, to rotate about the proximal end **201** reciprocally within a certain angular range (e.g., 8-12 degrees), thereby creating a torque force on the cam selector **100** to rotate the cam selector **100** forward or backward.

The cam selector **100** comprises a first recess **131** and a second recess **132** on the bottom side **104** of the cam selector **100**. The first recess **131** and a second recess **132** are transverse recesses on the cam selector **100**, perpendicular to the rotation axis of the cam selector **100**. A length of the first

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recess 131 is greater than a length of the second recess 132. Preferably, the length of the first recess 131 is twice the length of the second recess 132. The first recess 131 and the second recess 132 abut each other, forming an overall “L” shaped cutout. Due to the shorter length of the second recess 132, a cam portion 133 is formed by the second recess 132. The trigger 300 is similar to a standard trigger in the firearm (e.g., an AR-15) but features a modified trigger tail designed to interact with the cam selector 100 of the present invention. Specifically, the trigger 300 comprises a first trigger tail portion 301. The first trigger tail portion 301 will interact with the first recess 131, the second recess 132, and a safety cam profile 136 of the cam selector 100, respectively in different firing modes. Preferably, the first trigger tail portion 301 of the trigger 300 is rounded to facilitate the operation of the present invention. In another embodiment, the trigger 300 further comprises a second trigger tail portion 302 that has a corner cutout such that the second trigger tail portion 302 will not interfere with the operation of the trigger 300 and/or the cam selector 100.

The cam selector 100 is configured to operate between a first mode, a second mode, and a third mode, corresponding to the semi-automatic position, the active reset, and the safe position of the cam selector 100, respectively. The first mode of the cam selector 100 is configured to allow the first trigger tail portion 301 to be movable within the first recess 131. In this mode, the cam selector 100 will not interfere with the trigger 300, allowing the firearm to operate in the standard semi-automatic mode. The second mode of the cam selector 100 is configured to allow the first trigger tail portion 301 to engage the second recess and be moved down by a cam portion 133 of the second recess 132 when the cam selector rotates. The second mode resets the pressure and forces the trigger 300 to reset. The third mode of the cam selector 100 is configured to prevent the trigger 300 from being pulled. Specifically, the safety cam profile 136 of the cam selector 100 restricts any rotation of the trigger 300, preventing it from being pulled regardless of the direction in which the dual cam is rotated.

In a preferred embodiment, the present invention employs a unique detent-track mechanism to switch between different firing modes. The present invention may comprise a detent 400, and the cam selector 100 further comprises a first detent track 121, a second detent track 122, and a third detent track 123. The detent 400 is configured to move between the first detent track 121, the second detent track 122, and the third detent track 123 to select between the first mode, the second mode, and the third mode of the cam selector 100. The detent 400 may be a pin-like member, as shown in FIG. 8. In a preferred embodiment, the detent 400 may have a rounded top end 401 to facilitate smooth transitions between the different firing modes. The top end 401 slides against the first detent track 121, the second detent track 122, or the third detent track 123 in different firing modes. The detent 400 may be contained in a passage within the lower receiver of the firearm and biased against the cam selector 100 by a spring. This design allows the user to switch between firing modes by simply pushing the cam selector 100 to the right or left, while effectively preventing unintended lateral movement of the cam selector 100. In a preferred embodiment, the first detent track 121, the second detent track 122, and the third detent track 123 are configured to allow the detent to move along the first detent track 121, the second detent track 122, and the third detent track 123, respectively. In this way, the detent 400 allows the cam selector 100 to rotate within a certain range. Preferably, the first detent track 121, the second detent track 122, and the third detent track

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123 are transverse grooves on the bottom side 101 of the cam selector 100. In one embodiment, the first detent track 121, the second detent track 122, and the third detent track 123 may be formed by a plurality of ridges and grooves. In another embodiment, the first detent track 121, the second detent track 122, and the third detent track 123 are positioned adjacent to the first end of the cam selector. The detent 400 and the plurality of detent tracks serve dual purposes: restricting the cam selector's rotation to its intended range of motion and selecting different cam selector profiles to engage with the trigger 300.

The lever 200 is configured to transfer torque onto the cam selector 100 and thus rotate the cam selector 100. It should be noted that the lever 200 can be of any shape, size, material, features, type or kind, orientation, location, quantity, components, and arrangements of components that would allow the present invention to fulfill the objectives and intents of the present invention. In one embodiment, the lever 200 comprises a proximal end 201 and a distal end 202. Preferably, the lever comprises a dovetail portion 203 at the proximal end 201. In one embodiment, the lever 200 further comprises a bent portion 204 adjacent to the distal end 202. It should be noted that the opening 112 of the longitudinal slot 110 is wider than the lever 200, allowing a void or clearance to be formed between the lever 200 and the edge of the opening 112. The void can be on either side of the lever 200, depending on which direction the lever is pivoting. In other words, when the lever 200 pivots, it does not immediately transfer torque onto the cam selector 100 until the void is filled.

The present invention is designed to replace the standard safety within the receiver of a firearm such as an AR-15. The present invention engages with external components within a standard firearm as explained below. In its preferred embodiment, the trigger 300 and disconnect are pivotally mounted to the lower receiver by a transverse pin and pushed forward by a spring. The hammer is pivotally mounted to the lower receiver by a transverse pin and is pushed forward and can be rotated by a spring.

As mentioned above, the detent 400 is contained in a passage within the lower receiver and is pushed up against the cam by a spring. The bolt carrier reciprocates within the upper receiver. In the second mode of the present invention (i.e., the active reset mode), when the hammer is cocked and the trigger is in its forward position, the firearm is ready to fire. When the trigger bow is pulled to the rear by the operator, the trigger sear releases the hammer sear, allowing the hammer to swing forward under spring pressure. The striking surface of the hammer strikes the firing pin, thereby firing the firearm. As the trigger bow is pulled, the first trigger tail portion 301 of the trigger 300 moves up into the second recess 132 of the cam selector 100.

The first trigger tail portion 301 of the trigger 300 slides against the cam portion 132, rotating the cam selector 110 forward until the upper surface of the trigger is resting in the relief area of the modified trigger. The disconnect is rotated forward about its pivot congruent with the motion of the trigger. This allows the fire control group and mechanism to be in the fired state. This is when the hammer falls, and the trigger bow is pulled. As the bolt carrier moves to the rear under gas pressure, the hammer cam point pivotally displaces the hammer back down into the former ready state. The tail of the hammer may push the lever 200 out of its path as it swings back. The hammer hook on the hammer snaps past and may engage with the disconnect hook. The hammer is held down by the hammer cam surface as the bolt carrier continues to move toward the back of the firearm.

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As the bolt carrier continues to move, the hammer cam presses against the distal end **202** of the lever **200**, rotating the lever **200** toward the back. As the lever **200** rotates, it transfers torque to the cam selector **100** via the dovetail portion **203**. As the cam selector **100** rotates, the cam portion **133** slides against the first trigger tail portion **301** of the trigger **300**, moving the tail of the trigger down, and rotating the trigger back into the former ready position. The trigger sear then engages the hammer sear. The disconnecter pivots back rearward about its pivot congruent with the motion of the trigger **300**. The hammer hook on the hammer may no longer engage with the disconnecter hook.

When the bolt carrier is in its most rearward position, the lever **200** is held to the rear by the hammer cam surface and the cam selector is rotated so that the cam selector is against the top surface of the trigger tail. The trigger is held in the reset position by the cam selector **100** and cannot be pulled by the operator as the cam selector **100** is blocking the trigger's tail from moving up. As the bolt carrier moves forward again under spring pressure, the hammer is released by the hammer cam surface and the hammer sear engages the trigger sear, preventing the hammer from falling. As the bolt carrier moves forward, the rear surface of the bolt carrier presses against the second end **202** of the lever **200**, rotating the lever **200** forward. It should be noted that the lever **200** does not immediately transfer torque onto the cam selector **100**. The lever **200** pivots in the cam selector **100** until the void is filled. Once the void is filled, the lever **200** can transfer torque to the cam selector **100**.

The amount that the lever **200** rotates in the longitudinal slot **110** before transferring torque to the cam selector **100** is such that as the bolt carrier completes its forward movement, the cam selector **100** rotates to a position where the first trigger tail portion **301** begins to slide against the cam portion **133**. Once the cam selector **100** moves into this position, the trigger bow can be pulled again by the operator as previously described.

If the left side of the cam selector **100** is pressed by the operator, the cam selector **100** will transversely shift to the right and be held in the right position by the detent track and detent. In this example, when the cam selector **100** is resting to the right, the first recess **131** of the cam selector **100** can engage with the first trigger tail portion **301**, and the present invention will operate in the semi-automatic mode, as described previously. If the right side of the cam selector **100** is pressed by the operator, the cam selector **100** will transversely shift to the left and be held in this position by the detent track and the detent. In this example, when the cam selector **100** is resting to the left, the safety cam profile **136** engages with the trigger tail and prevents the trigger from being pulled regardless of what position the cam is rotated to. In other words, by pressing the right side or the left side, the manual safety can be engaged or disengaged. When the cam selector **100** is transversely shifted to the right or left, the lever is held approximately in the center of the firearm by the walls of the receiver of the firearm. The cam selector **100** can move transversely in the firearm independent of the lever **200**, as the dovetail portion **203** on the lever can move transversely within the longitudinal slot **110** on the cam selector **100**.

In one embodiment, the cam selector **100** can be expanded to support more cam profiles. Additional detent tracks may be provided to support another position, and another cam profile would be added to the cam selector **100** alongside, or in between the current profiles. An example of this would be to add another profile similar to the safety profile, but of a smaller diameter. If this profile was selected by transversely

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sliding the cam selector **100** to the proper position, it would be of a small enough diameter not to engage the first trigger tail portion regardless of what position the cam selector **100** was rotated to. This would result in the fire control group functioning as before, but without the cam selector **100** actively resetting the trigger. This would allow the operator to fire precise single shots more effectively due to the geometric constraints of the AR-15. With all the components working in tandem with each other, it can be seen that the present invention is a safety mechanism that provides the firearm user with a three-position fire control unit.

Although the disclosure has been explained in relation to its preferred embodiment, it is to be understood that many other possible modifications and variations can be made without departing from the spirit and scope of the disclosure.

What is claimed is:

1. A safety mechanism for a firearm comprising:

a cam selector;

a lever;

a trigger;

the cam selector comprising a first end, a second end, a top side, and a bottom side;

the cam selector comprising a longitudinal slot positioned on the top side of the cam selector;

the lever comprising a proximal end and a distal end;

the longitudinal slot being configured to receive the proximal end of the lever;

the cam selector further comprising a first recess and a second recess on the bottom side of the cam selector;

the trigger comprising a first trigger tail portion;

the cam selector being configured to operate between a first mode, a second mode, and a third mode;

wherein the first mode of the cam selector is configured to allow the first trigger tail portion to be movable within the first recess, wherein the second mode of the cam selector is configured to allow the first trigger tail portion to engage the second recess and be moved down by a cam portion of the second recess when the cam selector rotates, and wherein the third mode of the cam selector is configured to prevent the trigger from being pulled.

2. The safety mechanism as claimed in claim 1, wherein the cam selector has a substantially cylindrical shape.

3. The safety mechanism as claimed in claim 1, further comprising:

a detent;

the cam selector further comprising a first detent track, a second detent track and a third detent track;

the detent being configured to move between the first detent track, the second detent track and the third detent track to select between the first mode, the second mode, and the third mode of the cam selector.

4. The safety mechanism as claimed in claim 3, wherein the first detent track, the second detent track, and the third detent track are configured to allow the detent to move along the first detent track, the second detent track, and the third detent track, respectively.

5. The safety mechanism as claimed in claim 4, wherein the first detent track, the second detent track, and the third detent track are transverse grooves on the bottom side of the cam selector.

6. The safety mechanism as claimed in claim 5, wherein the first detent track, the second detent track and the third detent track are positioned adjacent to the first end of the cam selector.

7. The safety mechanism as claimed in claim 3, wherein the detent comprises a rounded top end.

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8. The safety mechanism as claimed in claim 1, wherein the longitudinal slot extends from the first end of the cam selector.

9. The safety mechanism as claimed in claim 8, wherein the longitudinal slot is ovular shaped and comprises an opening to allow the lever to travel trough. 5

10. The safety mechanism as claimed in claim 9, wherein the lever comprises a dovetail portion at the proximal end.

11. The safety mechanism as claimed in claim 10, wherein the lever further comprises a bent portion adjacent to the distal end. 10

12. The safety mechanism as claimed in claim 1, wherein the first trigger tail portion of the trigger is rounded.

13. The safety mechanism as claimed in claim 12, wherein the trigger further comprises a second trigger tail portion that has a corner cutout. 15

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 12,529,538 B2
APPLICATION NO. : 18/968984
DATED : January 20, 2026
INVENTOR(S) : Cameron Smith

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Specification

Column 2, Line 9, reads “travel trough” and should read -- travel through --.

Column 3, Lines 40-41, reads “denotes “at least one,” but does not exclude” and should read -- denote “at least one” but do not exclude --.

In the Claims

Column 9, Claim 9, Line 6, reads “travel trough” and should read -- travel through --.

Signed and Sealed this
Thirty-first Day of March, 2026



John A. Squires
Director of the United States Patent and Trademark Office

Exhibit C

EXHIBIT D



US012578159B2

(12) **United States Patent**
Blakley

(10) **Patent No.:** **US 12,578,159 B2**

(45) **Date of Patent:** ***Mar. 17, 2026**

(54) **FIREARM TRIGGER MECHANISM**

(56) **References Cited**

(71) Applicant: **ABC IP, LLC**, Dover, DE (US)

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(72) Inventor: **Brian A Blakley**, Pinellas Park, FL (US)

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(73) Assignee: **ABC IP, LLC**, Dover, DE (US)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 160 days.

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This patent is subject to a terminal disclaimer.

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(Continued)

(21) Appl. No.: **18/761,606**

(22) Filed: **Jul. 2, 2024**

Primary Examiner — Reginald S Tillman, Jr.

(65) **Prior Publication Data**

(74) *Attorney, Agent, or Firm* — Wood Herron & Evans LLP

US 2026/0055983 A1 Feb. 26, 2026

(57) **ABSTRACT**

Related U.S. Application Data

(63) Continuation of application No. 18/325,225, filed on May 30, 2023, now Pat. No. 12,038,247.

(Continued)

(51) **Int. Cl.**

F41A 19/45 (2006.01)

F41A 17/46 (2006.01)

(Continued)

(52) **U.S. Cl.**

CPC **F41A 19/45** (2013.01); **F41A 17/46** (2013.01); **F41A 19/10** (2013.01); **F41A 19/16** (2013.01); **F41A 19/15** (2013.01)

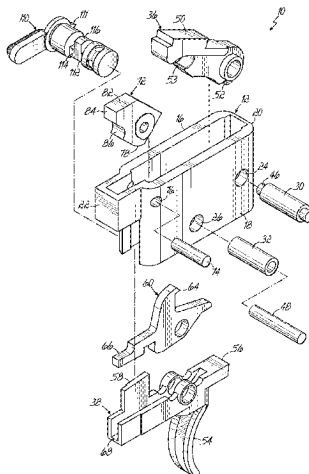
(58) **Field of Classification Search**

CPC F41A 19/45; F41A 19/10; F41A 19/15; F41A 19/64; F41A 17/46

(Continued)

A trigger mechanism that can be used in AR-pattern firearms has a hammer, a trigger member, a disconnecter, a cam, and a "three position" safety selector having safe, standard semi-automatic, and forced reset semi-automatic positions. In the standard semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and pivoting of the cam from a first position to a second position such that a cam lobe forces the trigger member towards the set position, but prior to reaching the set position the disconnecter hook catches the hammer hook, at which time a user must manually release the trigger member to free the hammer from the disconnecter to permit the hammer and trigger member to pivot to their set positions so that the user can pull the trigger member to fire the firearm. In the forced reset semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and pivoting of the cam from the first position to the second position such that the cam lobe forces the trigger member to the set position, the safety selector

(Continued)



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preventing the disconnecter hook from catching the hammer hook, at which time the user can pull the trigger member to fire the firearm without manually releasing the trigger member.

18 Claims, 18 Drawing Sheets

Related U.S. Application Data

- (60) Provisional application No. 63/374,941, filed on Sep. 8, 2022.
- (51) **Int. Cl.**
F41A 19/10 (2006.01)
F41A 19/15 (2006.01)
F41A 19/16 (2006.01)
- (58) **Field of Classification Search**
 USPC 42/69.01, 69.03; 89/146, 148, 129.01, 89/129.02, 132
 See application file for complete search history.

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Exhibit 1007 from IPR Petition No. 2025-01473 (photo of Tommy Triggers 3 Selector install for Alamo-15).

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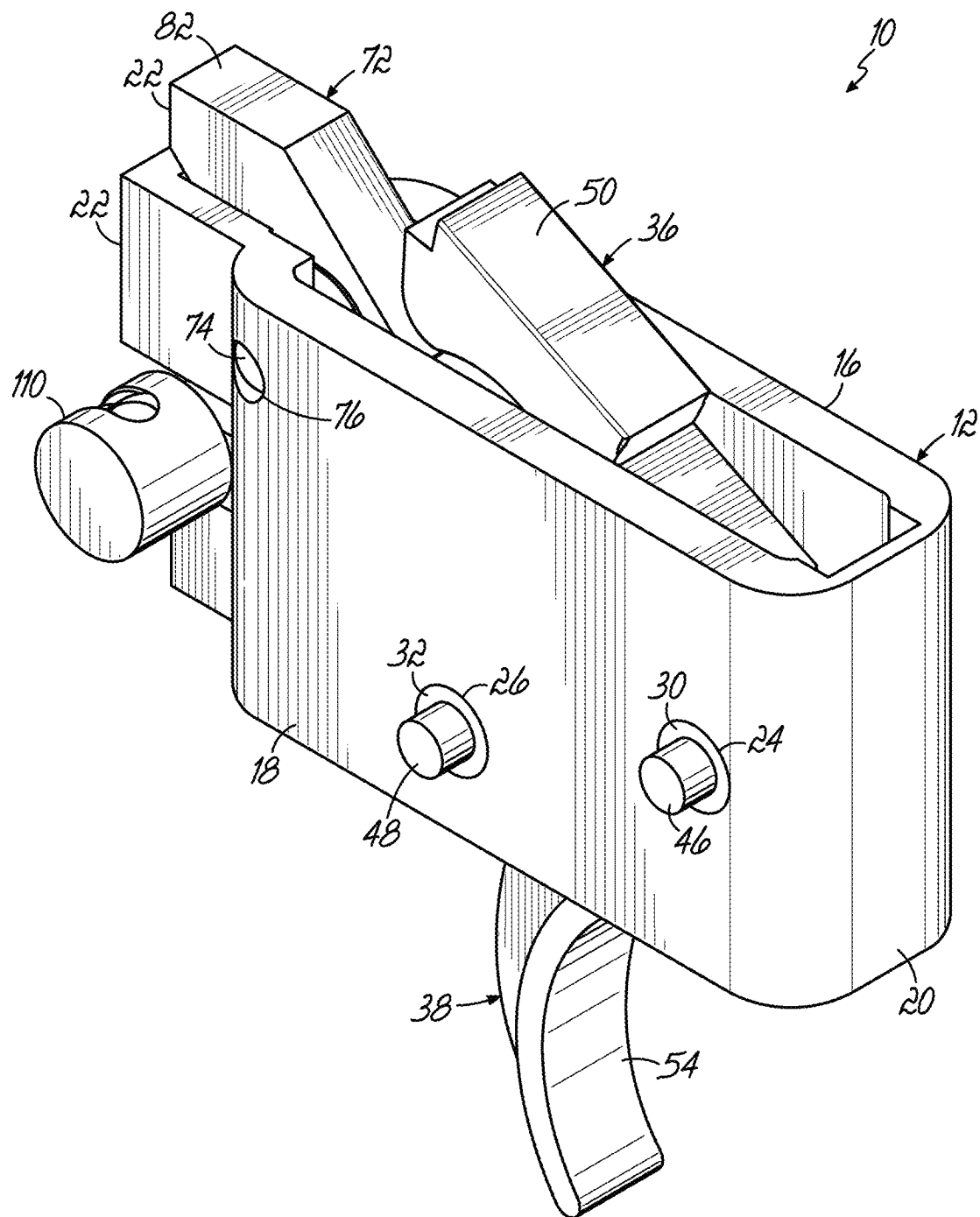


FIG. 1

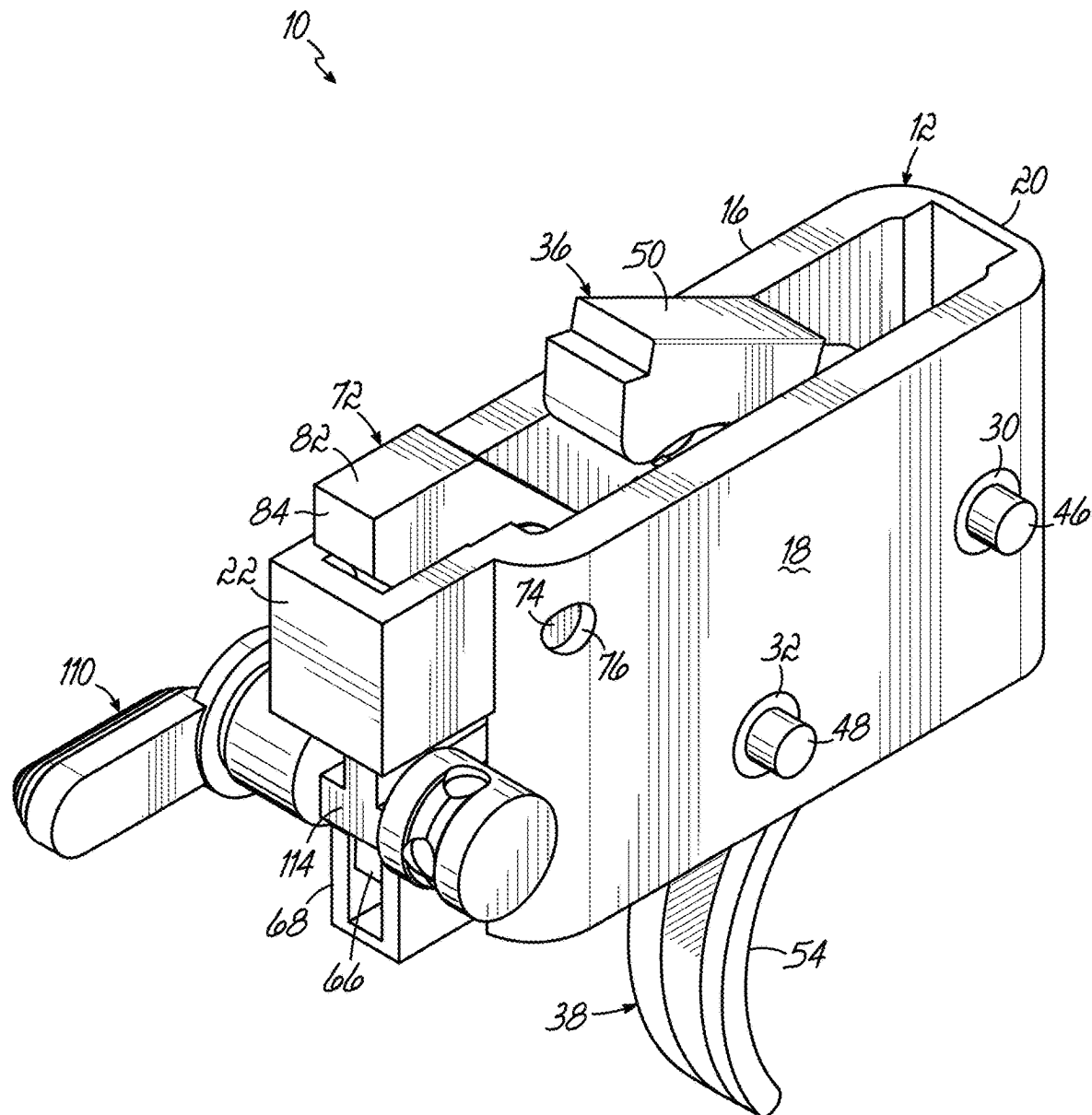


FIG. 2

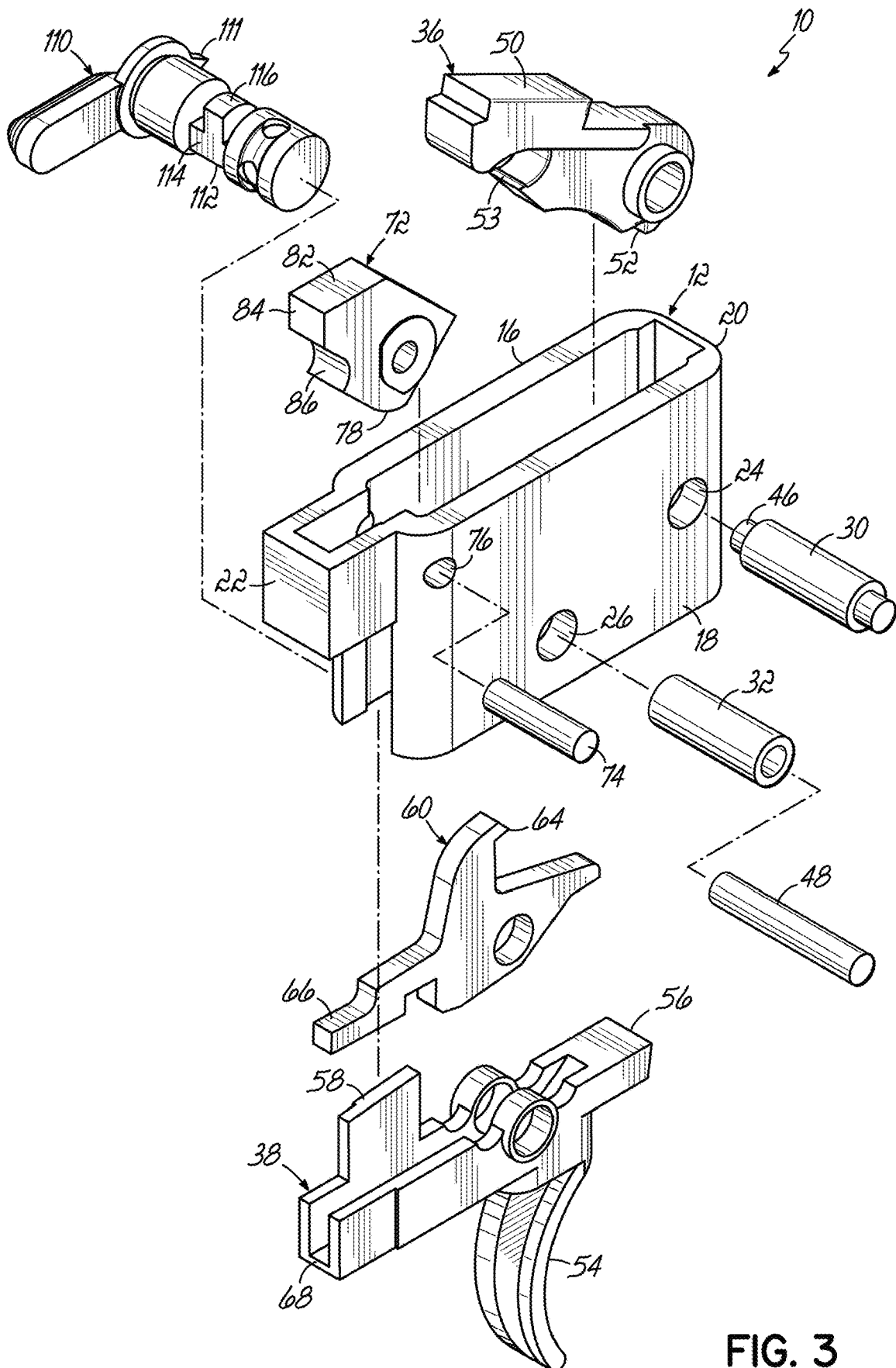


FIG. 3

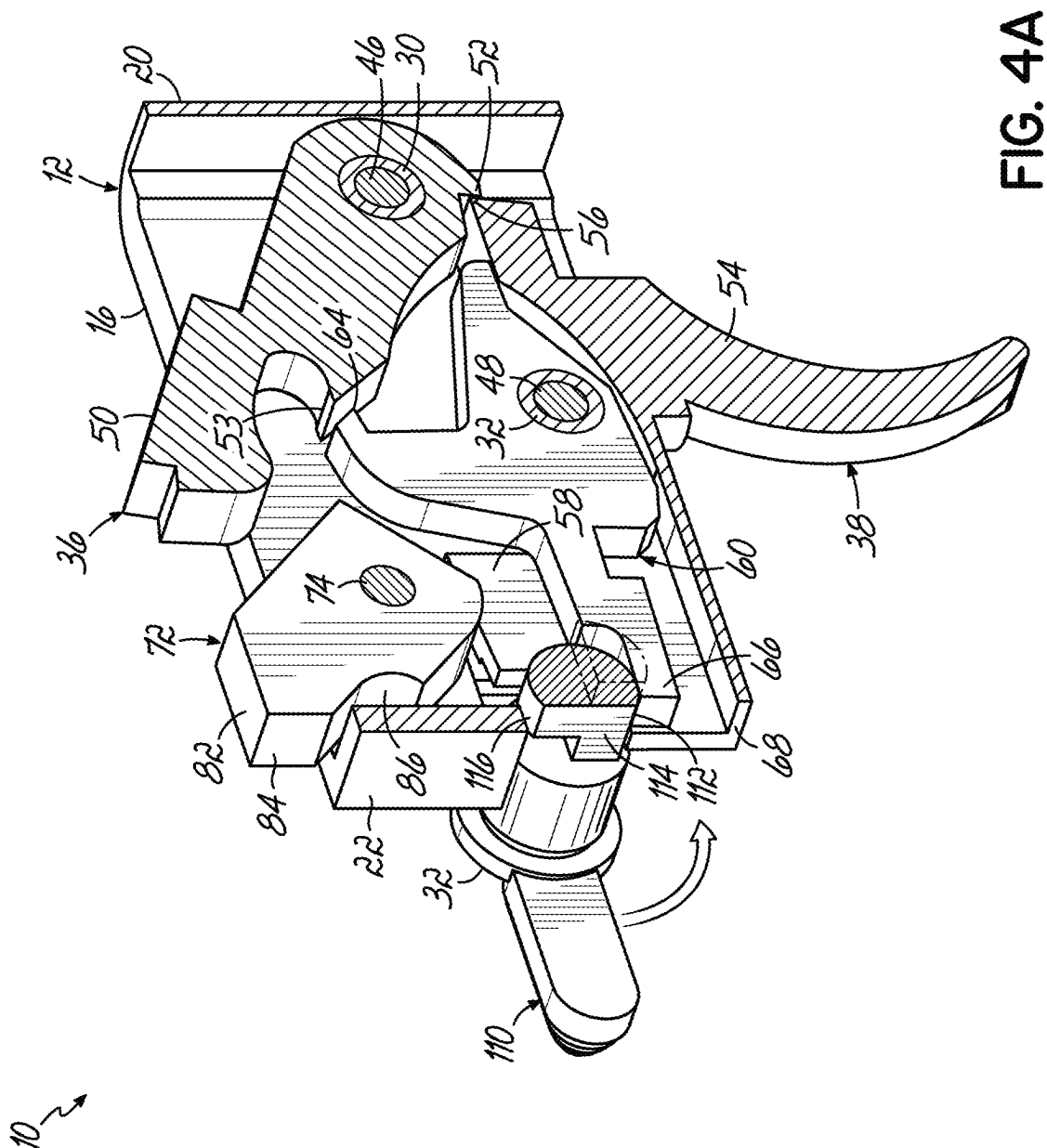
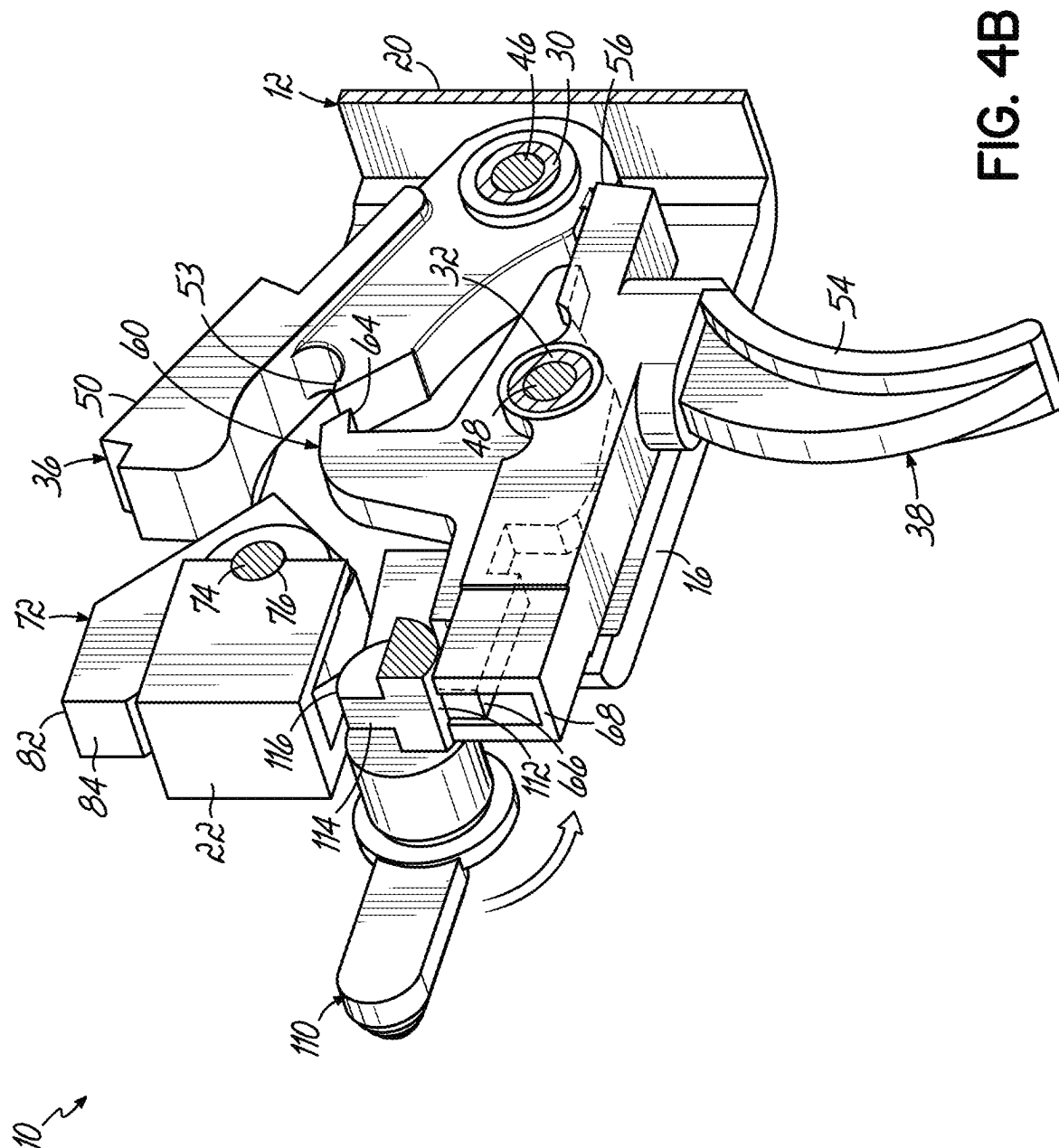
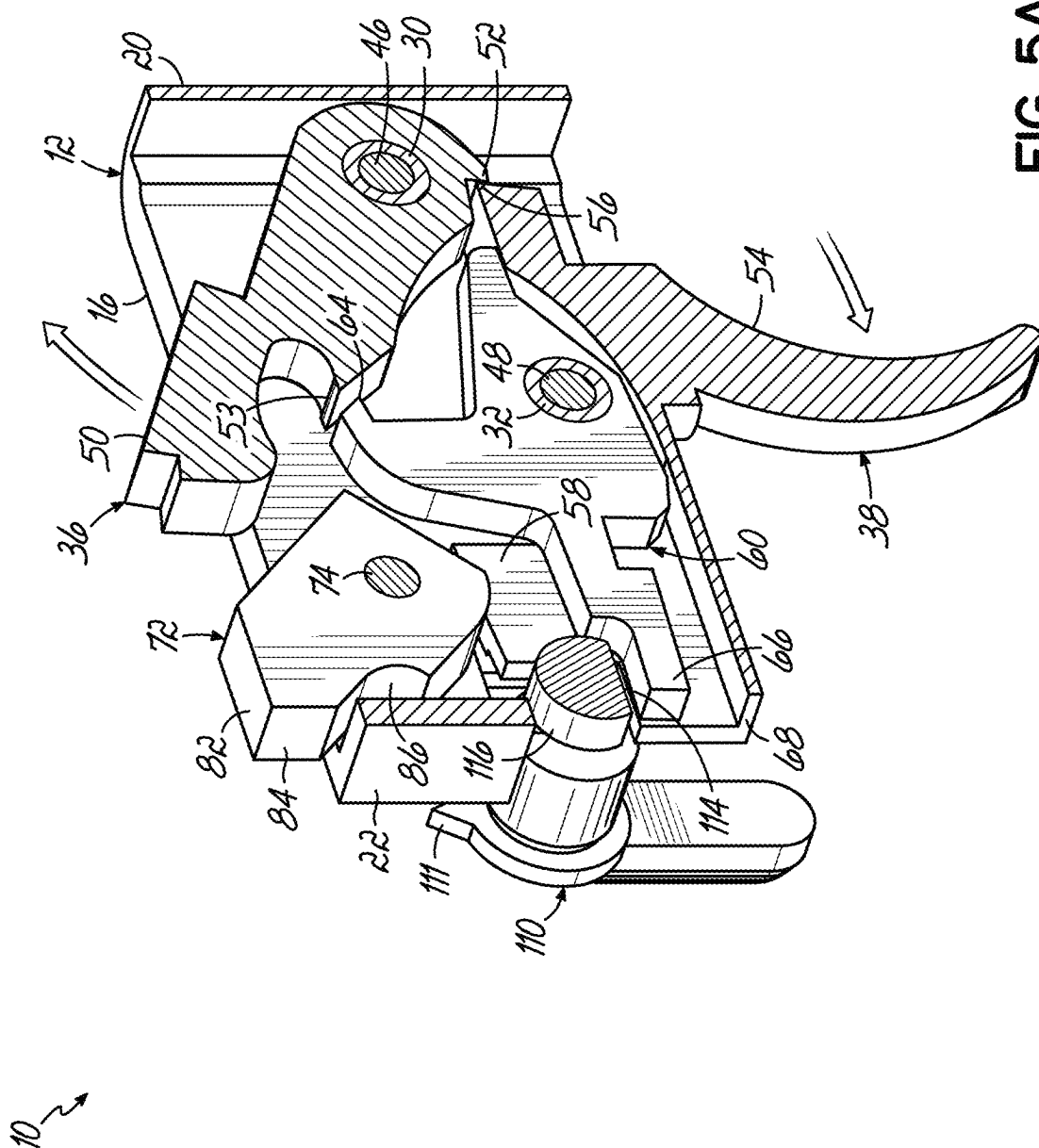
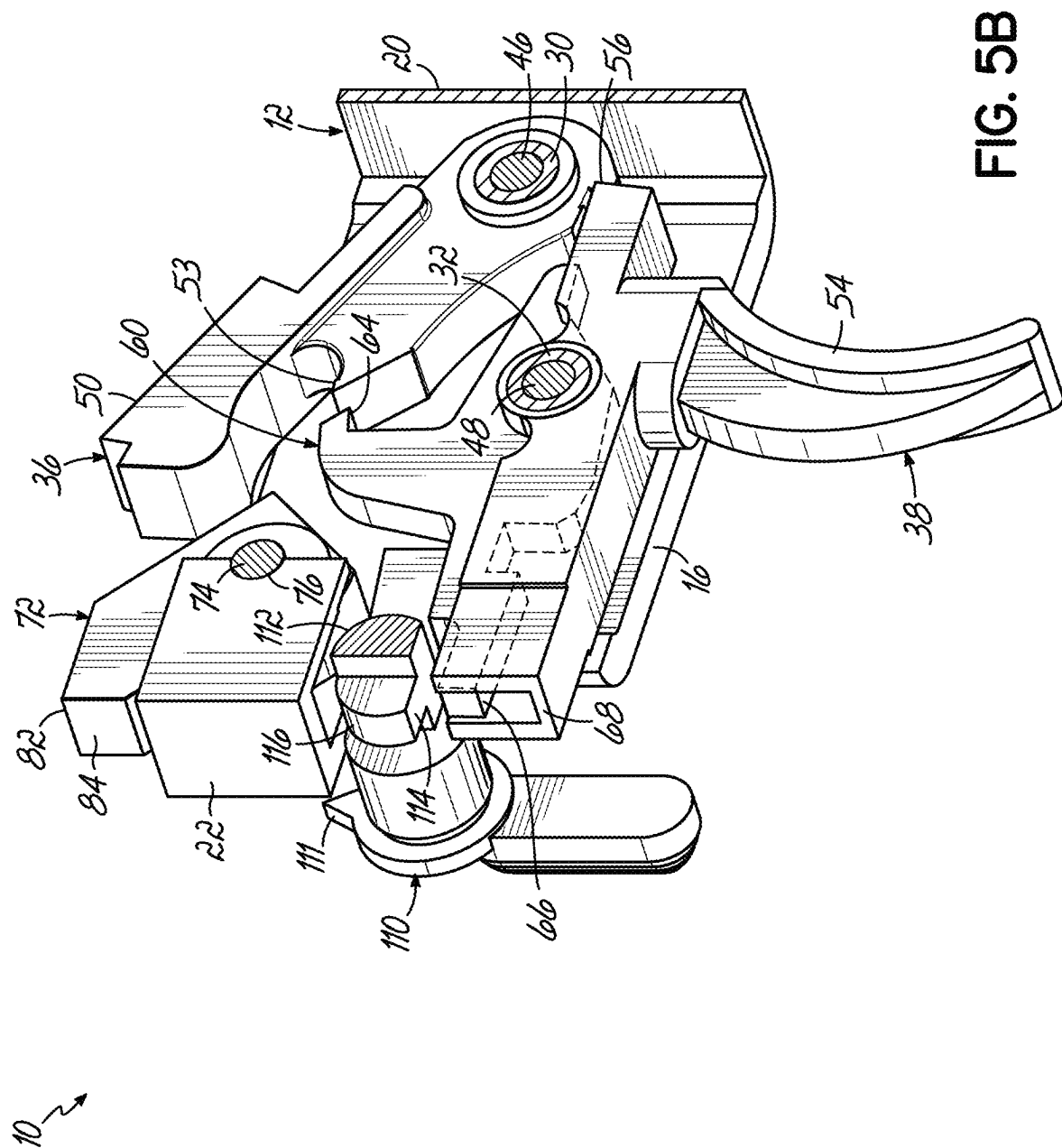
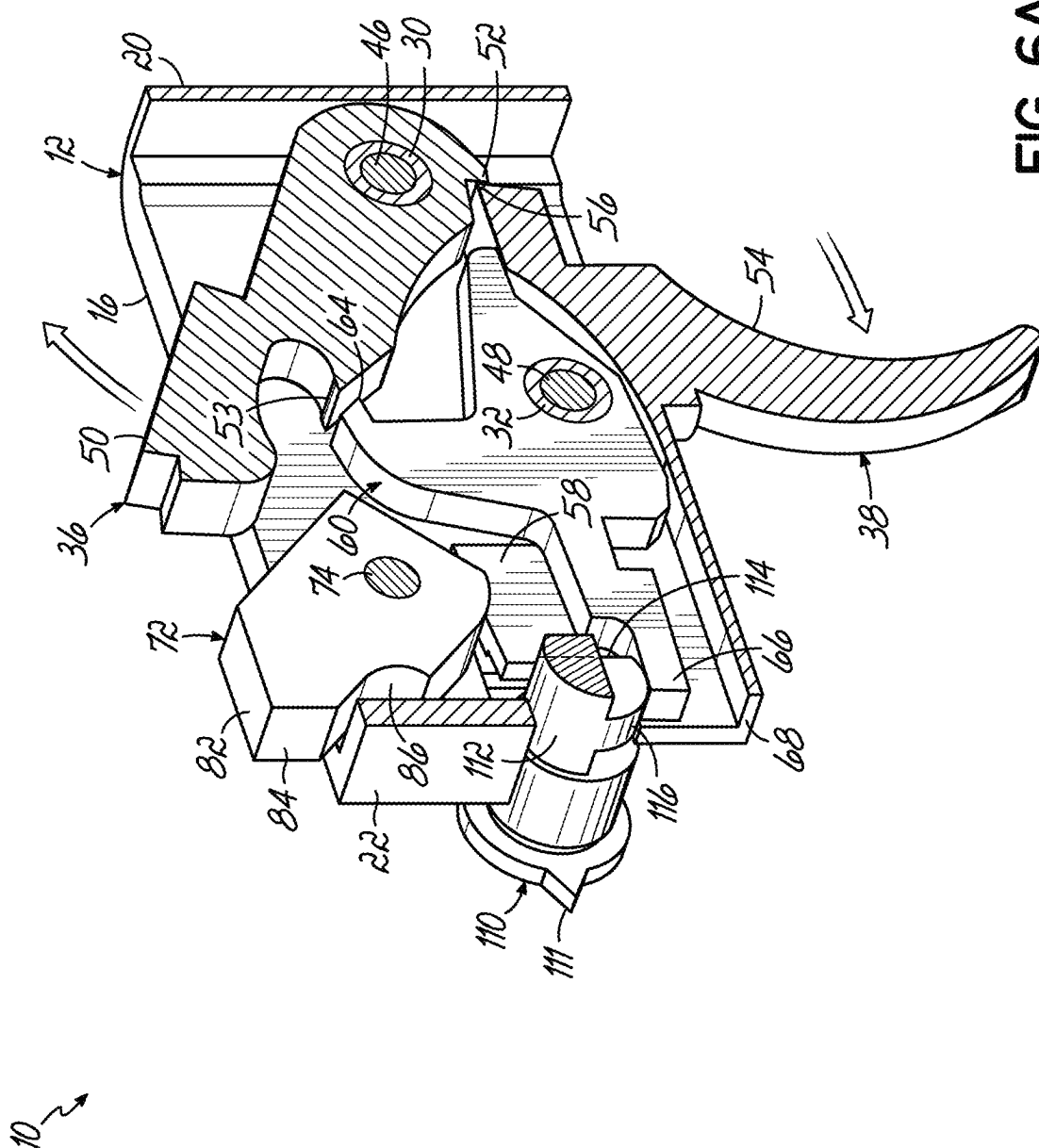


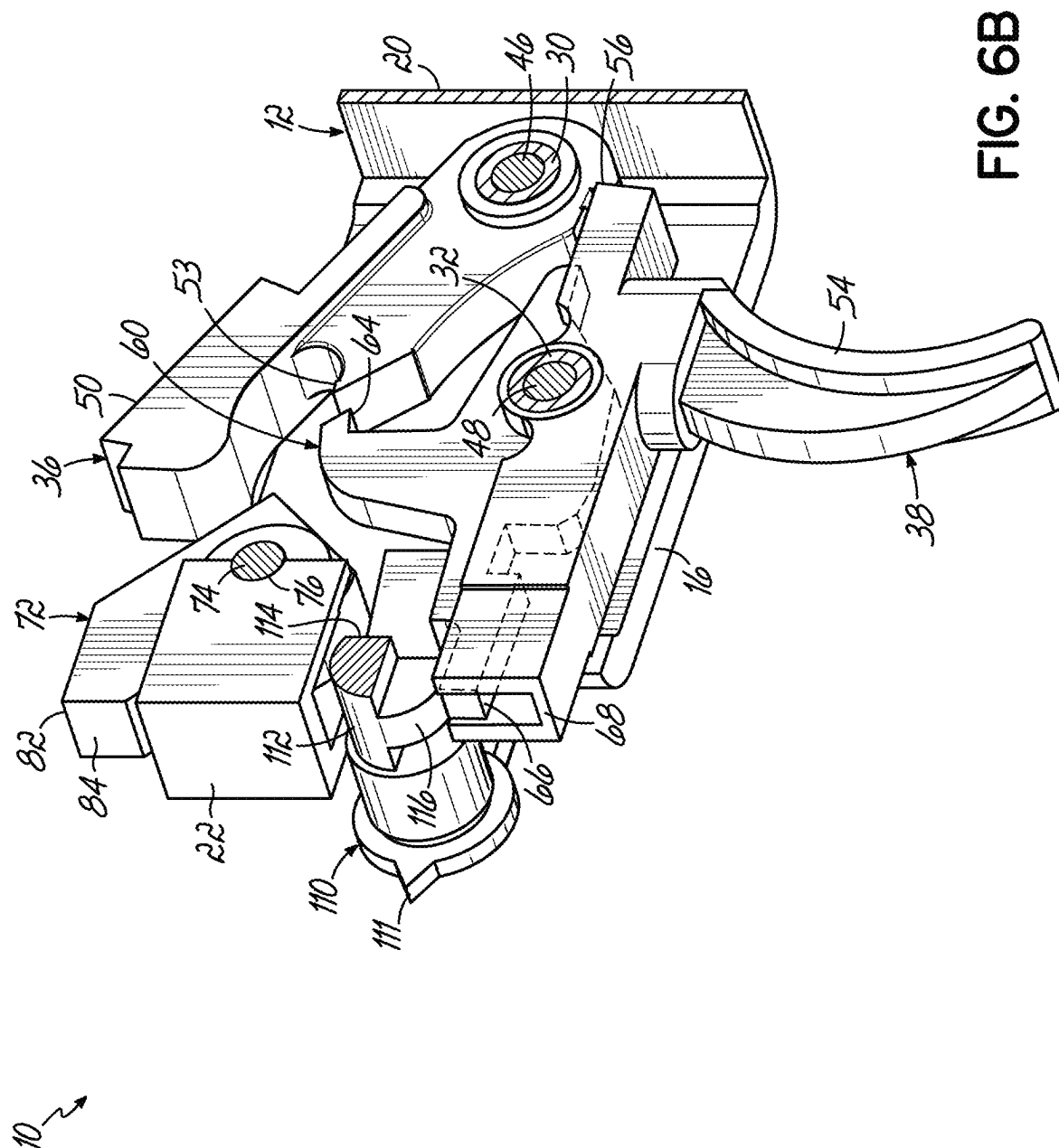
FIG. 4A











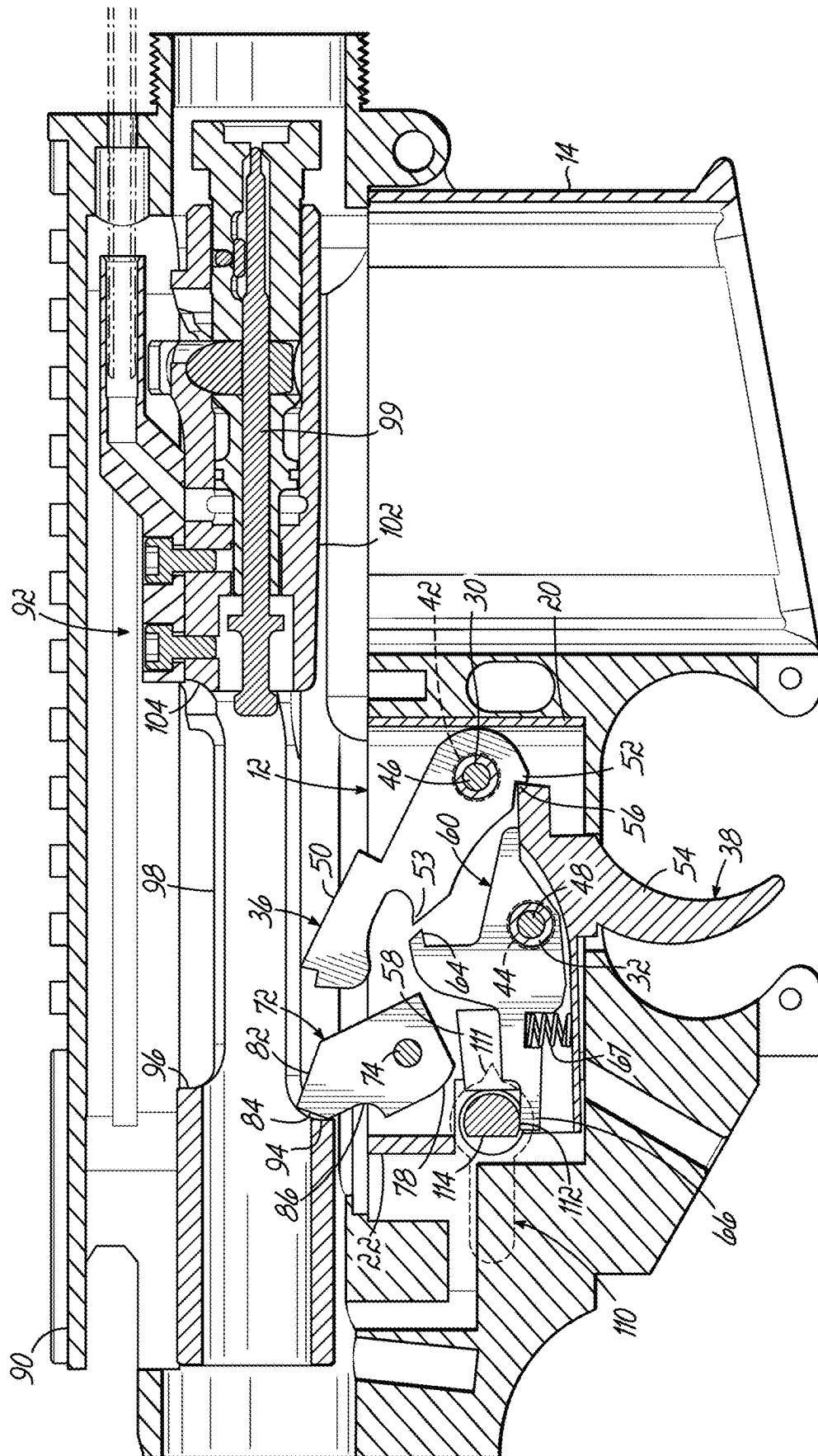


FIG. 7

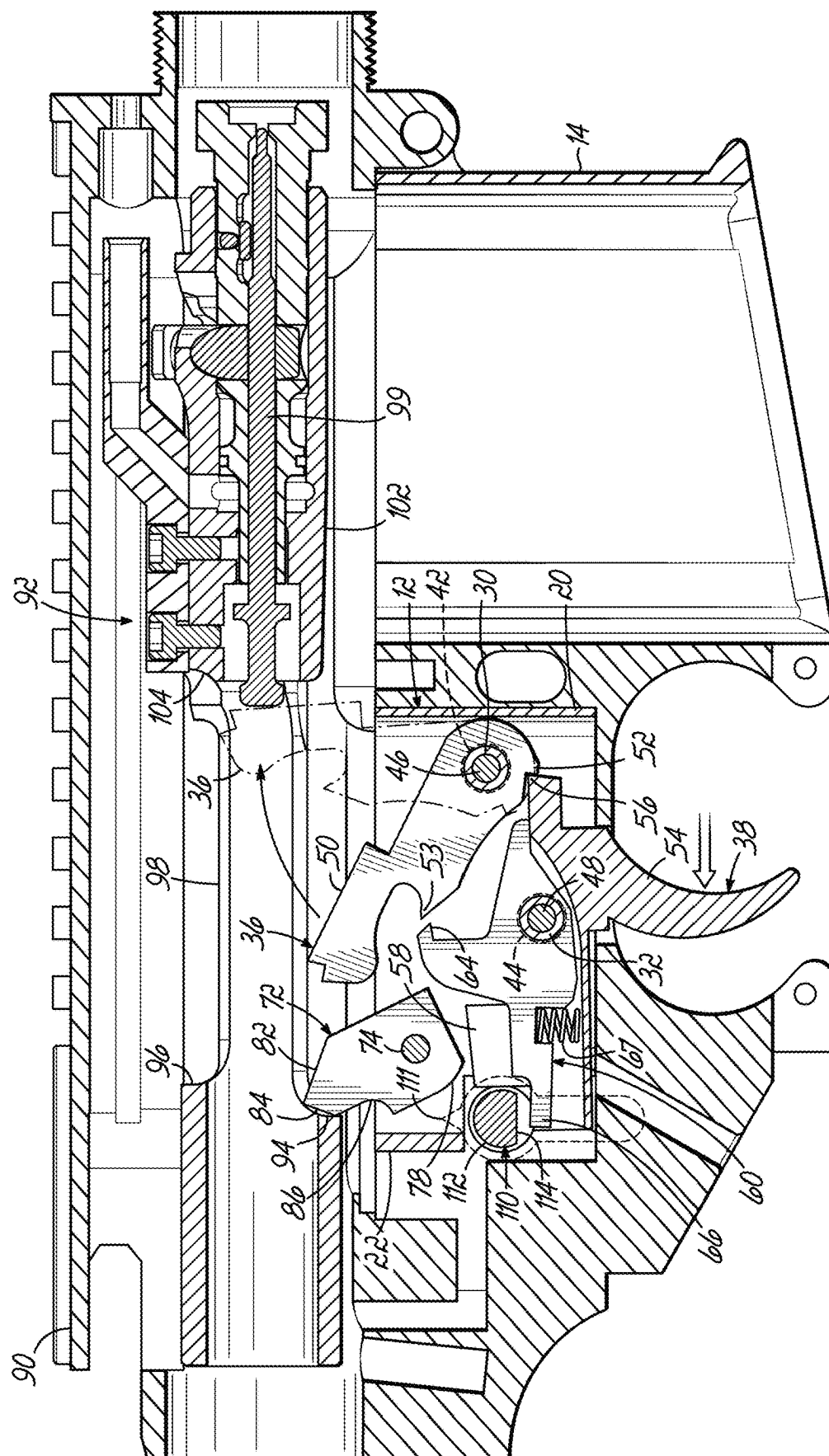


FIG. 8A

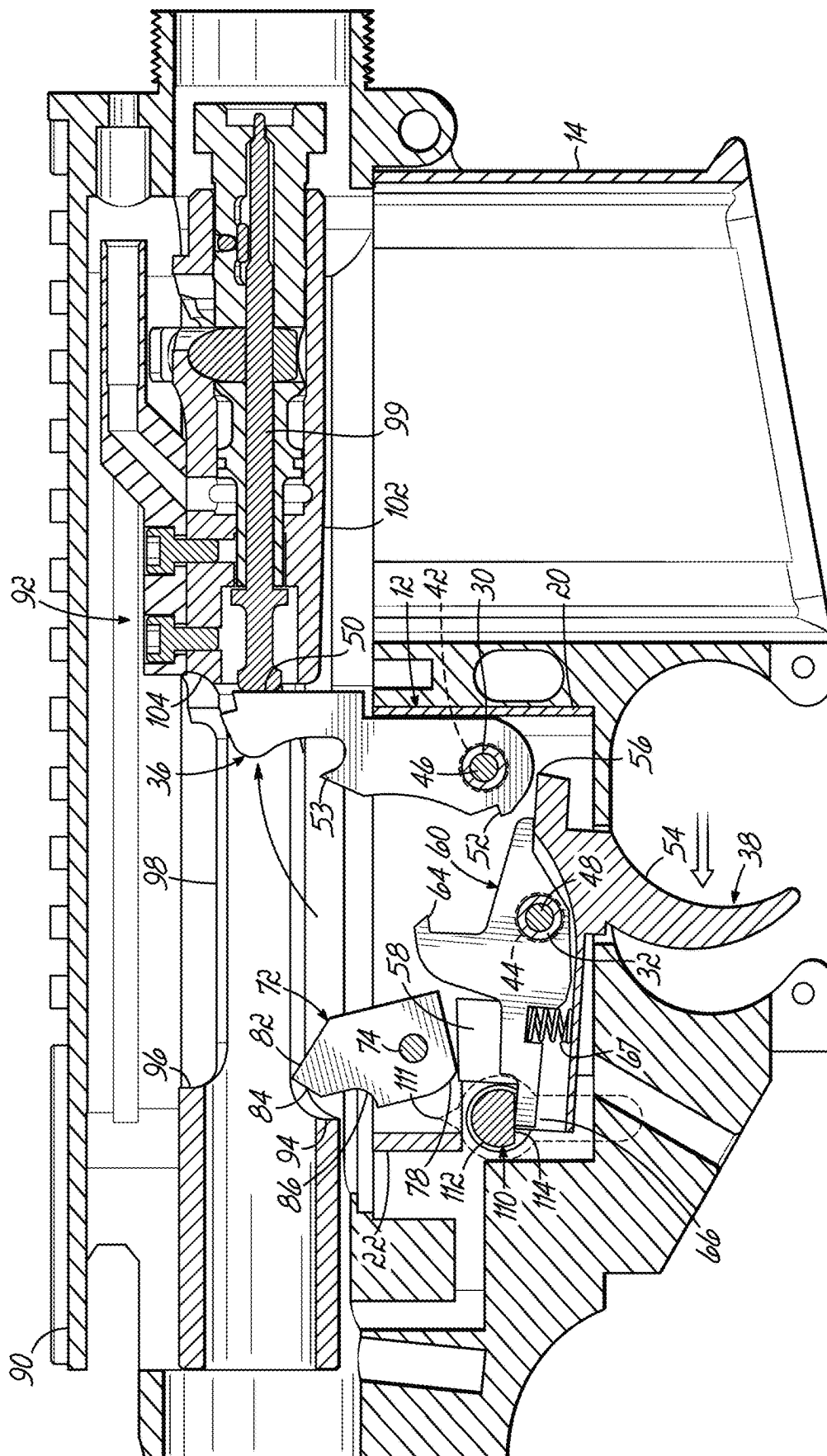


FIG. 8B

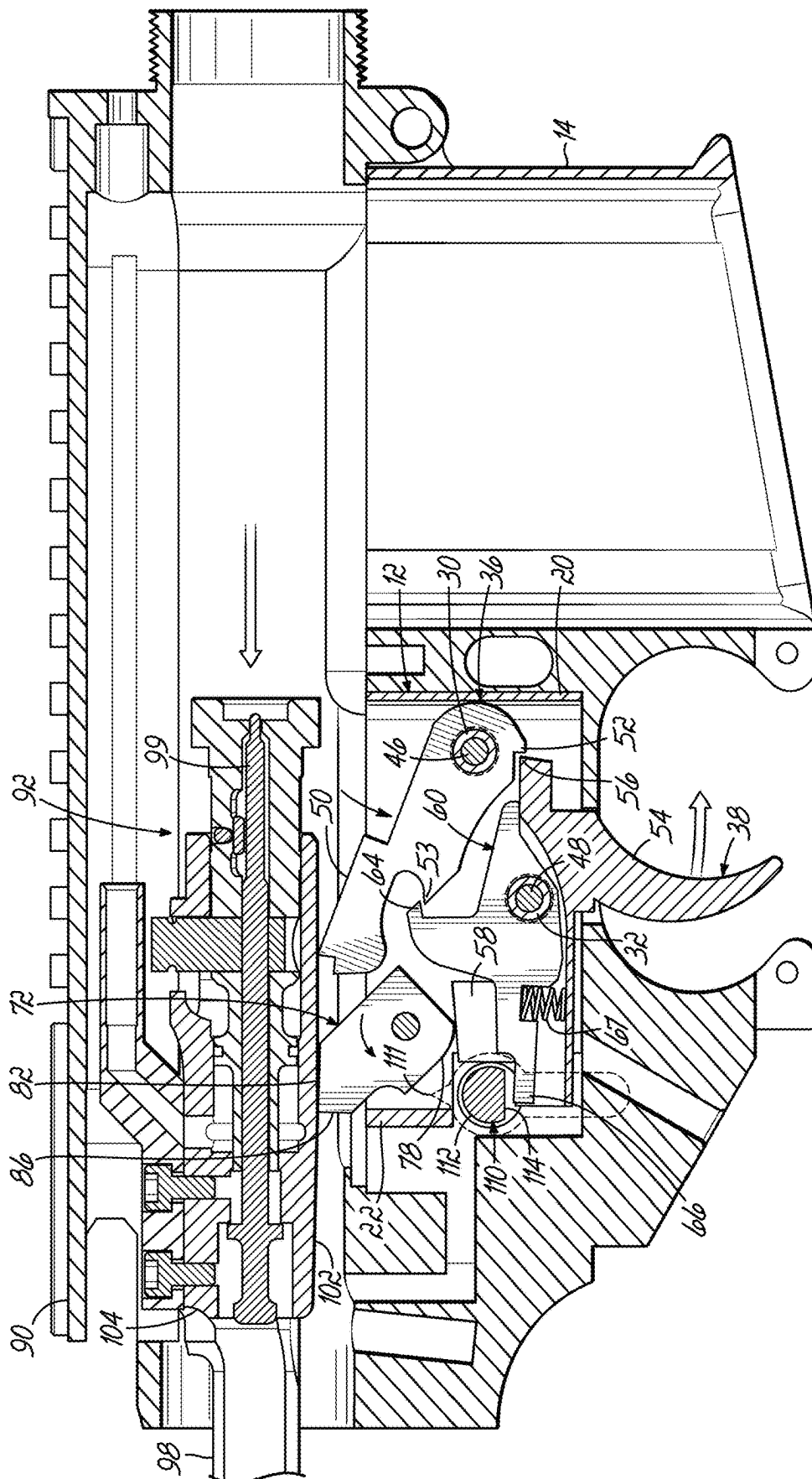


FIG. 8C

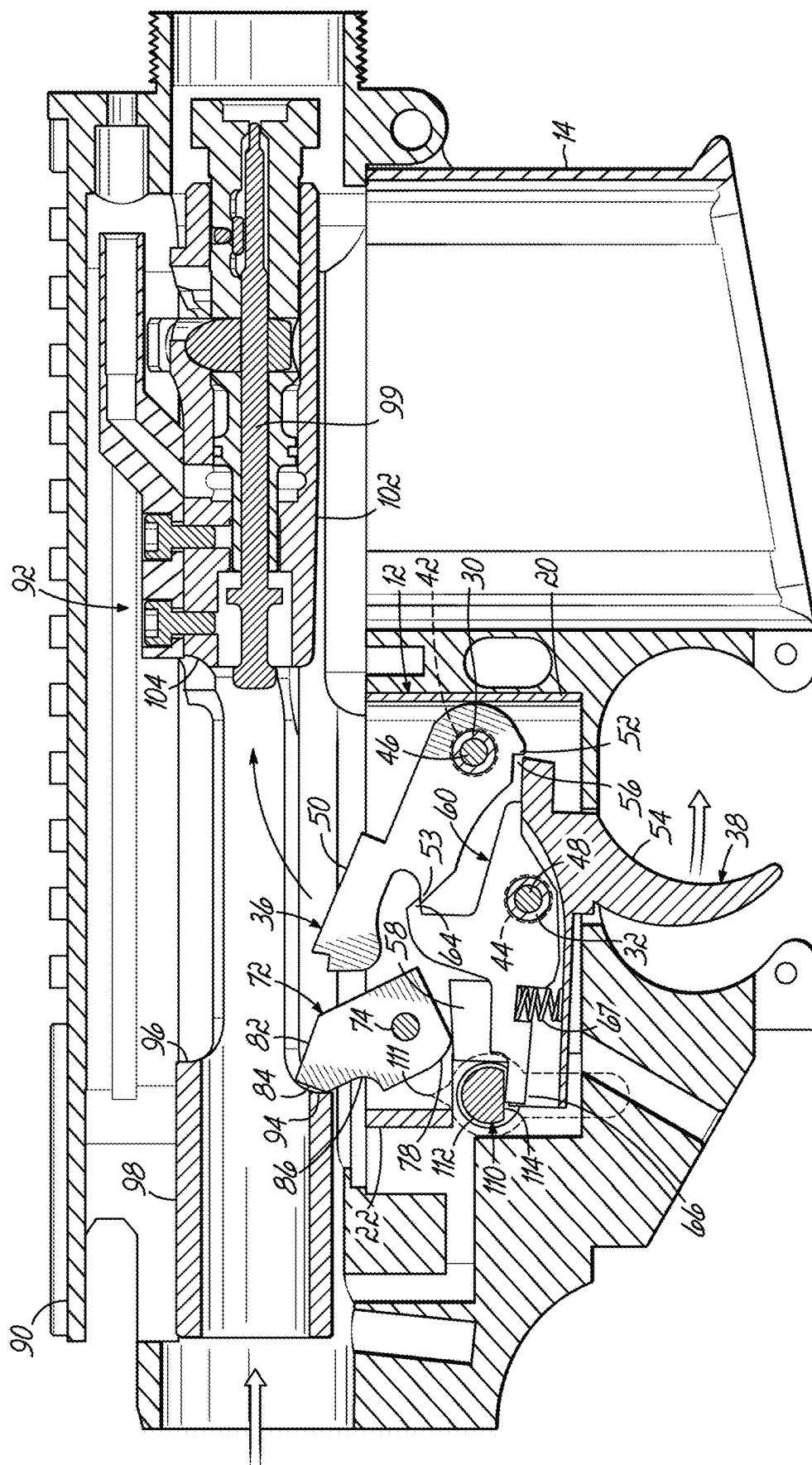


FIG. 8D

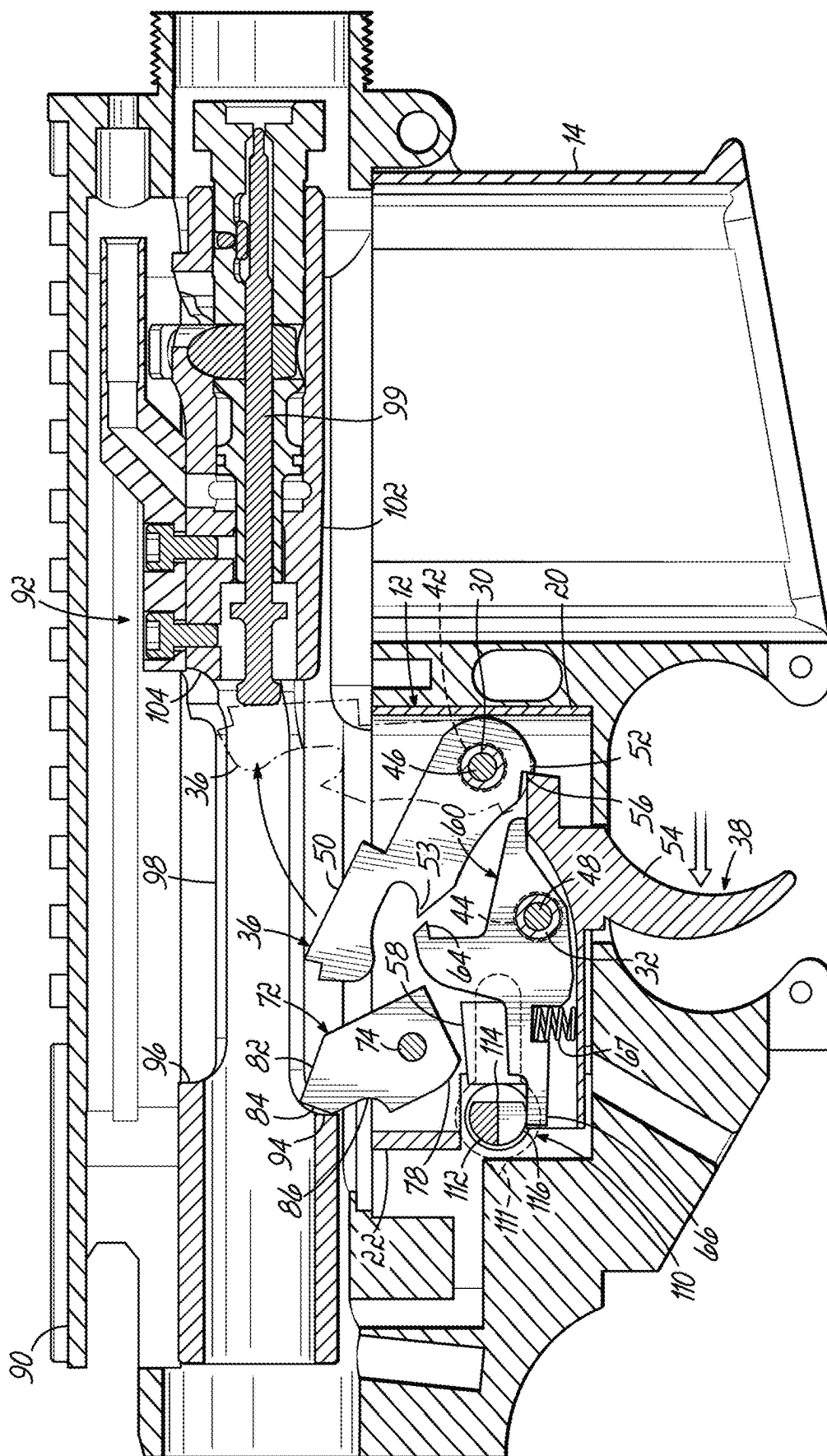


FIG. 9A

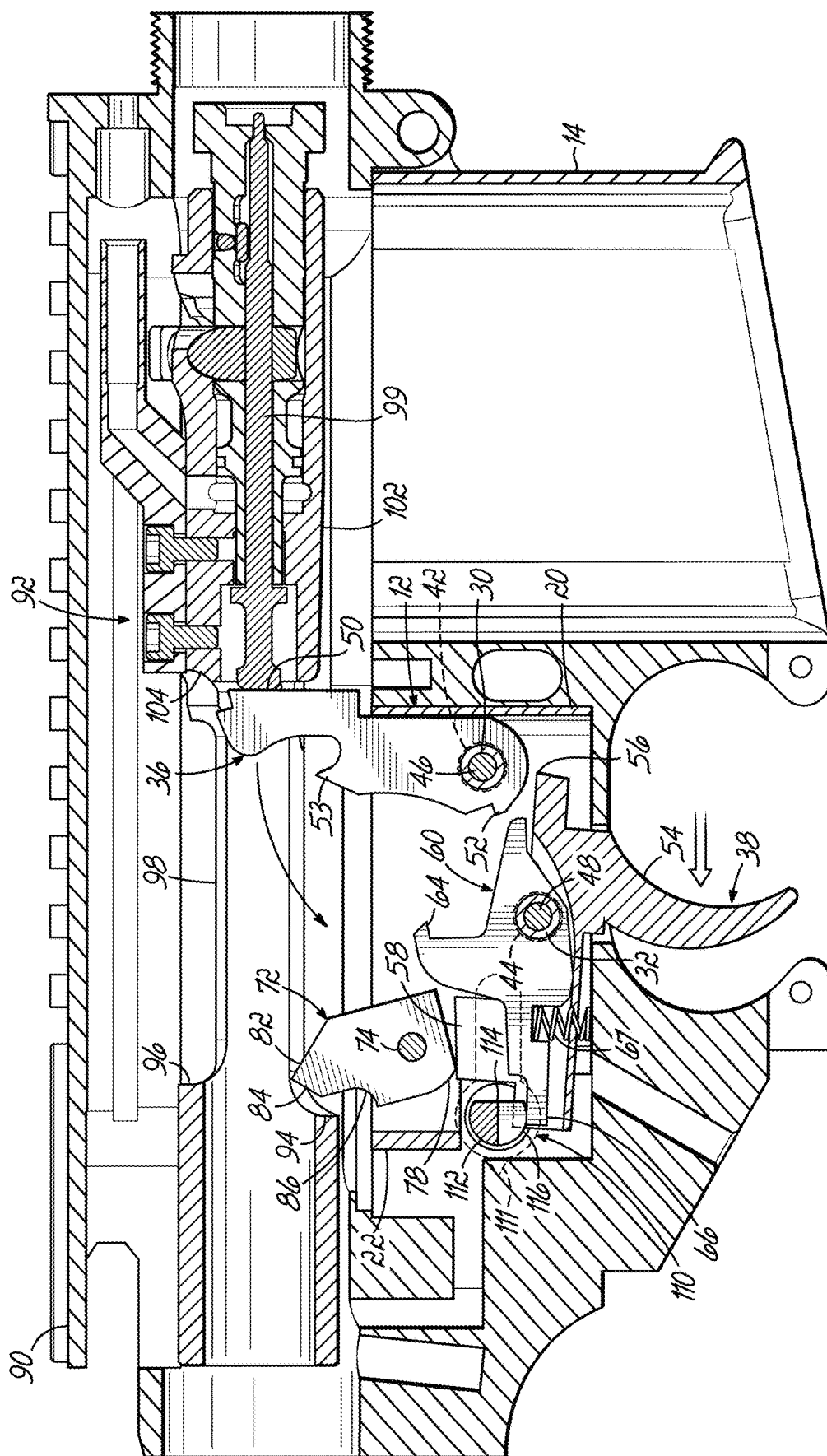


FIG. 9B

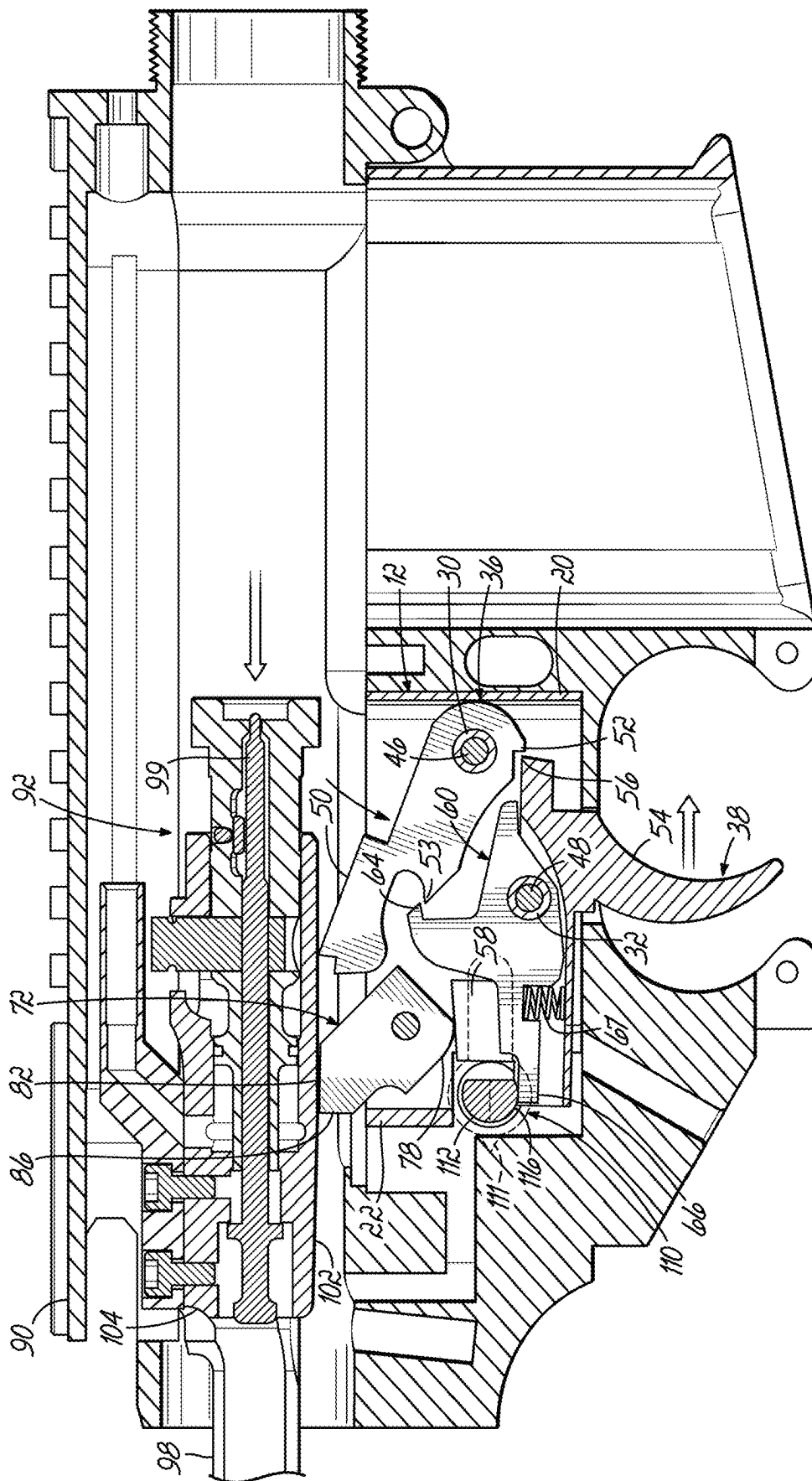


FIG. 9C

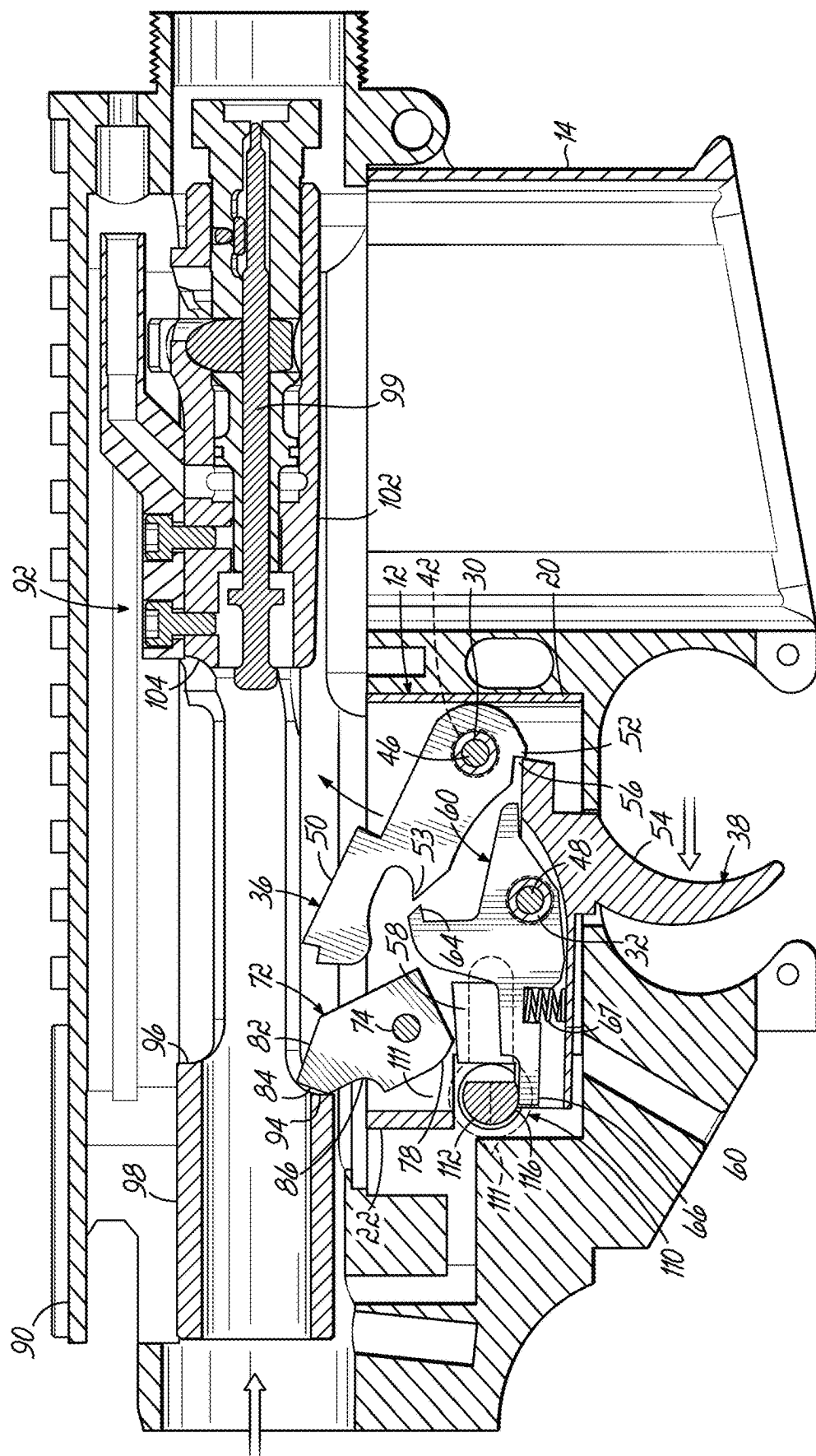


FIG. 9D

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FIREARM TRIGGER MECHANISM**RELATED APPLICATIONS**

This application is a continuation application of U.S. patent application Ser. No. 18/325,225, filed May 30, 2023, and claims the priority benefit of US Provisional Ser. No. 63/374,941 filed Sep. 8, 2022, which are hereby incorporated by reference herein as if fully set forth in their entirety.

FIELD OF THE INVENTION

The present invention relates generally to a firearm trigger mechanism, and more particularly to a semiautomatic trigger that is selectively mechanically reset by movement of the bolt carrier.

BACKGROUND OF THE INVENTION

In a standard semiautomatic firearm, actuation of the trigger releases a sear, allowing a hammer or striker to fire a chambered ammunition cartridge. Part of the ammunition's propellant force is used to cycle the action, extracting and ejecting a spent cartridge and replacing it with a loaded cartridge. The cycle includes longitudinal reciprocation of a bolt and/or carrier, which also resets the hammer or striker.

A standard semiautomatic trigger mechanism includes a disconnecter, which holds the hammer or striker in a cocked position until the trigger member is reset to engage the sear. This allows the firearm to be fired only a single time when the trigger is pulled and held, because the user is not typically able to release the trigger rapidly enough so that the sear engages before the bolt or bolt carrier returns to its in-battery position. The disconnecter prevents the firearm from either firing multiple rounds on a single pull of the trigger, or from allowing the hammer or striker to simply "follow" the bolt as it returns to battery without firing a second round, but leaving the hammer or striker uncocked.

For various reasons, shooters desire to increase the rate of semiautomatic fire. Sometimes this is simply for entertainment and the feeling of shooting a machine gun. In the past, users have been known to employ "bump firing" to achieve rapid semiautomatic fire. Bump firing uses the recoil of the semiautomatic firearm to fire shots in rapid succession. The process involves bracing the rifle with the non-trigger hand, loosening the grip of the trigger hand (but leaving the trigger finger in its normal position in front of the trigger), and pushing the rifle forward in order to apply pressure on the trigger from the finger while keeping the trigger finger stationary. When fired with the trigger finger held stationary, the firearm will recoil to the rear and allow the trigger to reset as it normally does. When the non-trigger hand pulls the firearm away from the body and back forward toward the original position, it causes the trigger to be pressed against the stationary finger again, firing another round as the trigger is pushed back.

Devices for increasing the rate of semiautomatic fire are shown in U.S. Pat. Nos. 9,568,264, 9,816,772, and 9,939,221, issued to Thomas Allen Graves. The devices shown in these patents forcefully reset the trigger with rigid mechanical contact between the trigger member and the bolt as the action cycles. To adapt this invention to an AR-pattern firearm, for example, would require not only a modified fire control mechanism, but also a modified bolt carrier.

Other devices for increasing the rate of semiautomatic fire are shown in the assignee's U.S. Pat. Nos. 10,514,223 and 11,346,627 and U.S. patent application Ser. No. 18/048,572

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filed Oct. 21, 2022, all of which are hereby incorporated by reference as if fully set forth in their entirety. In these devices the hammer forces the trigger to the set position, and a locking bar prevents early hammer release.

Another device for increasing the rate of semiautomatic fire is shown in U.S. Pat. No. 7,398,723, issued on Jul. 15, 2008, to Brian A. Blakley, and is hereby incorporated by reference herein as if fully set forth in its entirety. The device shown in this patent has a pivoting cam which is contacted by the rearwardly traveling bolt carrier, pivoting the cam rearwardly such that the bottom surface of the cam presses downward on the trigger-extension, forcing the rear of the trigger down, and thereby moving forward the surface of the trigger that an operator's finger engages.

Further improvement in forced reset triggers is desired.

SUMMARY OF INVENTION

The present invention provides a semiautomatic trigger mechanism for increasing rate of fire that can be retrofitted into popular existing firearm platforms. In particular, this invention provides a trigger mechanism that can be used in AR-pattern firearms with an otherwise standard M16-pattern bolt carrier assembly. Embodiments of the present invention are particularly adaptable for construction as a "drop-in" replacement trigger module that only requires insertion of two assembly pins and the safety selector. Advantageously, the present invention provides a "three position" trigger mechanism having safe, standard semi-automatic, and forced reset semi-automatic positions.

In one aspect, a firearm trigger mechanism comprises a housing adapted to be installed in a fire control mechanism pocket of a receiver and having a first pair of transversely aligned openings for receiving a hammer pin, a second pair of transversely aligned openings for receiving a trigger pin, and a third pair of transversely aligned openings for receiving a cam pin, a hammer having a sear catch and a hook for engaging a disconnecter and mounted in the housing to pivot on the hammer pin between set and released positions, the hammer adapted to be pivoted rearward by rearward movement of a bolt carrier, a trigger member having a sear and mounted in the housing to pivot on the trigger member pin between set and released positions, wherein the sear and sear catch are in engagement in the set positions of the hammer and trigger member and are out of engagement in the released positions of the hammer and trigger member, a disconnecter having a hook for engaging the hammer and mounted in the housing to pivot on the trigger member pin, a cam having a cam lobe and mounted in the housing to pivot on the cam pin, the cam being pivotable between a first position at which the cam lobe does not force the trigger member towards the set position and a second position at which the cam lobe does force the trigger member towards the set position, and a safety selector adapted to be mounted in the fire control mechanism pocket to pivot between safe, standard semi-automatic, and forced reset semi-automatic positions. In the standard semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and pivoting of the cam from the first position to the second position such that the cam lobe forces the trigger member towards the set position but prior to reaching the set position the disconnecter hook catches the hammer hook, and thereafter forward movement of the bolt carrier causes the cam to pivot to the first position, at which time a user must manually release the trigger member to free the hammer from the disconnecter to permit the hammer and trigger member to pivot to the set positions so that the user can pull

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the trigger member to fire the firearm. In the forced reset semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and pivoting of the cam from the first position to the second position such that the cam lobe forces the trigger member to the set position, the safety selector preventing the disconnecter hook from catching the hammer hook, and thereafter forward movement of the bolt carrier causes the cam to pivot to the first position, at which time the user can pull the trigger member to fire the firearm without manually releasing the trigger member.

The safety selector can have a protuberance thereon which, when the safety selector is in the forced reset semi-automatic position, contacts the disconnecter preventing the disconnecter hook from catching the hammer hook. The trigger mechanism can further include a spring which biases the trigger member towards the set position.

In another aspect, a firearm trigger mechanism comprises a housing adapted to be installed in a fire control mechanism pocket of a receiver and having a first pair of transversely aligned openings for receiving a hammer pin, a second pair of transversely aligned openings for receiving a trigger pin, and a third pair of transversely aligned openings for receiving a cam pin, a hammer having a sear catch and a hook for engaging a disconnecter and mounted in the housing to pivot on the hammer pin between set and released positions, the hammer adapted to be pivoted rearward by rearward movement of a bolt carrier, a trigger member having a sear and mounted in the housing to pivot on the trigger member pin between set and released positions, wherein the sear and sear catch are in engagement in the set positions of the hammer and trigger member and are out of engagement in the released positions of the hammer and trigger member, a disconnecter having a hook for engaging the hammer and mounted in the housing to pivot on the trigger member pin, a cam having a cam lobe and mounted in the housing to pivot on the cam pin, the cam being pivotable between a first position at which the cam lobe does not force the trigger member towards the set position and a second position at which the cam lobe does force the trigger member towards the set position, and a safety selector adapted to be mounted in the fire control mechanism pocket to pivot between safe, standard semi-automatic, and forced reset semi-automatic positions. In the standard semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and pivoting of the cam from the first position to the second position such that the cam lobe forces the trigger member towards the set position but prior to reaching the set position the disconnecter hook catches the hammer hook, and thereafter forward movement of the bolt carrier causes the cam to pivot to the first position, at which time a user must manually release the trigger member to free the hammer from the disconnecter to permit the hammer and trigger member to pivot to the set positions so that the user can pull the trigger member to fire the firearm. In the forced reset semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and pivoting of the cam from the first position to the second position such that the cam lobe forces the trigger member to the set position, the safety selector preventing the disconnecter hook from catching the hammer hook, and thereafter forward movement of the bolt carrier causes the cam to pivot to the first position, at which time the user can pull the trigger member to fire the firearm without manually releasing the trigger member.

The safety selector can have a protuberance thereon which, when the safety selector is in the forced reset

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semi-automatic position, contacts the disconnecter preventing the disconnecter hook from catching the hammer hook. The first and second pairs of transversely aligned openings in the housing can be adapted to be aligned with first and second pairs of transversely aligned assembly pin openings in the fire control mechanism pocket. The trigger mechanism can include a spring which biases the trigger member towards the set position. The spring can be a torsion spring.

In another aspect, a firearm comprises a receiver having a fire control mechanism pocket therein, a reciprocating bolt carrier, a hammer having a sear catch and a hook for engaging a disconnecter and mounted in the fire control mechanism pocket to pivot on a transverse hammer pivot axis between set and released positions, the hammer adapted to be pivoted rearward by rearward movement of the bolt carrier, a trigger member having a sear and mounted in the fire control mechanism pocket to pivot on a transverse trigger member pivot axis between set and released positions, wherein the sear and sear catch are in engagement in the set positions of the hammer and trigger member and are out of engagement in the released positions of the hammer and trigger member, a disconnecter having a hook for engaging the hammer and mounted in the fire control mechanism pocket to pivot on the transverse trigger member pivot axis, a cam having a cam lobe and mounted in the fire control mechanism pocket to pivot on a transverse cam pivot axis, the cam being pivotable between a first position at which the cam lobe does not force the trigger member towards the set position and a second position at which the cam lobe does force the trigger member towards the set position, and a safety selector mounted in the fire control mechanism pocket to pivot between safe, standard semi-automatic, and forced reset semi-automatic positions. In the standard semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and pivoting of the cam from the first position to the second position such that the cam lobe forces the trigger member towards the set position but prior to reaching the set position the disconnecter hook catches the hammer hook, and thereafter forward movement of the bolt carrier causes the cam to pivot to the first position, at which time a user must manually release the trigger member to free the hammer from the disconnecter to permit the hammer and trigger member to pivot to the set positions so that the user can pull the trigger member to fire the firearm. In the forced reset semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and pivoting of the cam from the first position to the second position such that the cam lobe forces the trigger member to the set position, the safety selector preventing the disconnecter hook from catching the hammer hook, and thereafter forward movement of the bolt carrier causes the cam to pivot to the first position, at which time the user can pull the trigger member to fire the firearm without manually releasing the trigger member.

The firearm can further comprise a housing having a first pair of transversely aligned openings with a hammer pin therethrough and a second pair of transversely aligned openings with a trigger member pin therethrough, the hammer mounted on the hammer pin, the trigger member and disconnecter mounted on the trigger member pin. The receiver can have a first pair of transversely aligned assembly pin openings and a second pair of transversely aligned assembly pin openings, the housing first pair of openings coaxial with the receiver first pair of openings and the housing second pair of openings coaxial with the receiver second pair of openings, a first assembly pin passing through the receiver first pair of openings and through the housing

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first pair of openings, and a second assembly pin passing through the receiver second pair of openings and through the housing second pair of openings. The firearm can further comprise a spring which biases the trigger member towards the set position. The spring can be a torsion spring.

In another aspect, a firearm trigger mechanism comprises a hammer having a sear catch and a hook for engaging a disconnecter and adapted to be mounted in a fire control mechanism pocket of a receiver to pivot on a transverse hammer pivot axis between set and released positions, the hammer adapted to be pivoted rearward by rearward movement of a bolt carrier, a trigger member having a sear and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse trigger member pivot axis between set and released positions, wherein the sear and sear catch are in engagement in the set positions of the hammer and trigger member and are out of engagement in the released positions of the hammer and trigger member, a disconnecter having a hook for engaging the hammer and adapted to be mounted in the fire control mechanism pocket to pivot on the transverse trigger member pivot axis, a cam having a cam lobe and adapted to be movably mounted in the fire control mechanism pocket, the cam being movable between a first position at which the cam lobe does not force the trigger member towards the set position and a second position at which the cam lobe does force the trigger member towards the set position, and a safety selector adapted to be mounted in the fire control mechanism pocket to pivot between safe, standard semi-automatic, and forced reset semi-automatic positions. In the standard semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and movement of the cam from the first position to the second position such that the cam lobe forces the trigger member towards the set position but prior to reaching the set position the disconnecter hook catches the hammer hook, and thereafter forward movement of the bolt carrier causes the cam to move to the first position, at which time a user must manually release the trigger member to free the hammer from the disconnecter to permit the hammer and trigger member to pivot to the set positions so that the user can pull the trigger member to fire the firearm. In the forced reset semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer and movement of the cam from the first position to the second position such that the cam lobe forces the trigger member to the set position, the safety selector preventing the disconnecter hook from catching the hammer hook, and thereafter forward movement of the bolt carrier causes the cam to move to the first position, at which time the user can pull the trigger member to fire the firearm without manually releasing the trigger member.

Other aspects, features, benefits, and advantages of the present invention will become apparent to a person of skill in the art from the detailed description of various embodiments with reference to the accompanying drawing figures, all of which comprise part of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

Like reference numerals are used to indicate like parts throughout the various drawing figures, wherein:

FIG. 1 is a top front right perspective view of a drop-in trigger module for an AR-pattern firearm according to one embodiment of the invention.

FIG. 2 is a top rear right perspective view thereof.

FIG. 3 is a top rear right exploded perspective view thereof.

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FIG. 4A is a top rear right cross-sectional view thereof with the safety selector in the safe position and with the hammer and trigger member in their set positions.

FIG. 4B is a bottom rear right cross-sectional view thereof with the safety selector in the safe position and with the hammer and trigger member in their set positions.

FIG. 5A is a top rear right cross-sectional view thereof with the safety selector in the standard semi-automatic position and with the hammer and trigger member in their set positions.

FIG. 5B is a bottom rear right cross-sectional view thereof with the safety selector in the standard semi-automatic position and with the hammer and trigger member in their set positions.

FIG. 6A is a top rear right cross-sectional view thereof with the safety selector in the forced reset semi-automatic position and with the hammer and trigger member in their set positions.

FIG. 6B is a bottom rear right cross-sectional view thereof with the safety selector in the forced reset semi-automatic position and with the hammer and trigger member in their set positions.

FIG. 7 is a cross-sectional view showing the trigger module installed in a typical AR15-pattern lower receiver, with the hammer and trigger member in their set positions and with the bolt carrier in an in-battery position, and with the safety selector in the safe position.

FIG. 8A is a view similar to FIG. 7 but with the safety selector in the standard semi-automatic position.

FIG. 8B is a view similar to FIG. 8A but after the trigger has been pulled to drop the hammer.

FIG. 8C is a view similar to FIG. 8B but with the bolt carrier cycling to the rear to pivot the hammer and cam.

FIG. 8D is a view similar to FIG. 8C but with the bolt carrier having returned to battery and the disconnecter having caught the hammer.

FIG. 9A is a view similar to FIG. 7 but with the safety selector in the forced reset semi-automatic position.

FIG. 9B is a view similar to FIG. 9A but after the trigger has been pulled to drop the hammer.

FIG. 9C is a view similar to FIG. 9B but with the bolt carrier cycling to the rear to pivot the hammer and cam.

FIG. 9D is a view similar to FIG. 9C but with the bolt carrier having returned to battery and the hammer and trigger having returned to their set positions.

DETAILED DESCRIPTION OF THE DRAWINGS

With reference to the drawing figures, this section describes particular embodiments and their detailed construction and operation. Throughout the specification, reference to “one embodiment,” “an embodiment,” or “some embodiments” means that a particular described feature, structure, or characteristic may be included in at least one embodiment. Thus, appearances of the phrases “in one embodiment,” “in an embodiment,” or “in some embodiments” in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the described features, structures, and characteristics may be combined in any suitable manner in one or more embodiments. In view of the disclosure herein, those skilled in the art will recognize that the various embodiments can be practiced without one or more of the specific details or with other methods, components, materials, or the like. In some instances, well-known structures, materials, or operations are not shown or not described in detail to avoid obscuring aspects of the embodiments. “Forward” will indi-

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cate the direction of the muzzle and the direction in which projectiles are fired, while “rearward” will indicate the opposite direction. “Lateral” or “transverse” indicates a side-to-side direction generally perpendicular to the axis of the barrel. Although firearms may be used in any orientation, “left” and “right” will generally indicate the sides according to the user’s orientation, “top” or “up” will be the upward direction when the firearm is gripped in the ordinary manner. QAs used herein, “transverse” means a side-to-side direction generally perpendicular to the longitudinal axis of the barrel.

Referring first to FIGS. 1-6B, there is illustrated a “drop-in” trigger module 10 adapted for use in an AR-pattern firearm according to a first embodiment of the present invention. As used herein, “AR-pattern” firearm includes the semiautomatic versions of the AR10 and AR15 firearms and variants thereof of any caliber, including pistol caliber carbines or pistols using a blow-back bolt. While select fire (fully automatic capable) versions of this platform, such as the M16 and M4, are also AR-pattern firearms, this invention only relates to semiautomatic firearm actions. The concepts of this invention may be adaptable to other popular semiautomatic firearm platforms, such as the Ruger 10/22™, AK-pattern firearms, and HK-pattern firearms.

The module 10 includes a frame or housing 12 sized and shaped to fit within the internal fire control pocket of an AR-pattern lower receiver 14. Lower receiver parts not important to the present invention are well-known in the art and are omitted from the figures for clarity. The housing 12 includes left and right sidewalls 16, 18 which extend substantially vertically and parallel to one another in a laterally spaced-apart relationship. The sidewalls 16, 18 may be interconnected by front and rear sidewalls 20, 22. The sidewalls 16, 18 include first and second pairs of aligned openings 24, 26 for receiving hollow transverse pins 30, 32 upon which a hammer 36 and trigger member 38 pivot. The openings 24, 26 are located coaxially with openings 42, 44 in the lower receiver 14. Standard AR-pattern hammer and trigger pins 46, 48 pass through the openings 42, 44 in the lower receiver 14 and through the hollow transverse pins 30, 32 to assemble the housing 12 into the lower receiver 14. Thus, the pins 30, 32 retain the hammer 36 and trigger member 38 in the housing 12 in modular fashion, whereas the pins 46, 48 retain the trigger module 10 in the lower receiver 14.

The hammer 36 has a hammer head 50, a sear catch 52, and a hammer hook 53. The hammer 36 is spring biased towards a forward position by a standard AR-pattern hammer torsion spring (not shown).

The trigger member 38 has a trigger blade 54 that extends downwardly. The trigger blade 54 is the part of the trigger member 38 contacted by a user’s finger to actuate the trigger mechanism. The trigger blade 54 may be curved (as shown) or straight, as desired. The trigger member 38 has a sear 56. When the sear 56 and the sear catch 52 are engaged, the hammer 36 and trigger member 38 are in their set positions. When the sear 56 and sear catch 52 are not engaged, the hammer 36 and trigger member 38 are in their released positions. The trigger member 38 also has a cam follower 58. The trigger member 38 is spring biased by a standard AR-pattern trigger member torsion spring (not shown) so that the trigger blade 54 is spring biased towards a forward position.

A disconnecter 60 is pivoted on the hollow transverse pin 32 upon which the trigger member 38 pivots. The disconnecter 60 has a disconnecter hook 64 and a tail 66. The tail 66 of the disconnecter 60 is spring biased upwardly away

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from a tail 68 of the trigger member 38 by a standard AR-pattern disconnecter compression spring 67.

A cam 72 is movably mounted to the housing 12. For example, the cam 72 can be pivoted on a cam pin 74 that is installed in aligned openings 76 in the sidewalls 16, 18 of the housing 12. The cam 72 has a cam lobe 78 that interacts with the cam follower 58, in a manner to be described below. The cam 72 has a first contact surface 82 on an upper forward portion thereof and a second contact surface 84 on an upper rearward portion thereof. The cam 72 has a notch 86 below the second contact surface 84 to provide clearance for the rear wall 22 of the housing 12. Alternatively, the cam 72 can be slidably mounted to the housing 12 with or without spring bias.

An upper receiver 90 houses a bolt carrier assembly 92. As is well-known in the art, the bolt carrier assembly 92 (or blow-back bolt) slidably reciprocates in the upper receiver 90 and engages the breach of a barrel or barrel extension. As used herein, “bolt carrier” and “bolt carrier assembly” may be used interchangeably and include a blow-back type bolt used in pistol caliber carbine configurations of the AR-platform. The bolt carrier assembly 92 used with the embodiments of this invention can have either a standard mil-spec M16-pattern bolt carrier, a standard AR15-pattern bolt carrier, or some variation of the two, depending on the design of the cam 72, and whether operated by a gas direct impingement system or a gas piston system. The bolt carrier assembly 92 has an engagement surface 94 in a rear portion 96 of the bolt carrier body 98. As in an ordinary AR15-pattern configuration, during rearward travel of the bolt carrier assembly 92 a lower surface 102 in a forward portion 104 of the bolt carrier body 98 contacts the face of the hammer head 50 causing the hammer 36 to pivot rearward. During further rearward travel of bolt carrier assembly 92 the lower surface 102 of the bolt carrier body 98 contacts the surface 82 of the cam 72 to the pivot cam 72 in a first direction from a first position to a second position. During forward travel of the bolt carrier assembly 92 the engagement surface 94 of the bolt carrier body 98 contacts the surface 84 of the cam 72 to pivot the cam 72 in a second opposite direction from the second position to the first position.

A three position safety selector 110 has safe, standard semi-automatic, and forced reset semi-automatic positions. When in the safe position (safety selector indicator 111 pointing forward), a wide semi-circular portion 112 of the safety selector 110 prevents the trigger blade 54 from being pulled (FIGS. 4A, 4B, and 7). When in the standard semi-automatic position (safety selector indicator 111 pointing upward), a flat portion 114 of the safety selector 110 permits the trigger blade 54 to be pulled. The disconnecter 60 can pivot with the trigger member 38 and the disconnecter hook 64 can catch the hammer hook 53 during rearward pivoting travel of the hammer head 50. (FIGS. 5A and 5B). When in the forced reset semi-automatic position (safety selector indicator 111 pointing rearward), a narrow semi-circular portion 116 permits the trigger blade 54 to be pulled but prevents the disconnecter 60 from pivoting with the trigger member 38 thus preventing the disconnecter hook 64 from catching the hammer hook 53 during rearward pivoting travel of the hammer head 50. (FIGS. 6A and 6B). In other words, in the forced reset semi-automatic position, the disconnecter 60 is “disabled” in that the disconnecter hook 64 is unable to catch the hammer hook 53 during cycling of the bolt carrier assembly 92.

Referring now to FIGS. 8A-8D, with the safety selector 110 set in the standard semi-automatic position, rearward

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finger pressure on the trigger blade 54 causes the trigger member 38 to rotate clockwise. Depending on the position of the cam 72, the cam follower 58 may or may not act upon the cam lobe 78 to pivot the cam 72 clockwise. Rotation of the trigger member 38 causes the sear 56 to disengage from the sear catch 52 of the hammer 36. This allows the hammer 36 to drop by spring force onto the firing pin 99 of the bolt carrier assembly 92, discharging an ammunition cartridge (not shown), and causing the action to cycle by moving the bolt carrier assembly 92 rearward. Rearward travel of the bolt carrier assembly 92 causes the lower surface 102 to contact the face of the hammer head 50 and pivot the hammer 36 counter-clockwise. During pivoting travel of the hammer 36 the disconnector hook 64 catches the hammer hook 53. During further rearward travel of the bolt carrier assembly 92 the lower surface 102 contacts the surface 82 of the cam 72 to pivot the cam 72 counter-clockwise. As the cam 72 pivots counter-clockwise, the cam lobe 78 may act upon the cam follower 58 to pivot the trigger member 38 counter-clockwise. Forward travel of the bolt carrier assembly 92 returning to battery causes the surface 94 to contact the surface 84 of the cam 72 to pivot the cam 72 clockwise. At this point rearward finger pressure on the trigger blade 54 must be released to allow the sear 56 to engage the sear catch 52, returning the hammer 36 and trigger member 38 to their set positions. Thereafter the user can reapply rearward finger pressure on the trigger blade 54 to fire another round.

Referring now to FIGS. 9A-9D, with the safety selector 110 set in the forced reset semi-automatic position, rearward finger pressure on the trigger blade 54 causes the trigger member 38 to rotate clockwise. The narrow semi-circular portion 116 of the safety selector 110 prevents the disconnector 60 from rotating with the trigger member 38, thus "disabling" the disconnector 60, preventing the disconnector hook 64 from catching the hammer hook 53. Depending on the position of the cam 72, the cam follower 58 may or may not act upon the cam lobe 78 to pivot the cam 72 clockwise. Rotation of the trigger member 38 causes the sear 56 to disengage from the sear catch 52 of the hammer 36. This allows the hammer 36 to drop by spring force onto the firing pin 99 of the bolt carrier assembly 92, discharging an ammunition cartridge, and causing the action to cycle by moving the bolt carrier assembly 92 rearward. Rearward travel of the bolt carrier assembly 92 causes the lower surface 102 to contact the face of the hammer head 50 and pivot the hammer 36 counter-clockwise. During further rearward travel of the bolt carrier assembly 92 the lower surface 102 contacts the surface 82 of the cam 72 to pivot the cam 72 counter-clockwise. As the cam 72 pivots counter-clockwise, the cam lobe 78 acts upon the cam follower 58 to the pivot trigger member 38 counter-clockwise. The bolt carrier assembly 92 thereby forces the hammer 36 and trigger member 38 to their set positions wherein the sear 56 engages the sear catch 52. Forward travel of the bolt carrier assembly 92 returning to battery causes the surface 94 to contact the surface 84 of the cam 72 to pivot the cam 72 clockwise. At this point the user can reapply rearward finger pressure on the trigger blade 54 to fire another round, without first manually releasing rear finger pressure on the trigger blade 54.

Thus, as the bolt carrier assembly 92 returns forward, the trigger member 38 is held in its set position by cam 72. The trigger member 38 cannot be pulled to release the sear/sear catch engagement, thus precluding early hammer release or "hammer follow" against the bolt carrier assembly 92 and firing pin 99 as the bolt carrier assembly 92 is returning to battery. When the bolt carrier assembly 92 has reached (or

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nearly reached) its closed, in-battery position, the engagement surface 94 contacts and forwardly displaces the contact surface 84 of cam 72, disengaging the cam lobe 78 from the cam follower 58, allowing the trigger blade 54 to be pulled. Again, this prevents early hammer release and contact of the hammer against the firing pin before the bolt is completely locked and in-battery.

While various embodiments of the present invention have been described in detail, it should be apparent that modifications and variations thereto are possible, all of which fall within the true spirit and scope of the invention. Therefore, the foregoing is intended only to be illustrative of the principles of the invention. The invention resides in each individual feature described herein, alone, and in any and all combinations and subcombinations of any and all of those features. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not intended to limit the invention to the exact construction and operation shown and described. Accordingly, all suitable modifications and equivalents may be included and considered to fall within the scope of the invention, defined by the following claim or claims.

What is claimed is:

1. A firearm trigger mechanism for a firearm having a fire control mechanism pocket and a reciprocating bolt means, the trigger mechanism operable in a first, standard semi-automatic mode and in a second, forced reset semi-automatic mode, the mechanism comprising:

a hammer having a hammer sear surface and a hook for engaging a disconnector and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse hammer pivot axis between set and released positions, the hammer adapted to be pivoted rearward by rearward movement of the bolt means,

a trigger member having a trigger sear surface and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse trigger member pivot axis between set and released positions,

wherein the trigger member sear surface and hammer sear catch surface are in engagement in the set positions of the hammer and trigger member and are out of engagement in the released positions of the hammer and trigger member,

the disconnector having a hook for engaging the hammer and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse disconnector pivot axis, and

a cam having a cam lobe and adapted to be movably mounted in the fire control mechanism pocket, the cam being movable between a first position and a second position, in the second position the cam lobe forces the trigger member toward the set position,

whereupon in the first mode, rearward movement of the bolt means causes rearward pivoting of the hammer such that the disconnector hook catches the hammer hook, and thereafter the bolt means moves forward into battery, at which time a user must manually reduce pressure on the trigger member to free the hammer from the disconnector to permit the hammer and trigger member to pivot to the set positions so that the user can pull the trigger member to fire the firearm, and

whereupon in the second mode, rearward movement of the bolt means causes rearward pivoting of the hammer such that the disconnector hook is prevented from holding the hammer, and thereafter the bolt means moves forward into battery, at which time the user can pull the trigger member to fire the firearm.

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2. The trigger mechanism of claim 1, further comprising:
a housing having a first pair of transversely aligned openings with a hammer pin therethrough and a second pair of transversely aligned openings with a trigger member pin therethrough,
the hammer mounted on the hammer pin, the trigger member and disconnector mounted on the trigger member pin.

3. The trigger mechanism of claim 1, further comprising a spring which biases the trigger member toward the set position.

4. The trigger mechanism of claim 3, wherein the spring is a torsion spring.

5. The trigger mechanism of claim 1, wherein the trigger member pivot axis and disconnector pivot axis are coaxial.

6. A firearm trigger mechanism for a firearm having a fire control mechanism pocket and a reciprocating bolt means, the trigger mechanism operable in a first, standard semi-automatic mode and in a second, forced reset semi-automatic mode, the mechanism comprising:
a hammer having a sear surface and a hook for engaging a disconnector and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse hammer pivot axis between set and released positions, the hammer adapted to be pivoted rearward by rearward movement of the bolt means,
a trigger member having a sear surface and adapted to be mounted in the fire control mechanism pocket to move between set and released positions,
wherein the hammer sear surface and trigger member sear surface are in engagement in the set positions of the hammer and trigger member and are out of engagement in the released positions of the hammer and trigger member,
the disconnector having a hook for engaging the hammer and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse disconnector pivot axis, and
a cam having a cam lobe and adapted to be movably mounted in the fire control mechanism pocket, the cam being movable between a first position and a second position, in the second position the cam prevents the trigger member from moving from the set position to the released position,
whereupon in the first mode, rearward movement of the bolt means causes rearward pivoting of the hammer such that the disconnector hook catches the hammer hook, and thereafter the bolt means moves forward into battery, at which time a user must manually reduce pressure on the trigger member to free the hammer from the disconnector to permit the hammer and trigger member to move to the set positions so that the user can pull the trigger member to fire the firearm again, and whereupon in the second mode, rearward movement of the bolt means causes rearward pivoting of the hammer, movement of the trigger member to the set position, and the disconnector hook is prevented from holding the hammer, and thereafter the bolt means moves forward into battery, at which time the cam is moved to the first position, allowing the user to pull the trigger member to fire the firearm.

7. The trigger mechanism of claim 6, further comprising a spring which biases the trigger member toward the set position.

8. The trigger mechanism of claim 7, wherein the spring is a torsion spring.

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9. The trigger mechanism of claim 6, wherein the trigger member pivots on a transverse trigger axis between set and released positions.

10. A firearm trigger mechanism for a firearm having a fire control mechanism pocket and a reciprocating bolt means, the trigger mechanism operable in a first, standard semi-automatic mode and in a second, forced reset semi-automatic mode, the mechanism comprising:

a hammer having a sear surface and a hook for engaging a disconnector and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse hammer pivot axis between set and released positions, the hammer adapted to be pivoted rearward by rearward movement of the bolt means,

a trigger member having a sear surface and adapted to be mounted in the fire control mechanism pocket to move between set and released positions,

wherein the hammer sear surface and trigger member sear surface are in engagement in the set positions of the hammer and trigger member and are out of engagement in the released positions of the hammer and trigger member,

the disconnector having a hook for engaging the hammer and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse disconnector pivot axis, and

a cam having a cam lobe and adapted to be movably mounted in the fire control mechanism pocket, the cam being movable between a first position and a second position, movement of the cam to the second position causing the trigger member to move from the released position toward the set position,

whereupon in the first mode, rearward movement of the bolt means causes rearward pivoting of the hammer such that the disconnector hook catches the hammer hook, and thereafter the bolt means moves forward into battery, at which time a user must manually reduce pressure on the trigger member to free the hammer from the disconnector to permit the hammer and trigger member to move to the set positions so that the user can pull the trigger member to fire the firearm again, and whereupon in the second mode, rearward movement of the bolt means causes rearward pivoting of the hammer and causes movement of the trigger member to the set position, and wherein the disconnector hook is prevented from holding the hammer, and thereafter the bolt means moves forward into battery, at which time the cam is moved to the first position and the user can pull the trigger member to fire the firearm again.

11. The trigger mechanism of claim 10, further comprising a spring which biases the trigger member toward the set position.

12. The trigger mechanism of claim 11, wherein the spring is a torsion spring.

13. The trigger mechanism of claim 10, wherein the trigger member pivots on a transverse trigger axis between set and released positions.

14. A firearm trigger mechanism comprising: a hammer having a sear surface and a hook for engaging a disconnector and adapted to be mounted in a fire control mechanism pocket of a receiver to move between set and released positions, the hammer adapted to be moved to the set position by rearward movement of a bolt means, a trigger member having a sear surface and adapted to be mounted in the fire control mechanism pocket to move between set and released positions, wherein the hammer sear surface and trigger member sear surface are in position to engage in the

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set positions of the hammer and trigger member and are out of engagement in the released positions of the hammer and trigger member, the disconnecter having a hook for engaging the hammer, and a cam having a cam lobe and adapted to be movably mounted in the fire control mechanism pocket, the cam being movable between a first position and a second position, in the second position the cam lobe forces the trigger member toward the set position, when in a standard semi-automatic mode, rearward movement of the bolt carrier causes movement of the hammer such that the disconnecter hook catches the hammer hook, and thereafter the bolt means moves forward into battery, at which time a user must manually reduce pressure on the trigger member to free the hammer from the disconnecter to permit the hammer sear surface and trigger member sear surface to move into engagement so that the user can pull the trigger member to fire the firearm, and when in a forced reset semi-automatic mode, rearward movement of the bolt means causes movement of the hammer and the disconnecter hook is prevented from holding the hammer, and thereafter the bolt means moves forward into battery, at which time the user can pull the trigger member to fire the firearm.

15. A firearm trigger mechanism comprising:

a hammer having a sear surface and a hook means for engaging a disconnecter and adapted to move between set and released positions, the hammer adapted to be moved to the set position by rearward movement of a bolt means,

a trigger means having a sear surface and adapted to move between set and released positions,

wherein the hammer sear surface and trigger means sear surface are positioned to engage when the hammer and trigger means are in their set positions and are out of engagement in the hammer and trigger means are in their released positions,

the disconnecter having a disconnecter hook means for engaging the hammer hook means,

a cam adapted to be movable between a first position at which the cam does not force the trigger member into the set position and a second position at which the cam does force the trigger member toward the set position, and

a means for selecting between at least standard semi-automatic and forced reset semi-automatic modes,

when in the standard semi-automatic position, rearward movement of the bolt means causes movement of the hammer such that the disconnecter hook means catches the hammer hook means, and thereafter the bolt means moves forward into battery, at which time a user must manually reduce pressure on the trigger means to free the hammer from the disconnecter to permit the hammer and trigger means to move to the set positions so that the user can pull the trigger means to fire the firearm, and

when in the forced reset semi-automatic position, rearward movement of the bolt means causes movement of the hammer, the disconnecter is prevented from holding the hammer, and thereafter the bolt means moves forward into battery, at which time the user can pull the trigger means to fire the firearm.

16. A firearm trigger mechanism comprising:

a hammer having a sear engagement surface and a hook means for engaging a disconnecter and adapted to move between set and released positions, the hammer adapted to be moved to the set position by rearward movement of a bolt means,

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a trigger means having a sear engagement surface and adapted to move between set and released positions, wherein the trigger means and hammer sear engagement surfaces are in position to engage in the set positions of the hammer and trigger means and will not engage in the released positions of the hammer and trigger means, the disconnecter having a hook means for engaging the hammer hook means, and

a cam movable between a first position and a second position, in the second position the cam forces the trigger member toward the set position,

when in a standard semi-automatic mode, rearward movement of the bolt means causes movement of the hammer and the disconnecter hook means catches the hammer hook means, and thereafter the bolt means moves forward into battery, at which time a user must manually reduce pressure on the trigger means to free the hammer from the disconnecter to permit the hammer and trigger means to move to their set positions so that the user can pull the trigger means to fire the firearm, and

when in a forced reset semi-automatic mode, upon rearward movement of the bolt means, the disconnecter is prevented from holding the hammer, and thereafter the bolt means moves forward into battery, at which time the user can pull the trigger means to fire the firearm.

17. A firearm trigger mechanism comprising:

a hammer movable between a set position and a released position, and having a sear engagement surface;

a trigger member having a sear engagement surface, the trigger member being movable between a set position and a released position;

a cam configured to move during cycling of the firearm's action and to contact the trigger member to bias it toward the set position;

a movable blocking means configured to selectively prevent the hammer sear catch surface from engaging with the sear in the set position;

a mode selector operable by the user to select between at least two modes of operation of the trigger mechanism, including:

a semi-automatic mode, in which the hammer and trigger member sear engagement surfaces are not able engage in the set position during cycling of the firearm's action until the user manually reduces pressure from the trigger member to disengage the blocking means before firing again, regardless of whether the cam moves the trigger member to the set position; and

a forced reset mode, in which the cam moves during cycling and forcibly biases the trigger member into the set position with the hammer and trigger member sear engagement surfaces engaged, permitting the user to immediately fire again without the user manually releasing pressure on the trigger member; wherein if the cam moves in both modes, the difference in operation between modes is determined by movable selection of the blocking means, thereby selectively either permitting or preventing the hammer and trigger member sear engagement surfaces from engaging when the trigger member is biased by the cam.

18. For use in a firearm having a semiautomatic action, a firearm trigger mechanism comprising:

a trigger member movable between a set condition in which the trigger member is ready to fire and a released condition; and

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a cam movable between a first position and a second position, in the second position, the cam contacting and biasing the trigger member toward the set condition; wherein cycling of the firearm's action causes the cam to move from the first position toward the second position; wherein the trigger mechanism is selectable between at least standard semi-automatic and forced reset semiautomatic operating modes, in the standard semi-automatic mode, after firing, cycling of the action causes the cam to move the trigger member without reaching the set condition, such that manually releasing pressure on the trigger member by the user is required to fully reset the trigger mechanism and enable subsequent firing, and in the forced reset semi-automatic mode, after firing, cycling of the action causes the cam to force the trigger member to the set condition, thereby enabling subsequent firing without requiring further manual reduction of pressure on the trigger member; and wherein a selector means is provided to selectively prevent the trigger member from being fully reset by the cam without the user manually reducing pressure on the trigger member, thereby enabling operation in the standard semi-automatic mode.

* * * * *

EXHIBIT E

(12) **United States Patent**
Strbac

(10) **Patent No.:** **US 12,636,403 B2**
(45) **Date of Patent:** ***May 26, 2026**

(54) **FIREARM TRIGGER MECHANISM**

(56) **References Cited**

(71) Applicant: **ABC IP, LLC**, Dover, DE (US)

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(72) Inventor: **Mladen Thomas Strbac**, Cleveland, OH (US)

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(73) Assignee: **ABC IP, LLC**, Dover, DE (US)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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This patent is subject to a terminal disclaimer.

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Statutory Invention Registration No. H107, Inventor: Bauer, Published Aug. 5, 1986 (8 pages).

(22) Filed: **Jan. 21, 2025**

(Continued)

(65) **Prior Publication Data**

Primary Examiner — J. Woodrow Eldred

US 2025/0170297 A1 May 29, 2025

(57) **ABSTRACT**

Related U.S. Application Data

(63) Continuation of application No. 18/665,926, filed on May 16, 2024, now Pat. No. 12,274,807, which is a (Continued)

(51) **Int. Cl.**

F41A 19/24 (2006.01)

A61L 24/00 (2006.01)

A61L 24/04 (2006.01)

(52) **U.S. Cl.**

CPC **A61L 24/0036** (2013.01); **A61L 24/0015** (2013.01); **A61L 24/043** (2013.01);
(Continued)

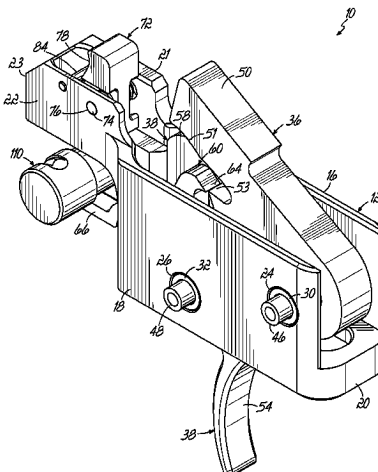
(58) **Field of Classification Search**

CPC F41A 19/24; F41A 19/10; F41A 19/15;
F41A 19/16; F41A 17/46

See application file for complete search history.

A trigger mechanism that can be used in AR-pattern firearms has a hammer, a trigger member, a disconnecter, a locking member, and a “three position” safety selector having safe, standard semi-automatic, and forced reset semi-automatic positions. In the standard semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer such that the disconnecter hook catches the hammer hook, at which time a user must manually release the trigger member to free the hammer from the disconnecter to permit the hammer and trigger member to pivot to the set positions so that the user can pull the trigger member to fire the firearm. In the forced reset semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer causing the trigger member to be forced to the set position, the safety selector preventing the disconnecter hook from catching the hammer hook, and thereafter when the bolt carrier reaches the substantially in-battery

(Continued)



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position the user can pull the trigger member to fire the firearm without manually releasing the trigger member. The locking member is pivotable between a first position at which the locking member mechanically blocks the trigger member from moving to the released position and a second position at which the locking member does not mechanically block the trigger member allowing the trigger member to be moved to the released position. The locking member is spring biased toward the first position and moved against the spring bias to the second position by contact from the bolt carrier during forward movement of the bolt carrier as the bolt carrier reaches a substantially in-battery position.

55 Claims, 18 Drawing Sheets

Related U.S. Application Data

continuation of application No. 18/346,423, filed on Jul. 3, 2023, now Pat. No. 12,036,336, which is a continuation of application No. 18/048,572, filed on Oct. 21, 2022, now Pat. No. 11,724,003.

(60) Provisional application No. 63/297,884, filed on Jan. 10, 2022.

(52) U.S. Cl.

CPC *F41A 19/24* (2013.01); *A61L 2300/252* (2013.01); *A61L 2300/418* (2013.01); *A61L 2400/04* (2013.01); *A61L 2430/36* (2013.01)

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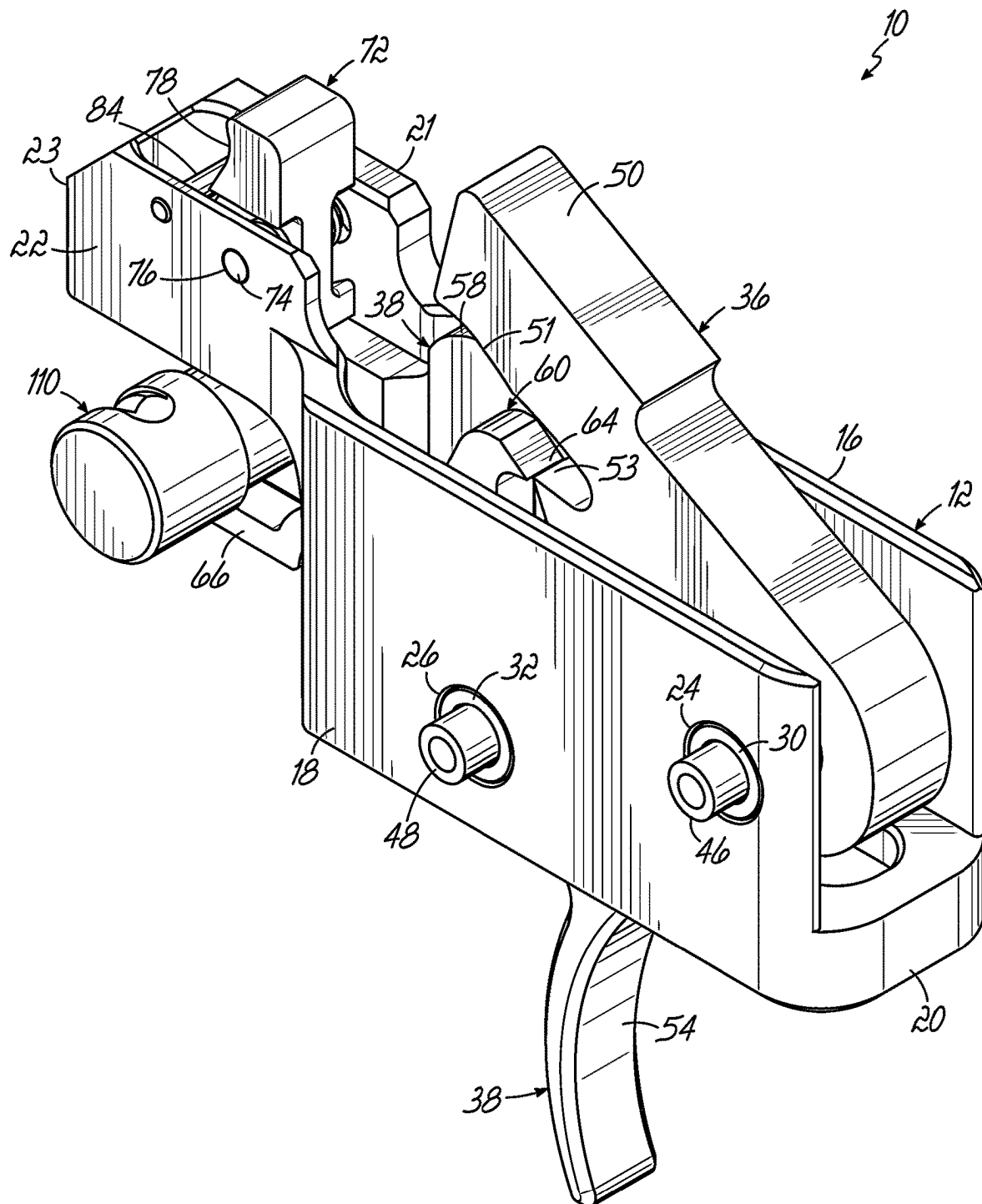


FIG. 1

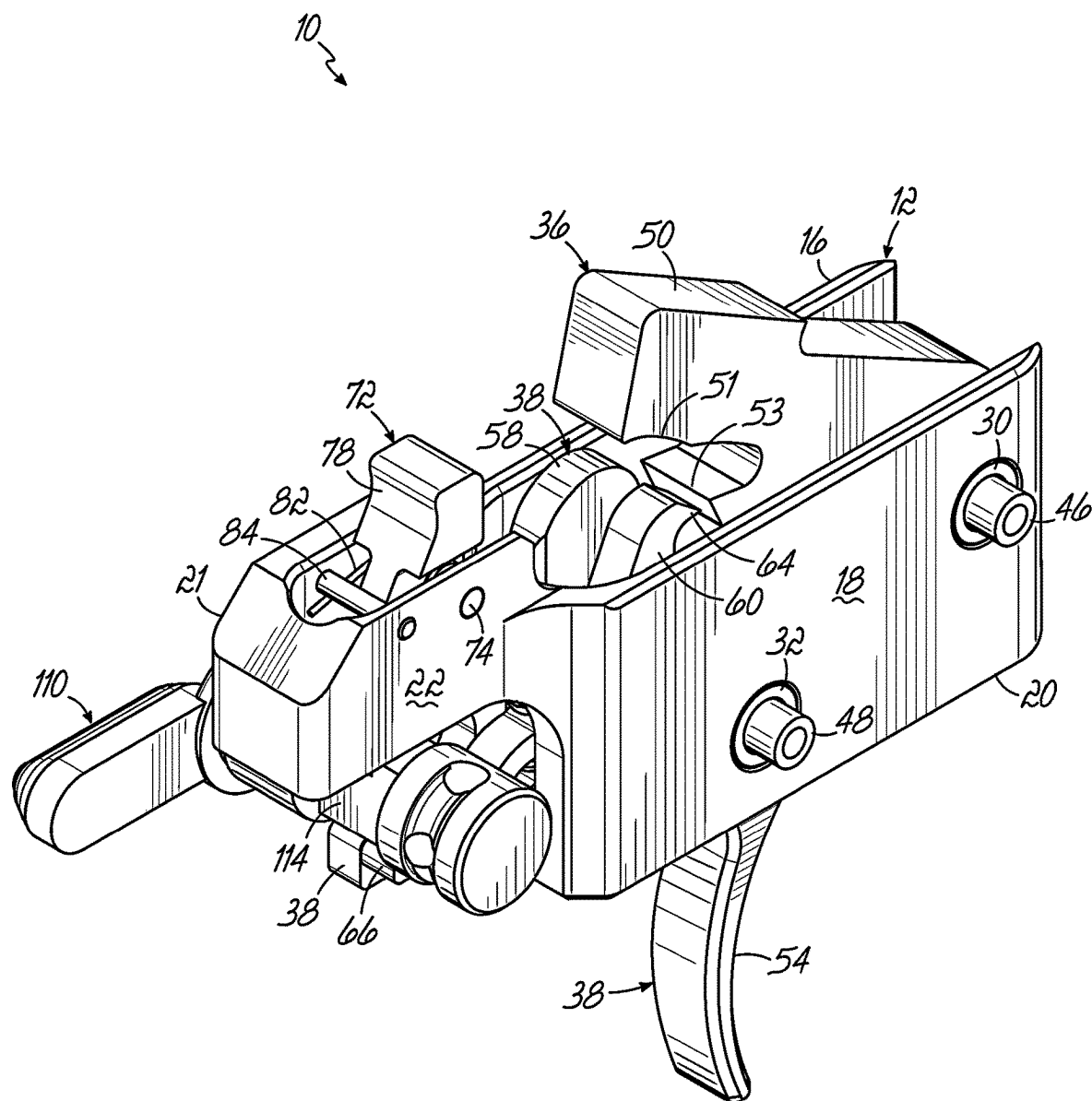


FIG. 2

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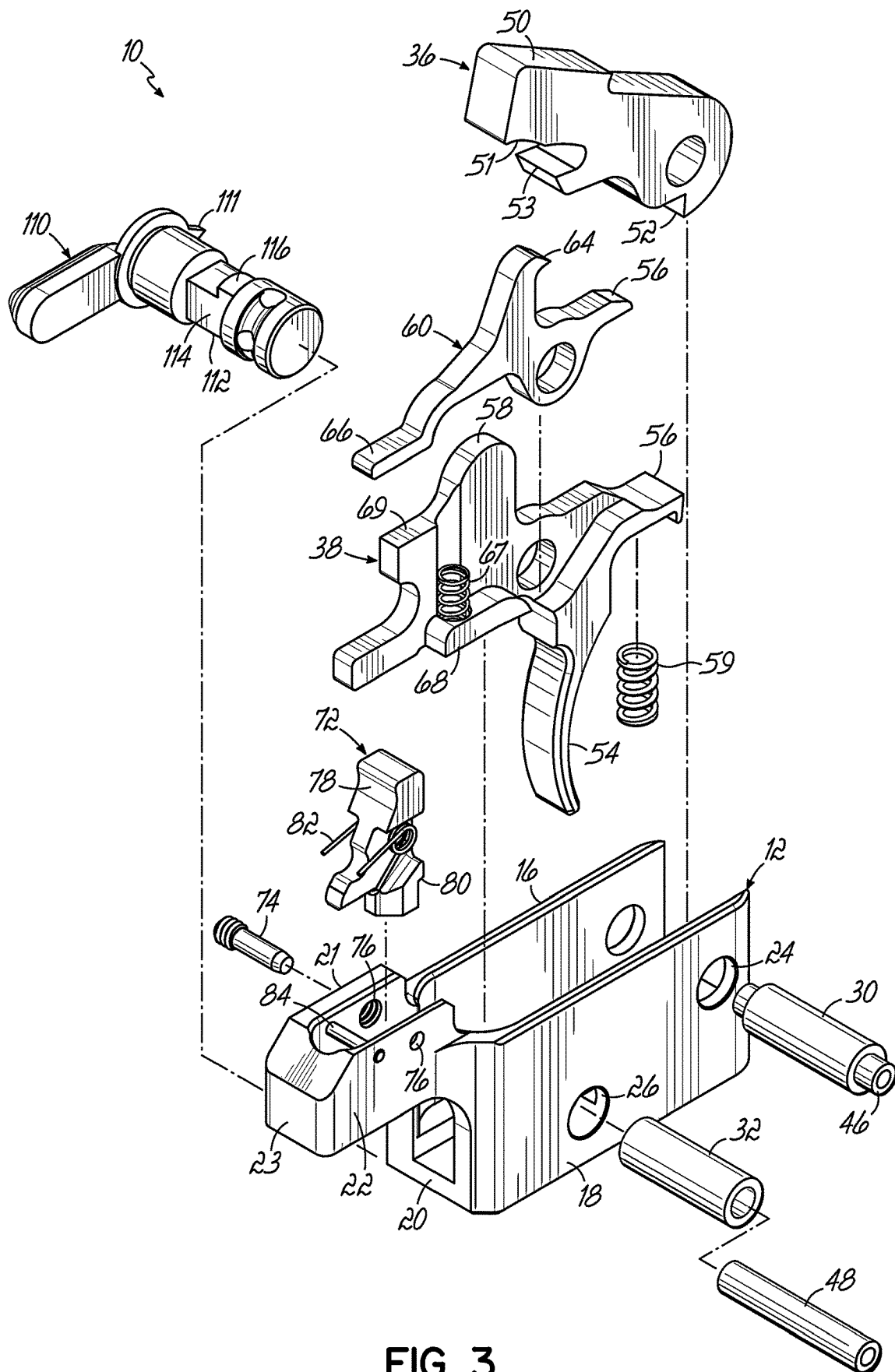
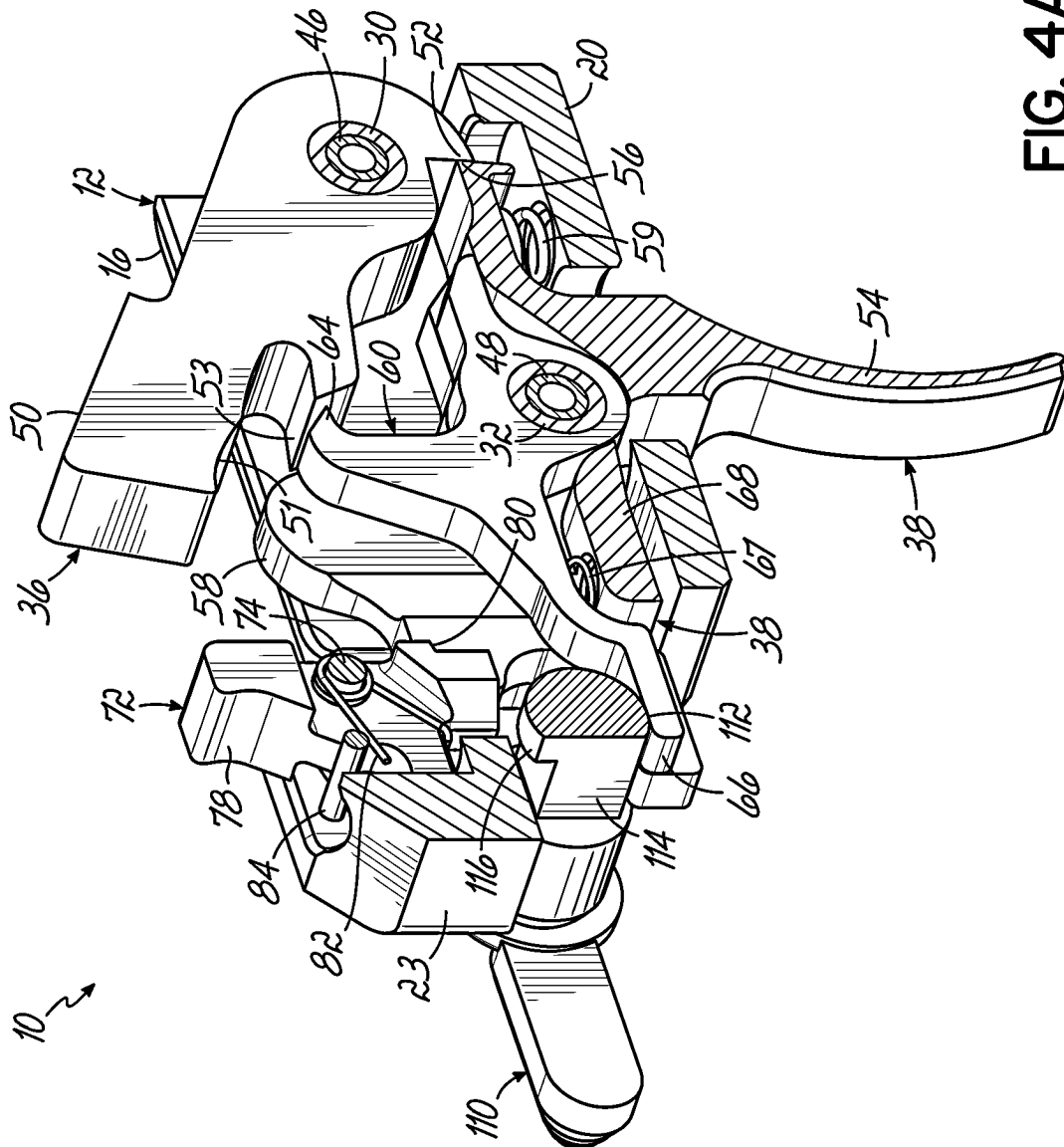
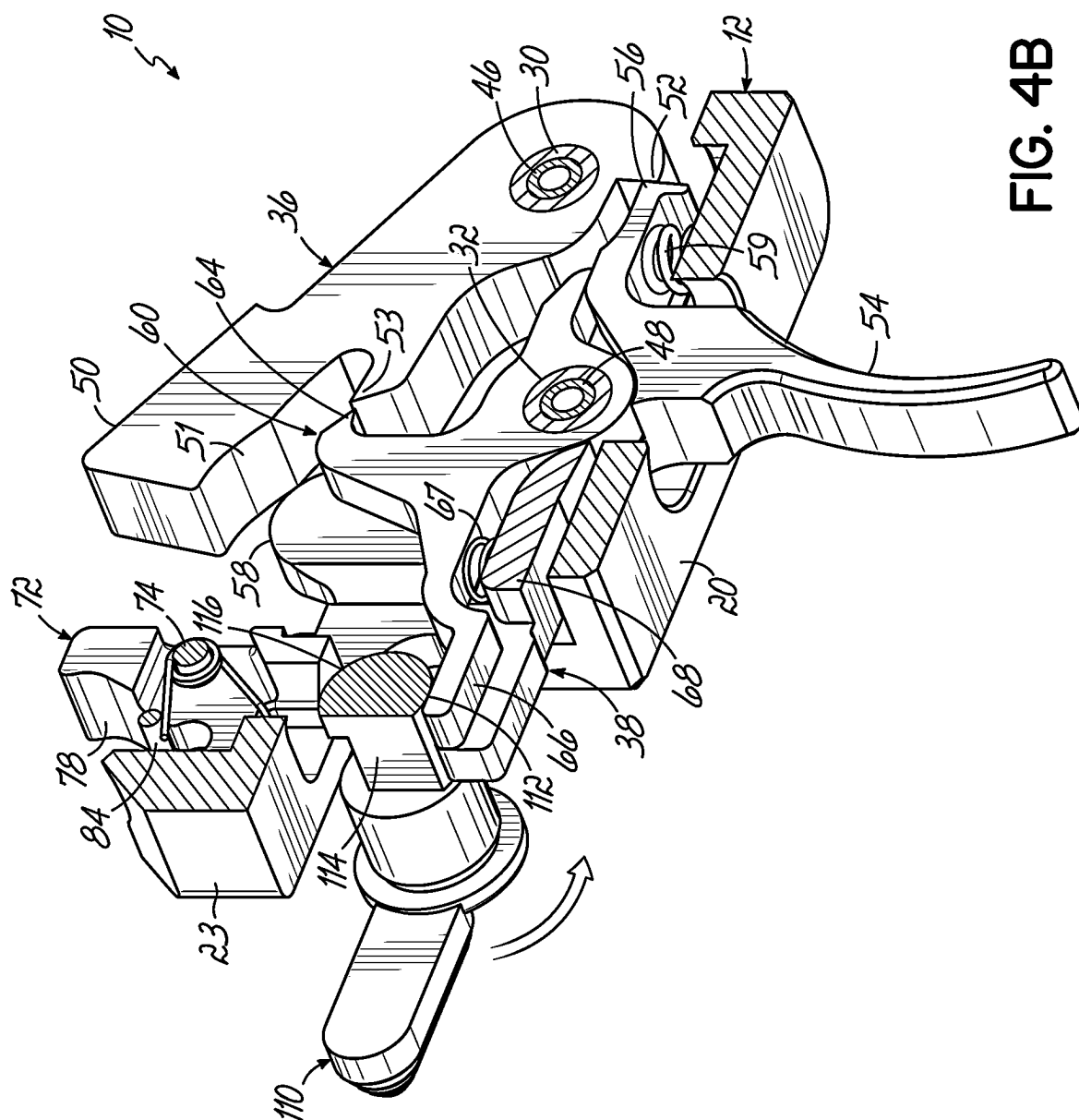
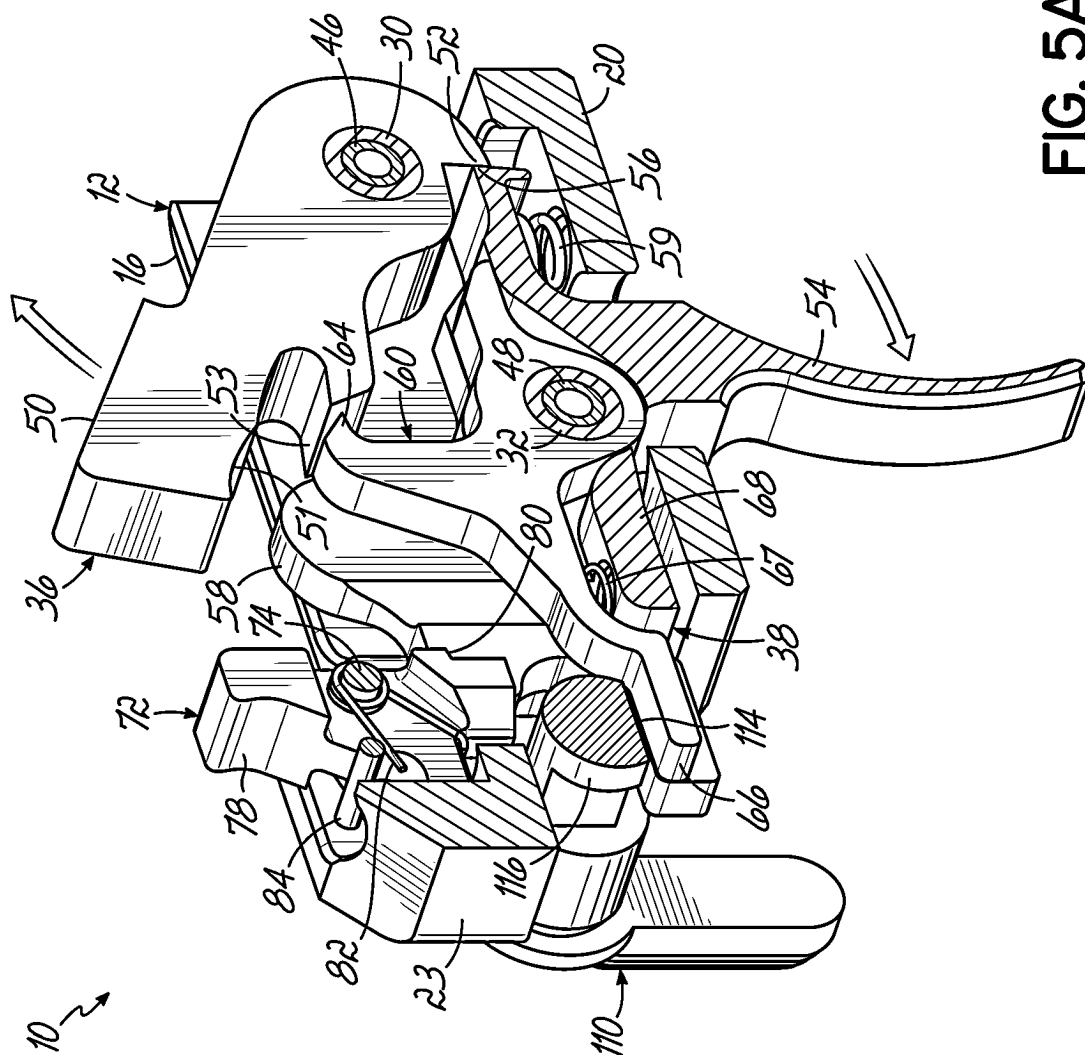


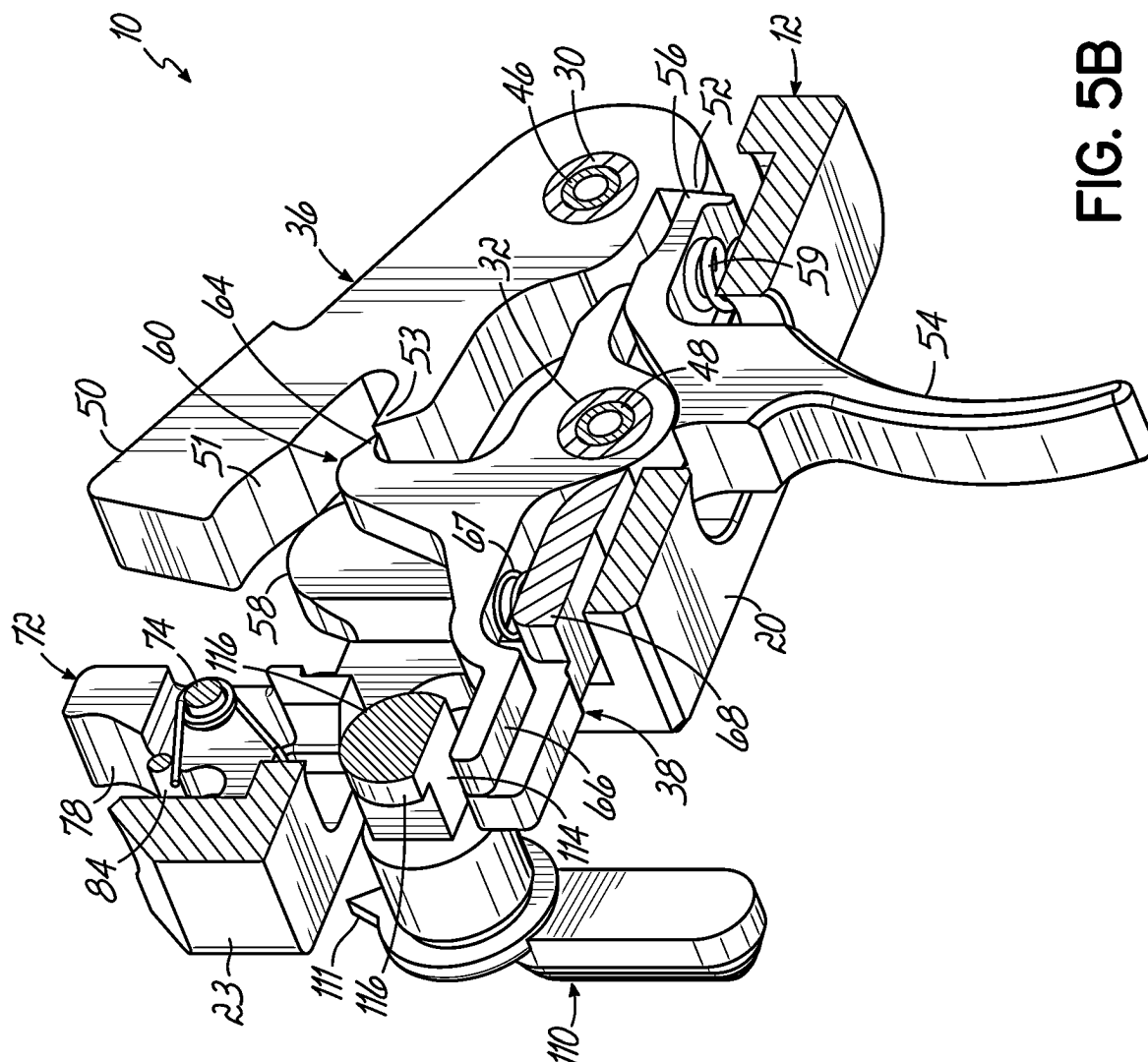
FIG. 3

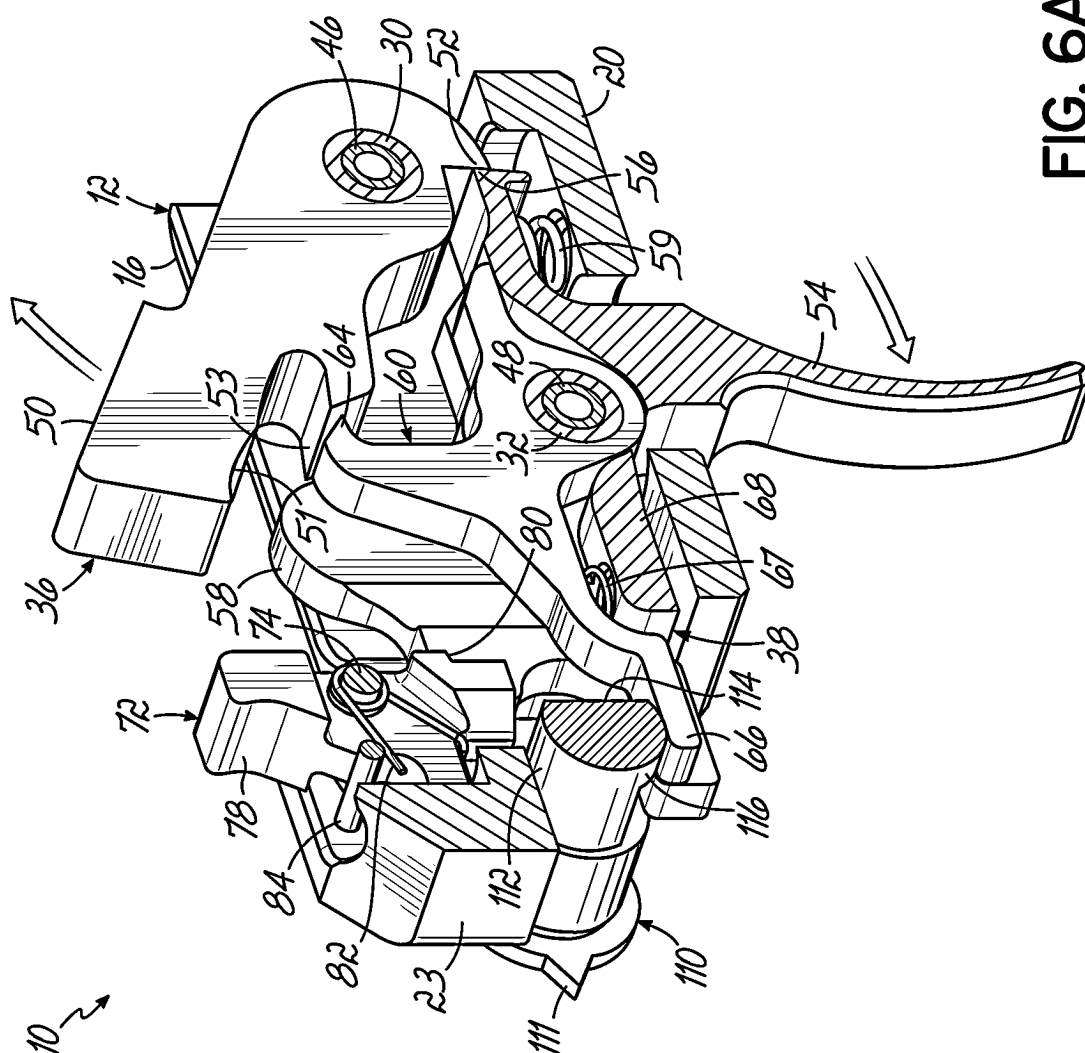
Exhibit E

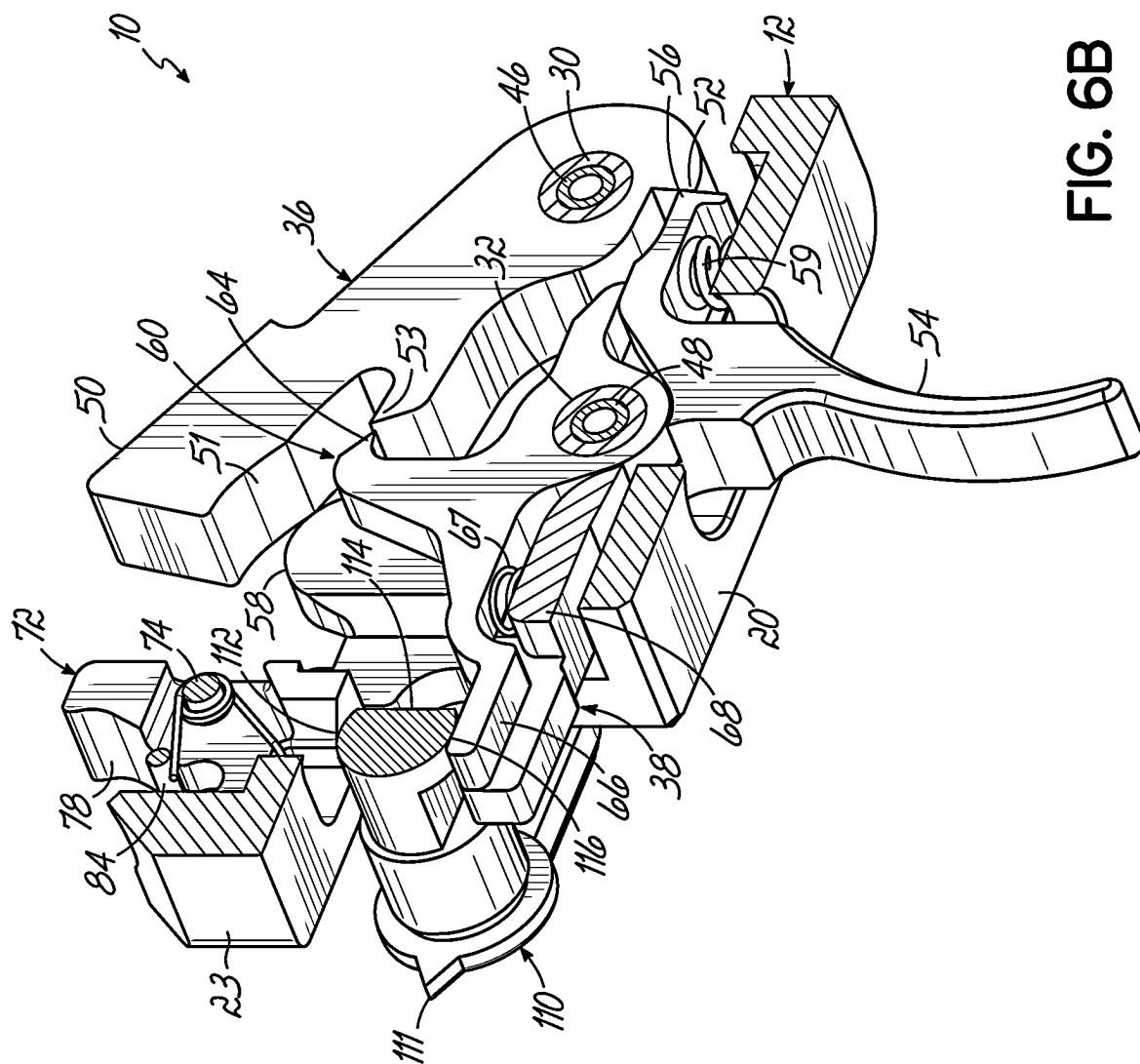












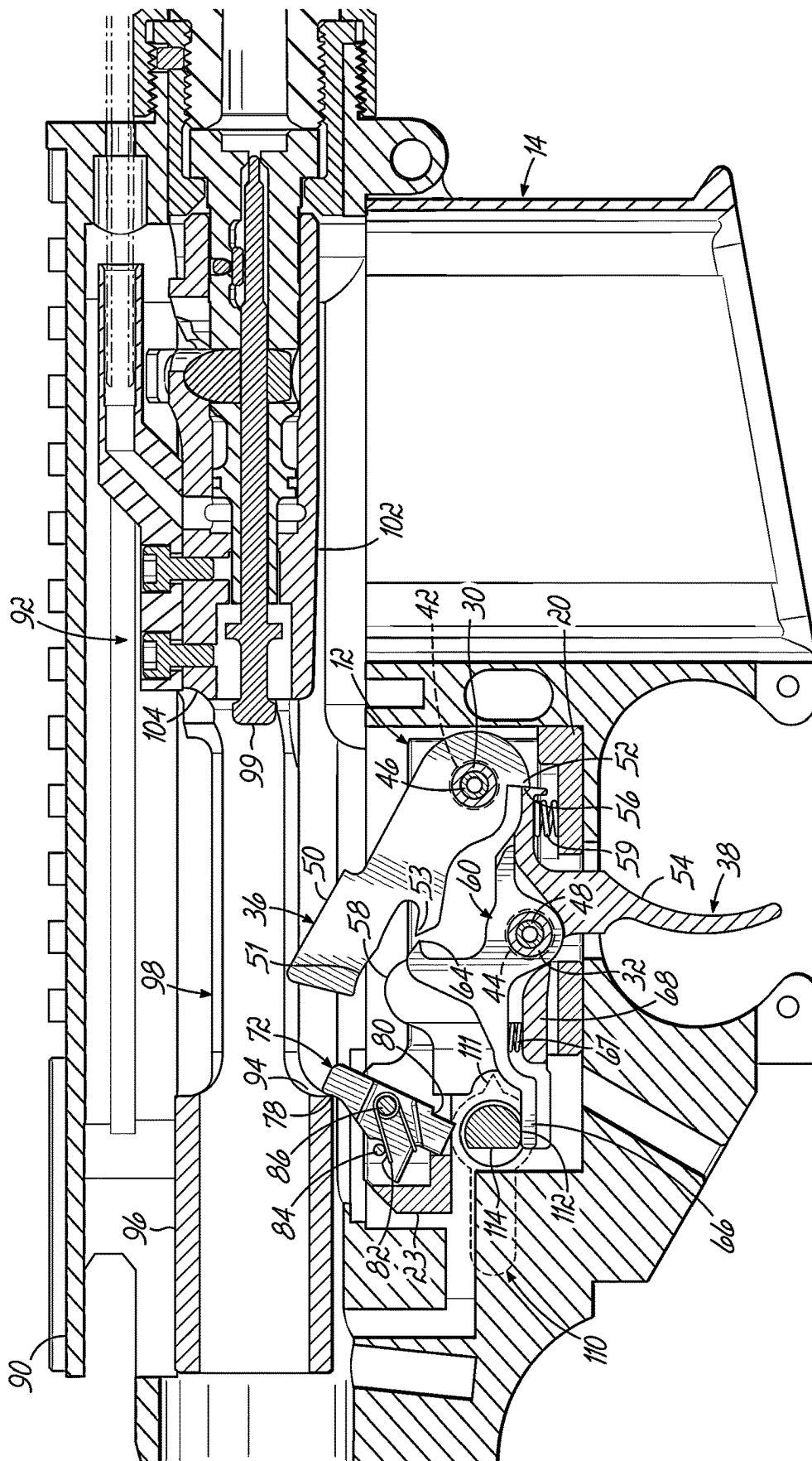


FIG. 7

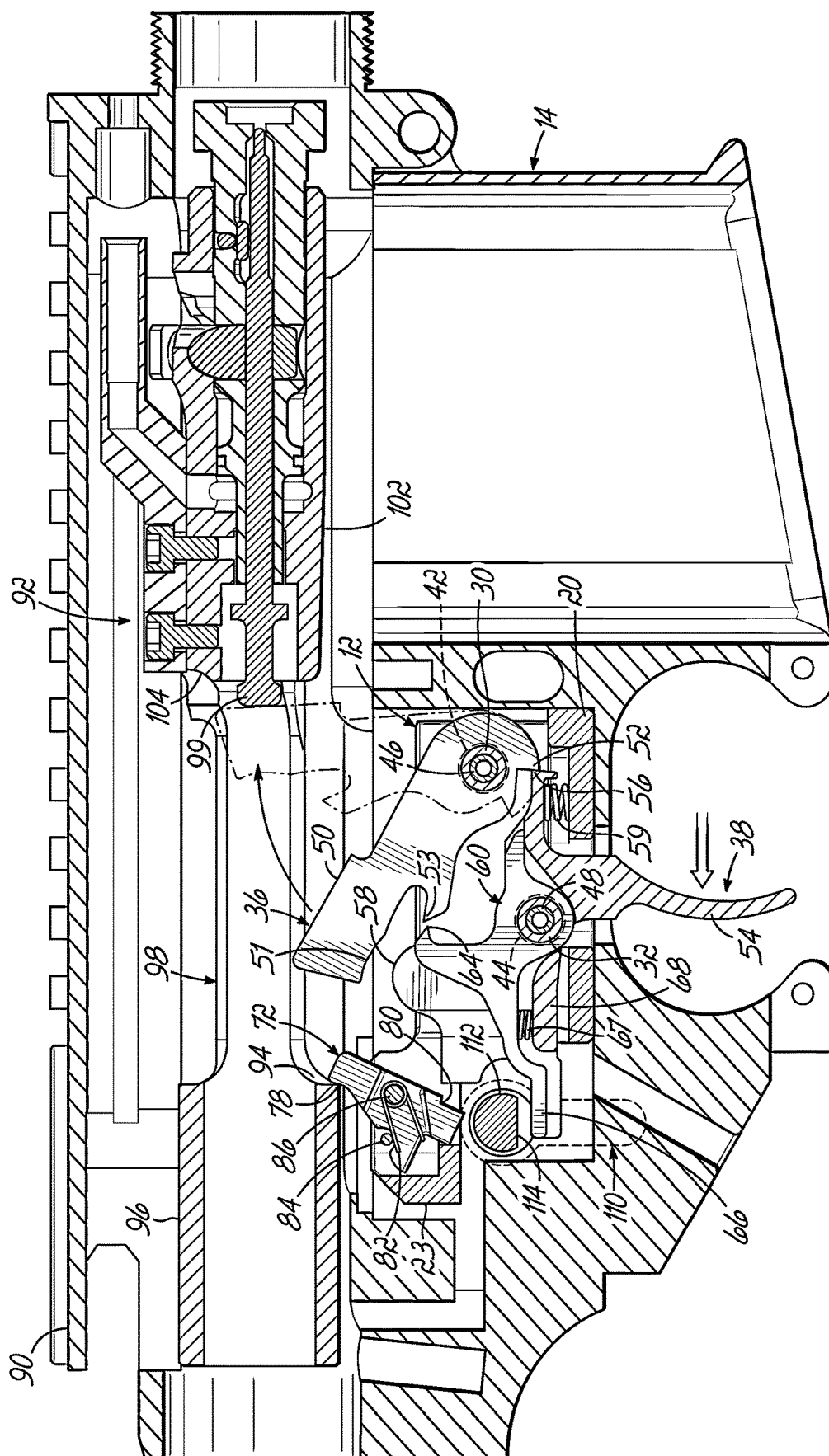


FIG. 8A

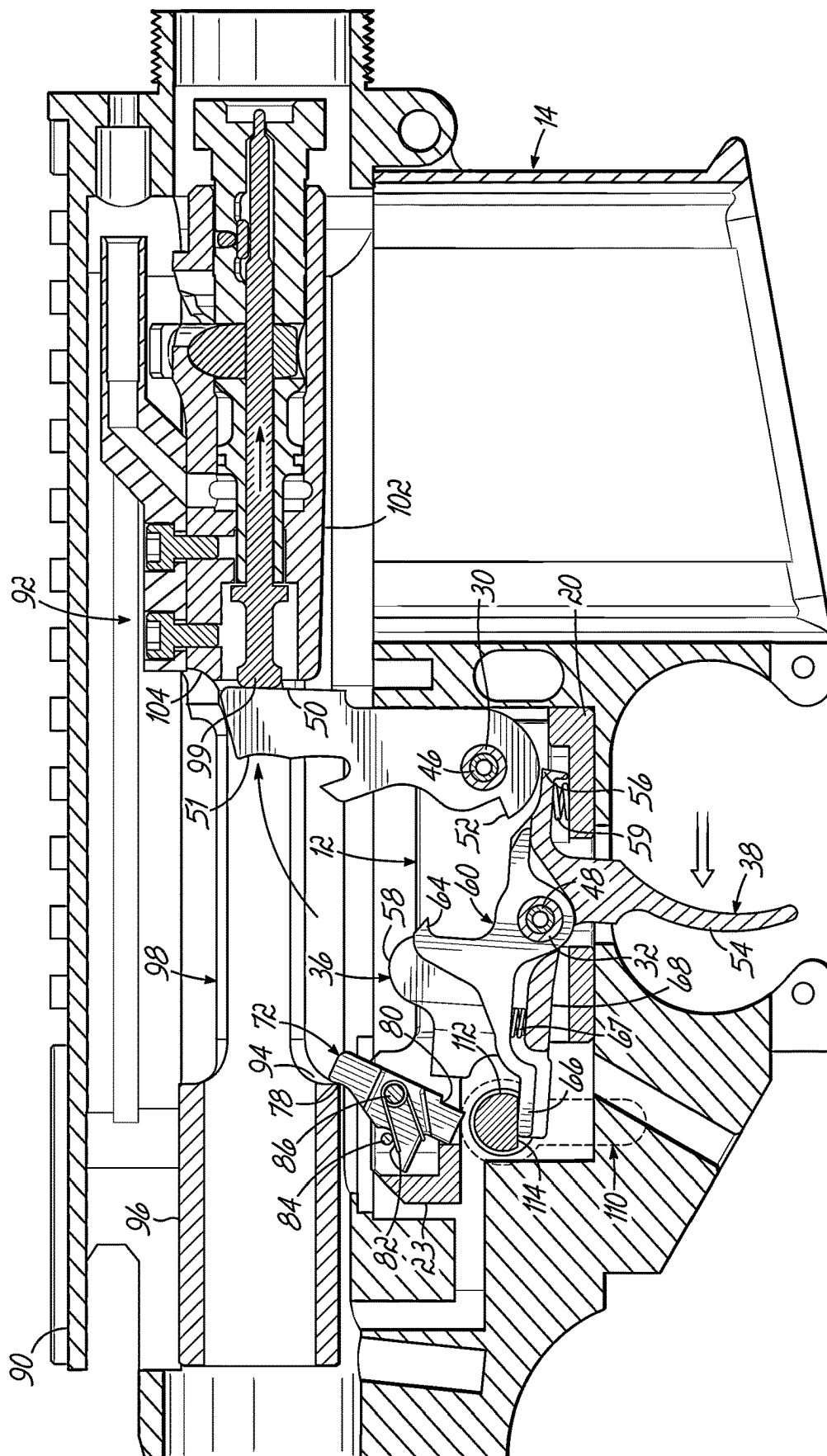


FIG. 8B

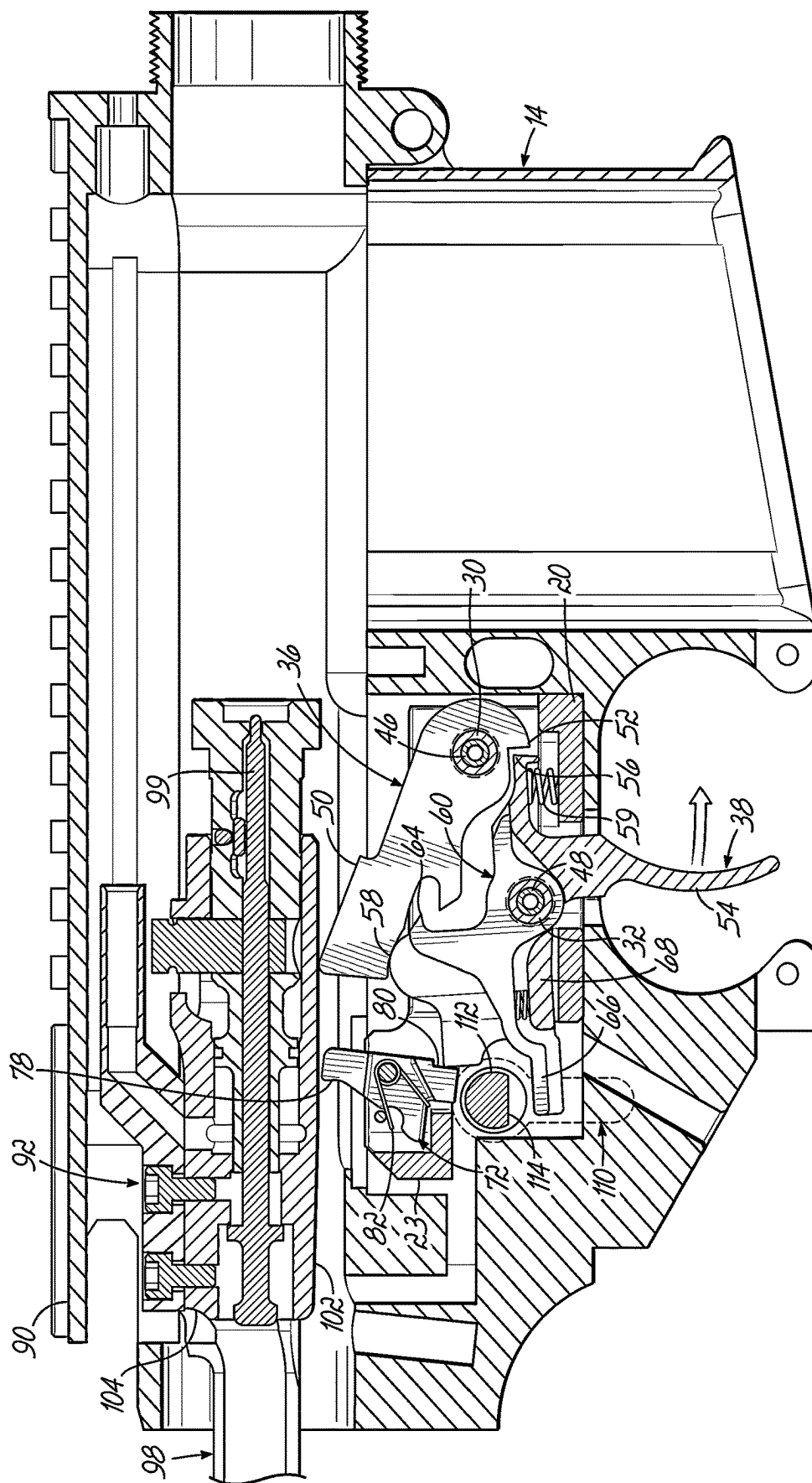


FIG. 8C

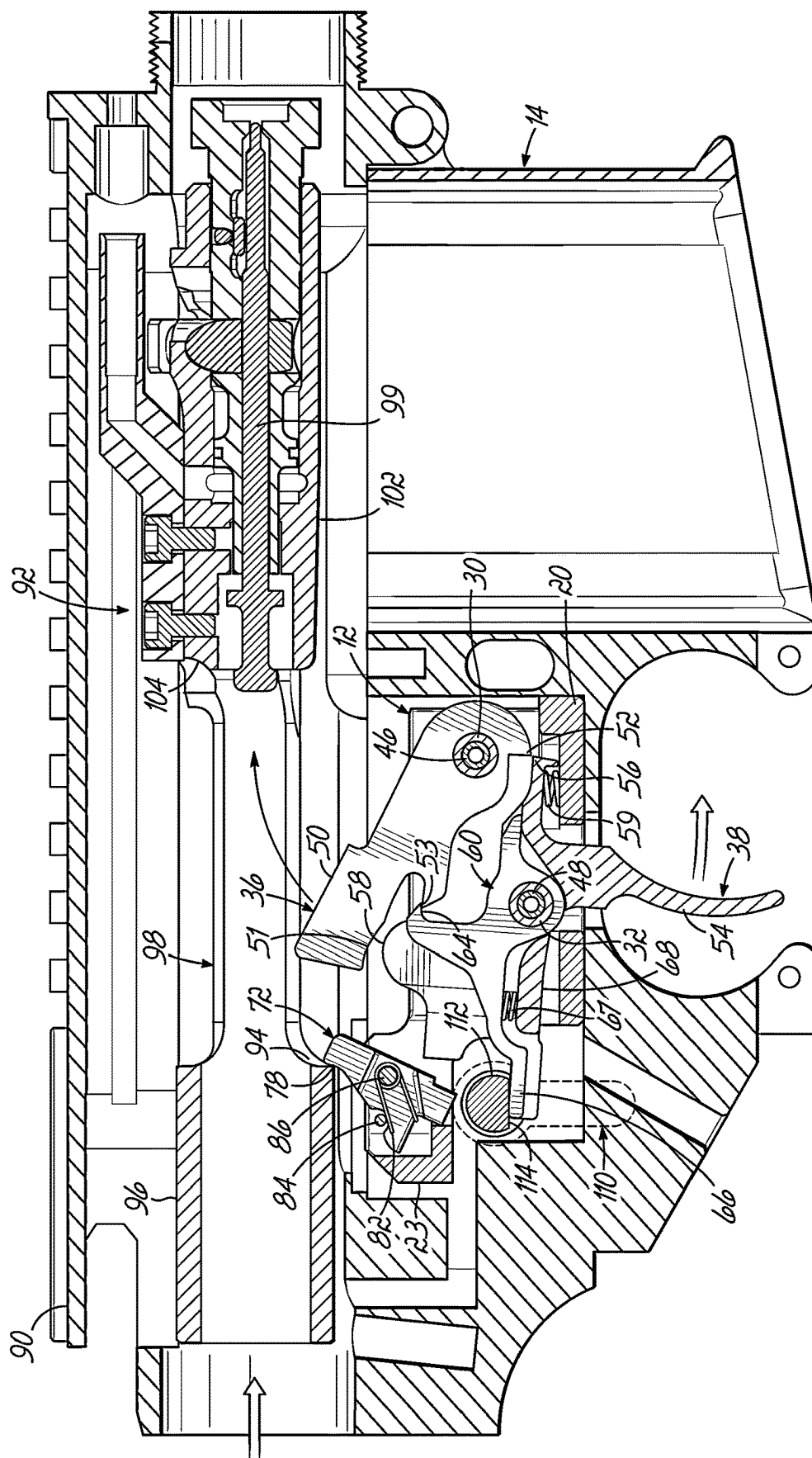


FIG. 8D

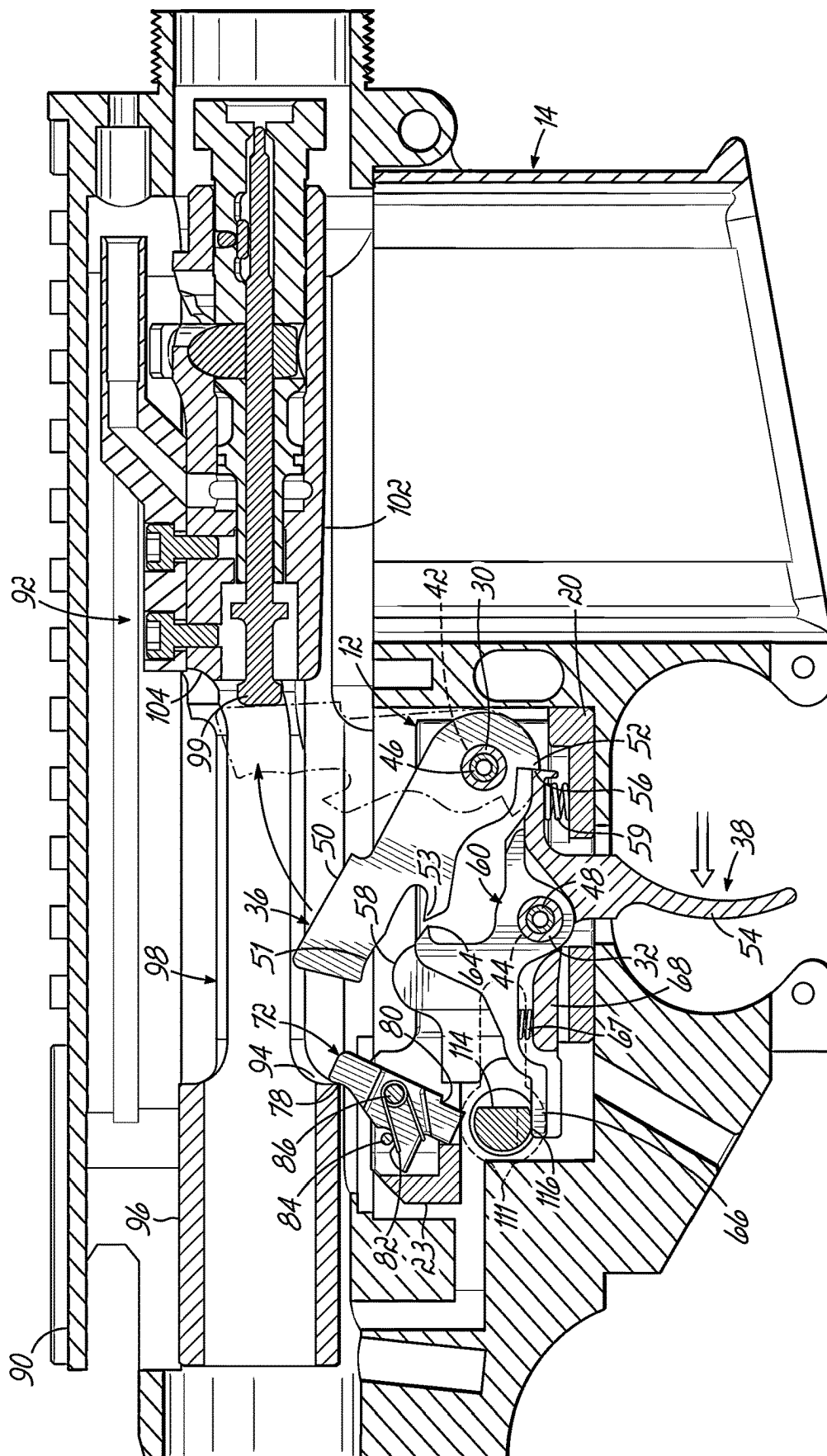


FIG. 9A

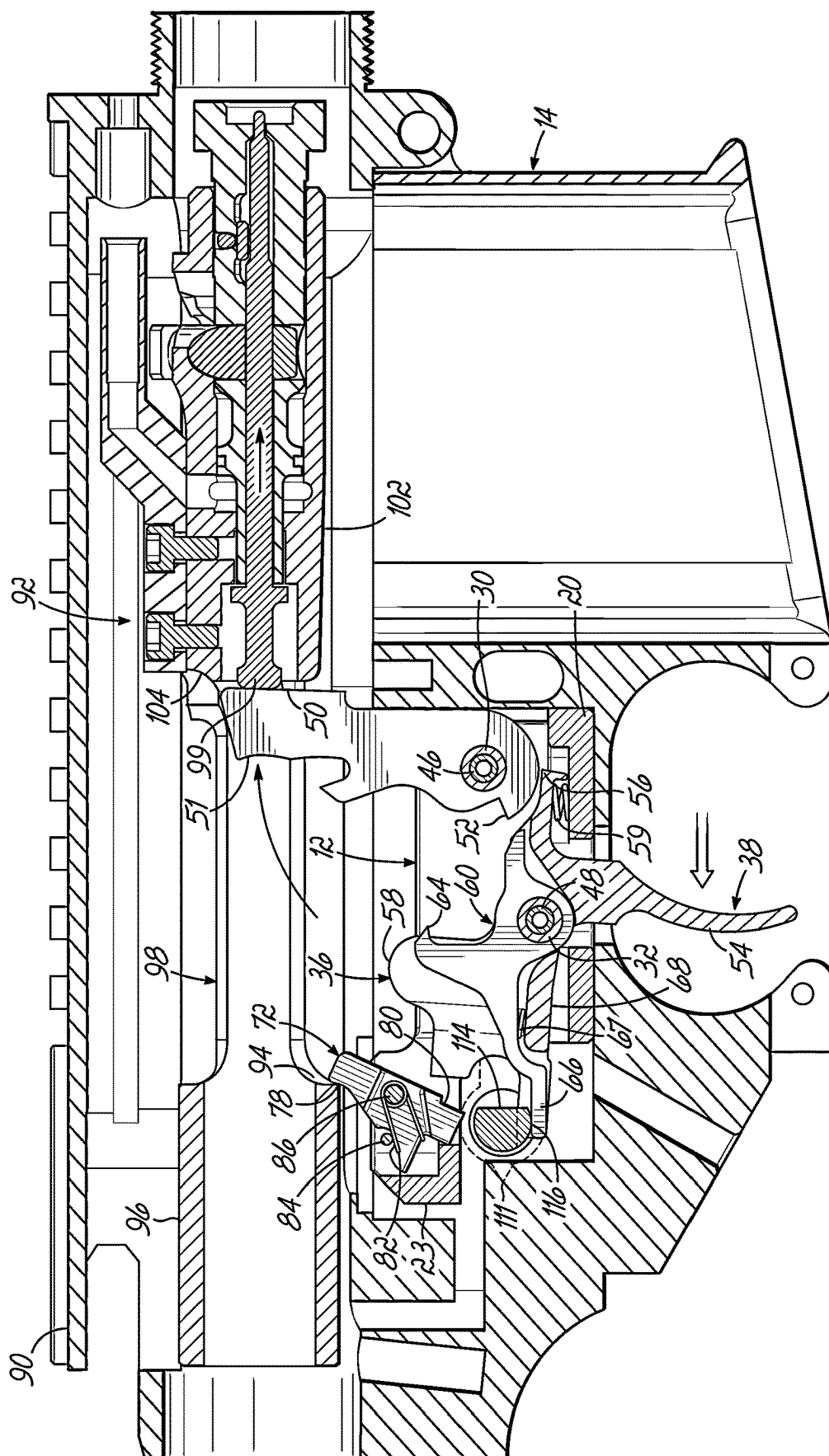


FIG. 9B

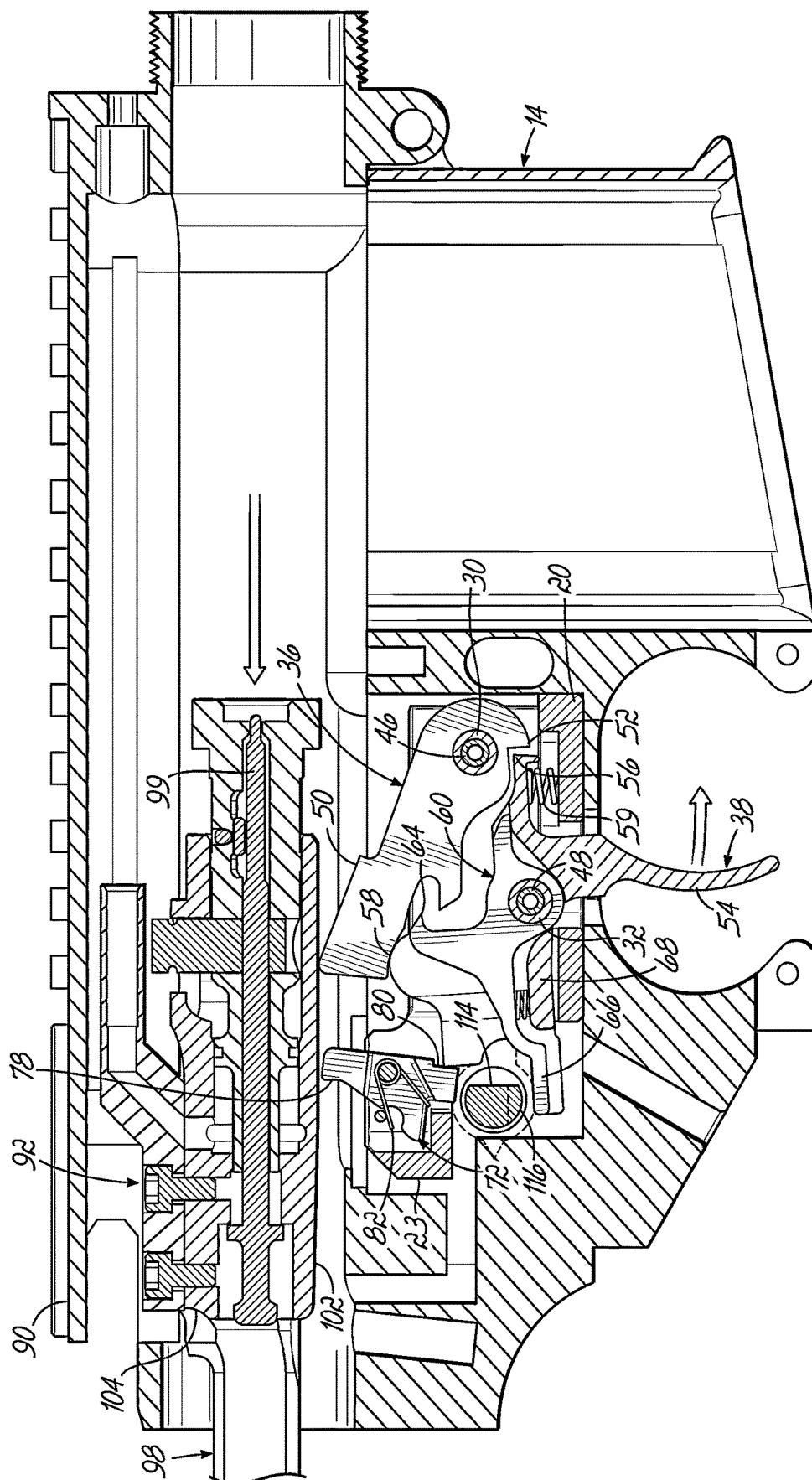


FIG. 9C

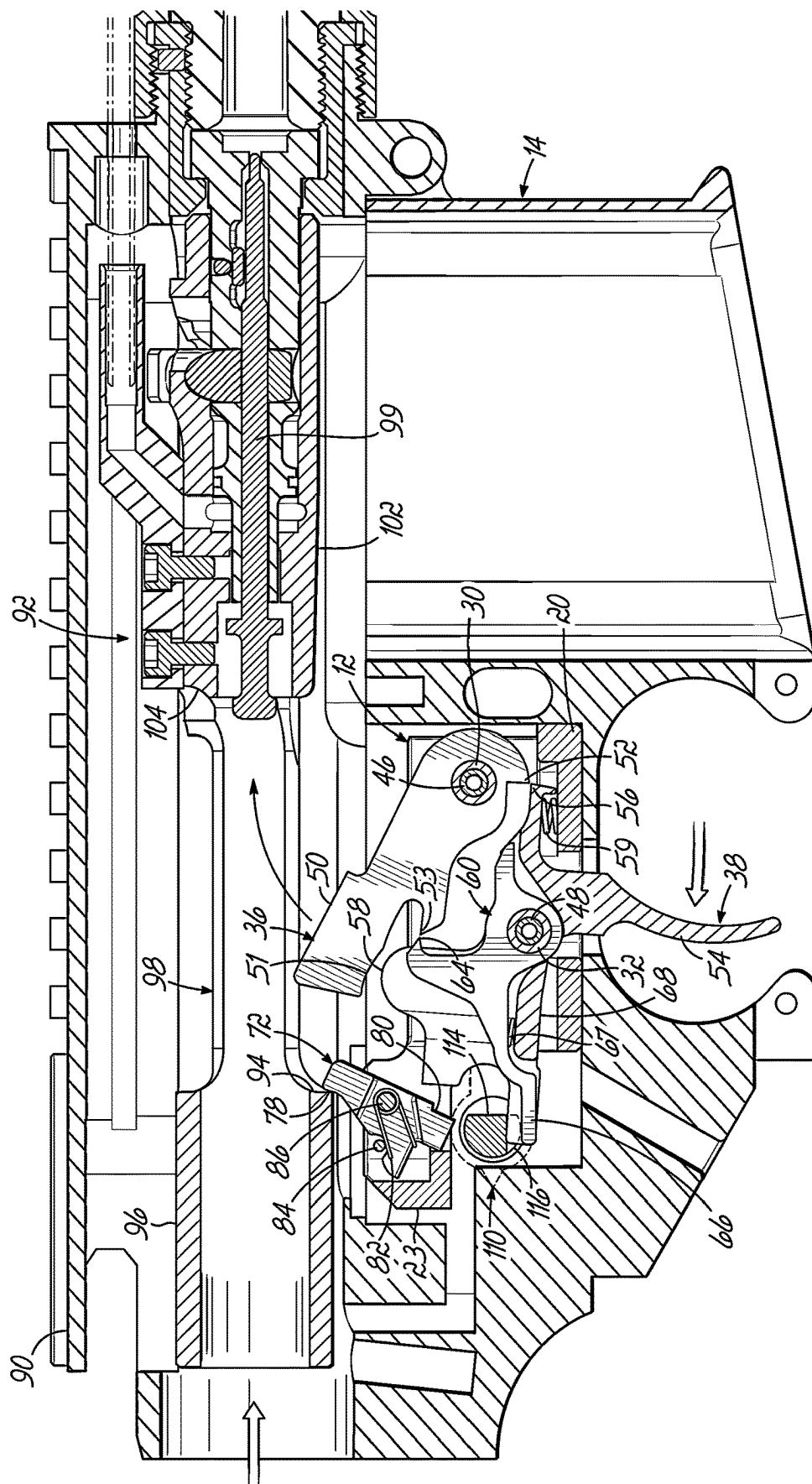


FIG. 9D

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FIREARM TRIGGER MECHANISM**RELATED APPLICATIONS**

This application is a continuation of U.S. patent application Ser. No. 18/665,926 filed May 16, 2024, which is a continuation of U.S. patent application Ser. No. 18/346,423 filed Jul. 3, 2023, now U.S. Pat. No. 12,036,336 issued Jul. 16, 2024, which is a continuation of U.S. patent application Ser. No. 18/048,572 filed Oct. 21, 2022, now U.S. Pat. No. 11,724,003 issued Aug. 15, 2023, which claims the priority benefit of U.S. Provisional Patent Application No. 63/297,884 filed Jan. 10, 2022, all of which are hereby incorporated by reference herein as if fully set forth in their entirety.

TECHNICAL FIELD

The present invention relates generally to a firearm trigger mechanism, and more particularly to a semiautomatic trigger that is selectively mechanically reset by movement of the bolt carrier.

BACKGROUND

In a standard semiautomatic firearm, actuation of the trigger releases a sear, allowing a hammer or striker to fire a chambered ammunition cartridge. Part of the ammunition's propellant force is used to cycle the action, extracting and ejecting a spent cartridge and replacing it with a loaded cartridge. The cycle includes longitudinal reciprocation of a bolt and/or carrier, which also resets the hammer or striker.

A standard semiautomatic trigger mechanism includes a disconnecter, which holds the hammer or striker in a cocked position until the trigger member is reset to engage the sear. This allows the firearm to be fired only a single time when the trigger is pulled and held, because the user is not typically able to release the trigger rapidly enough so that the sear engages before the bolt or bolt carrier returns to its in-battery position. The disconnecter prevents the firearm from either firing multiple rounds on a single pull of the trigger, or from allowing the hammer or striker to simply "follow" the bolt as it returns to battery without firing a second round, but leaving the hammer or striker uncocked.

For various reasons, shooters desire to increase the rate of semiautomatic fire. Sometimes this is simply for entertainment and the feeling of shooting a machine gun. In the past, users have been known to employ "bump firing" to achieve rapid semiautomatic fire. Bump firing uses the recoil of the semiautomatic firearm to fire shots in rapid succession. The process involves bracing the rifle with the non-trigger hand, loosening the grip of the trigger hand (but leaving the trigger finger in its normal position in front of the trigger), and pushing the rifle forward in order to apply pressure on the trigger from the finger while keeping the trigger finger stationary. When fired with the trigger finger held stationary, the firearm will recoil to the rear and allow the trigger to reset as it normally does. When the non-trigger hand pulls the firearm away from the body and back forward toward the original position, it causes the trigger to be pressed against the stationary finger again, firing another round as the trigger is pushed back.

Devices for increasing the rate of semiautomatic fire are shown in U.S. Pat. Nos. 9,568,264; 9,816,772; and 9,939,221, issued to Thomas Allen Graves. The devices shown in these patents forcefully reset the trigger with rigid mechanical contact between the trigger member and the bolt as the action cycles. To adapt this invention to an AR-pattern

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firearm, for example, would require not only a modified fire control mechanism, but also a modified bolt carrier.

Other devices for increasing the rate of semiautomatic fire are shown in U.S. Pat. Nos. 10,514,223 and 11,346,627, which are hereby incorporated by reference herein as if fully set forth in their entirety. In these devices the hammer forces the trigger to the set position, and a locking bar prevents early hammer release.

Another device for increasing the rate of semiautomatic fire is shown in U.S. Pat. No. 7,398,723, issued to Brian A. Blakley, and is hereby incorporated by reference herein as if fully set forth in its entirety. The device shown in this patent has a pivoting cam which is contacted by the rearwardly traveling bolt carrier, pivoting the cam rearwardly such that the bottom surface of the cam presses downward on the trigger-extension, forcing the rear of the trigger down, and thereby moving forward the surface of the trigger that an operator's finger engages. Another device for increasing the rate of semiautomatic fire employing a pivoting cam arrangement is shown in U.S. Provisional Patent Application No. 63/374,941 filed Sep. 8, 2022, also invented by Brian A. Blakley, and which is hereby incorporated by reference herein as if fully set forth in its entirety. This pivoting cam arrangement incorporates a three-position safety selector and associated structure to provide safe, standard semiautomatic, and forced reset semi-automatic modes.

Further improvement in forced reset triggers is desired.

SUMMARY OF INVENTION

The present invention provides a semiautomatic trigger mechanism for increasing rate of fire that can be retrofitted into popular existing firearm platforms. In particular, this invention provides a trigger mechanism that can be used in AR-pattern firearms with an otherwise standard M16-pattern bolt carrier assembly. The present invention is particularly adaptable for construction as a "drop-in" replacement trigger module that only requires insertion of two assembly pins and the safety selector. Advantageously, the present invention provides a "three position" trigger mechanism having safe, standard semi-automatic, and forced reset semi-automatic positions.

In one aspect, a firearm trigger mechanism comprises a hammer having a sear catch and a hook for engaging a disconnecter and adapted to be mounted in a fire control mechanism pocket of a receiver to pivot on a transverse hammer pivot axis between set and released positions, the hammer adapted to be pivoted rearward by rearward movement of a bolt carrier, a trigger member having a sear and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse trigger member pivot axis between set and released positions, the trigger member having a surface positioned to be contacted by the hammer during rearward pivoting of the hammer to cause the trigger member to be forced to the set position, wherein the sear and sear catch are in engagement in the set positions of the hammer and trigger member and are out of engagement in the released positions of the hammer and trigger member, a disconnecter having a hook for engaging the hammer and adapted to be mounted in the fire control mechanism pocket to pivot on the transverse trigger member pivot axis, a locking member adapted to be mounted in the fire control mechanism pocket to pivot on a transverse locking member pivot axis, the locking member being pivotable between a first position at which the locking member mechanically blocks the trigger member from moving to the released position and a second position at which the locking member

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does not mechanically block the trigger member allowing the trigger member to be moved to the released position, the locking member spring biased toward the first position and adapted to be moved against the spring bias to the second position by contact from the bolt carrier during forward movement of the bolt carrier as the bolt carrier reaches a substantially in-battery position, and a safety selector adapted to be mounted in the fire control mechanism pocket to pivot between safe, standard semi-automatic, and forced reset semi-automatic positions. In the standard semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer such that the disconnecter hook catches the hammer hook, at which time a user must manually release the trigger member to free the hammer from the disconnecter to permit the hammer and trigger member to pivot to the set positions so that the user can pull the trigger member to fire the firearm. In the forced reset semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer causing the trigger member to be forced to the set position, the safety selector preventing the disconnecter hook from catching the hammer hook, and thereafter when the bolt carrier reaches the substantially in-battery position the user can pull the trigger member to fire the firearm without manually releasing the trigger member.

The safety selector can have a protuberance thereon which, when the safety selector is in the forced reset semi-automatic position, contacts the disconnecter preventing the disconnecter hook from catching the hammer hook. The trigger mechanism can further include a spring which biases the trigger member towards the set position.

In another aspect, a firearm trigger mechanism comprises a housing having a first pair of transversely aligned openings for receiving a hammer pin and a second pair of transversely aligned openings for receiving a trigger member pin, a hammer having a sear catch and a hook for engaging a disconnecter and mounted in the housing to pivot on the hammer pin between set and released positions, the hammer adapted to be pivoted rearward by rearward movement of a bolt carrier, a trigger member having a sear and mounted in the housing to pivot on the trigger member pin between set and released positions, the trigger member having a surface positioned to be contacted by the hammer during rearward pivoting of the hammer to cause the trigger member to be forced to the set position, wherein the sear and sear catch are in engagement in the set positions of the hammer and trigger member and are out of engagement in the released positions of the hammer and trigger member, a disconnecter having a hook for engaging the hammer and mounted in the housing to pivot on the trigger member pin, a locking member mounted in the housing to pivot on a transverse locking member pin, the locking member being pivotable between a first position at which the locking member mechanically blocks the trigger member from moving to the released position and a second position at which the locking member does not mechanically block the trigger member allowing the trigger member to be moved to the released position, the locking member spring biased toward the first position and adapted to be moved against the spring bias to the second position by contact from the bolt carrier during forward movement of the bolt carrier as the bolt carrier reaches a substantially in-battery position, and a safety selector adapted to be mounted in a fire control mechanism pocket of a receiver to pivot between safe, standard semi-automatic, and forced reset semi-automatic positions. In the standard semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer such that the

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disconnecter hook catches the hammer hook, at which time a user must manually release the trigger member to free the hammer from the disconnecter to permit the hammer and trigger member to pivot to the set positions so that the user can pull the trigger member to fire the firearm. In the forced reset semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer causing the trigger member to be forced to the set position, the safety selector preventing the disconnecter hook from catching the hammer hook, and thereafter when the bolt carrier reaches the substantially in-battery position the user can pull the trigger member to fire the firearm without manually releasing the trigger member.

The safety selector can have a protuberance thereon which, when the safety selector is in the forced reset semi-automatic position, contacts the disconnecter preventing the disconnecter hook from catching the hammer hook. The transversely aligned pairs of openings in the housing for receiving the hammer and trigger member pins can be adapted to be aligned with assembly pin openings in the fire control mechanism pocket. The trigger mechanism can further include a spring which biases the trigger member towards the set position. The spring can be a compression spring positioned between a forward end of the trigger member and a floor of the housing.

In another aspect, a firearm comprises a receiver having a fire control mechanism pocket therein, a reciprocating bolt carrier, a hammer having a sear catch and a hook for engaging a disconnecter and mounted in the fire control mechanism pocket to pivot on a transverse hammer pivot axis between set and released positions, the hammer pivoted rearward by rearward movement of the bolt carrier, a trigger member having a sear and mounted in the fire control mechanism pocket to pivot on a transverse trigger member pivot axis between set and released positions, the trigger member having a surface positioned to be contacted by the hammer during rearward pivoting of the hammer to cause the trigger member to be forced to the set position, wherein the sear and sear catch are in engagement in the set positions of the hammer and trigger member and are out of engagement in the released positions of the hammer and trigger member, a disconnecter having a hook for engaging the hammer and mounted in the fire control mechanism pocket to pivot on the transverse trigger member pivot axis, a locking member mounted in the fire control mechanism pocket to pivot on a transverse locking member pivot axis, the locking member being pivotable between a first position at which the locking member mechanically blocks the trigger member from moving to the released position and a second position at which the locking member does not mechanically block the trigger member allowing the trigger member to be moved to the released position, the locking member spring biased toward the first position and moved against the spring bias to the second position by contact from the bolt carrier during forward movement of the bolt carrier as the bolt carrier reaches a substantially in-battery position, and a safety selector adapted to be mounted in the fire control mechanism pocket to pivot between safe, standard semi-automatic, and forced reset semi-automatic positions. In the standard semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer such that the disconnecter hook catches the hammer hook, at which time a user must manually release the trigger member to free the hammer from the disconnecter to permit the hammer and trigger member to pivot to the set positions so that the user can pull the trigger member to fire the firearm. In the forced reset semi-automatic position, rear-

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ward movement of the bolt carrier causes rearward pivoting of the hammer causing the trigger member to be forced to the set position, the safety selector preventing the disconnect hook from catching the hammer hook, and thereafter when the bolt carrier reaches the substantially in-battery position the user can pull the trigger member to fire the firearm without manually releasing the trigger member.

The firearm can further comprise a housing having a first pair of transversely aligned openings with a hammer pin therethrough and a second pair of transversely aligned openings with a trigger member pin therethrough, the hammer mounted on the hammer pin, the trigger member and disconnecter mounted on the trigger member pin. The firearm can further comprise the receiver having a first pair of transversely aligned assembly pin openings and a second pair of transversely aligned assembly pin openings, the housing first pair of openings coaxial with the receiver first pair of openings and the housing second pair of openings coaxial with the receiver second pair of openings, a first assembly pin passing through the receiver first pair of openings and through the housing first pair of openings, and a second assembly pin passing through the receiver second pair of openings and through the housing second pair of openings. The firearm can further include a spring which biases the trigger member towards the set position. The spring can be a compression spring positioned between a forward end of the trigger member and a floor of the housing.

In another aspect, a firearm trigger mechanism comprises a hammer having a sear catch and a hook for engaging a disconnecter and adapted to be mounted in a fire control mechanism pocket of a receiver to pivot on a transverse hammer pivot axis between set and released positions, the hammer adapted to be pivoted rearward by rearward movement of a bolt carrier, a trigger member having a sear and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse trigger member pivot axis between set and released positions, the trigger member having a surface positioned to be contacted by a surface of the hammer during rearward pivoting of the hammer to cause the trigger member to be forced to the set position, wherein the sear and sear catch are in engagement in the set positions of the hammer and trigger member and are out of engagement in the released positions of the hammer and trigger member, a disconnecter having a hook for engaging the hammer and adapted to be mounted in the fire control mechanism pocket to pivot on the transverse trigger member pivot axis, a locking member adapted to be movably mounted in the fire control mechanism pocket, the locking member being movable between a first position at which the locking member mechanically blocks the trigger member from moving to the released position and a second position at which the locking member does not mechanically block the trigger member allowing the trigger member to be moved to the released position, the locking member spring biased toward the first position and adapted to be moved against the spring bias to the second position by contact from the bolt carrier during forward movement of the bolt carrier as the bolt carrier reaches a substantially in-battery position, and a safety selector adapted to be mounted in the fire control mechanism pocket to pivot between safe, standard semi-automatic, and forced reset semi-automatic positions. In the standard semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer such that the disconnecter hook catches the hammer hook, at which time a user must manually release the trigger member to free the hammer from the disconnecter to permit

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the hammer and trigger member to pivot to the set positions so that the user can pull the trigger member to fire the firearm. In the forced reset semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of the hammer causing the trigger member to be forced to the set position, the safety selector preventing the disconnecter hook from catching the hammer hook, and thereafter when the bolt carrier reaches the substantially in-battery position the user can pull the trigger member to fire the firearm without manually releasing the trigger member.

Other aspects, features, benefits, and advantages of the present invention will become apparent to a person of skill in the art from the detailed description of various embodiments with reference to the accompanying drawing figures, all of which comprise part of the disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

Like reference numerals are used to indicate like parts throughout the various drawing figures, wherein:

FIG. 1 is a top front right perspective view of a drop-in trigger module for an AR-pattern firearm according to one embodiment of the invention.

FIG. 2 is a top rear right perspective view thereof.

FIG. 3 is a top rear right exploded perspective view thereof.

FIG. 4A is a top rear right cross-sectional view thereof with the safety selector in the safe position and with the hammer and trigger member in their set positions.

FIG. 4B is a bottom rear right cross-sectional view thereof with the safety selector in the safe position and with the hammer and trigger member in their set positions.

FIG. 5A is a top rear right cross-sectional view thereof with the safety selector in the standard semi-automatic position and with the hammer and trigger member in their set positions.

FIG. 5B is a bottom rear right cross-sectional view thereof with the safety selector in the standard semi-automatic position and with the hammer and trigger member in their set positions.

FIG. 6A is a top rear right cross-sectional view thereof with the safety selector in the forced reset semi-automatic position and with the hammer and trigger member in their set positions.

FIG. 6B is a bottom rear right cross-sectional view thereof with the safety selector in the forced reset semi-automatic position and with the hammer and trigger member in their set positions.

FIG. 7 is a cross-sectional view showing the trigger module installed in a typical AR15-pattern lower receiver, with the hammer and trigger member in their set positions and with the bolt carrier in an in-battery position, and with the safety selector in the safe position.

FIG. 8A is a view similar to FIG. 7 but with the safety selector in the standard semi-automatic position.

FIG. 8B is a view similar to FIG. 8A but after the trigger has been pulled to drop the hammer.

FIG. 8C is a view similar to FIG. 8B but with the bolt carrier cycling to the rear to pivot the hammer.

FIG. 8D is a view similar to FIG. 8C but with the bolt carrier having returned to battery and the disconnecter having caught the hammer.

FIG. 9A is a view similar to FIG. 7 but with the safety selector in the forced reset semi-automatic position.

FIG. 9B is a view similar to FIG. 9A but after the trigger has been pulled to drop the hammer.

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FIG. 9C is a view similar to FIG. 9B but with the bolt carrier cycling to the rear to pivot the hammer.

FIG. 9D is a view similar to FIG. 9C but with the bolt carrier having returned to battery and the hammer and trigger having returned to their set positions.

DETAILED DESCRIPTION

With reference to the drawing figures, this section describes particular embodiments and their detailed construction and operation. Throughout the specification, reference to “one embodiment,” “an embodiment,” or “some embodiments” means that a particular described feature, structure, or characteristic may be included in at least one embodiment. Thus, appearances of the phrases “in one embodiment,” “in an embodiment,” or “in some embodiments” in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the described features, structures, and characteristics may be combined in any suitable manner in one or more embodiments. In view of the disclosure herein, those skilled in the art will recognize that the various embodiments can be practiced without one or more of the specific details or with other methods, components, materials, or the like. In some instances, well-known structures, materials, or operations are not shown or not described in detail to avoid obscuring aspects of the embodiments. “Forward” will indicate the direction of the muzzle and the direction in which projectiles are fired, while “rearward” will indicate the opposite direction. “Lateral” or “transverse” indicates a side-to-side direction generally perpendicular to the axis of the barrel. Although firearms may be used in any orientation, “left” and “right” will generally indicate the sides according to the user’s orientation, “top” or “up” will be the upward direction when the firearm is gripped in the ordinary manner.

Referring first to FIGS. 1-6B, there is illustrated a “drop-in” trigger module 10 adapted for use in an AR-pattern firearm according to a first embodiment of the present invention. As used herein, “AR-pattern” firearm includes the semiautomatic versions of the AR10 and AR15 firearms and variants thereof of any caliber, including pistol caliber carbines or pistols using a blow-back bolt. While select fire (fully automatic capable) versions of this platform, such as the M16 and M4, are also AR-pattern firearms, this invention only relates to semiautomatic firearm actions. The concepts of this invention may be adaptable to other popular semiautomatic firearm platforms, such as the Ruger 10/22™, AK-pattern firearms, and HK-pattern firearms.

The module 10 includes a frame or housing 12 sized and shaped to fit within the internal fire control pocket of an AR-pattern lower receiver 14. Lower receiver parts not important to the present invention are well-known in the art and are omitted from the figures for clarity. The housing 12 includes forward left and right sidewalls 16, 18 which extend substantially vertically and parallel to one another in a laterally spaced-apart relationship. The sidewalls 16, 18 may be interconnected by a floor 20. Shorter, more narrowly spaced apart and substantially vertical and parallel rear sidewalls 21, 22 extend rearward from forward sidewalls 16, 18 and are interconnected by a rear end wall 23. The sidewalls 16, 18 include first and second pairs of aligned openings 24, 26 for receiving hollow transverse pins 30, 32 upon which a hammer 36 and trigger member 38 pivot. The openings 24, 26 are located coaxially with openings 42, 44 in the lower receiver 14. Standard AR-pattern hammer and trigger pins 46, 48 pass through the openings 42, 44 in the lower receiver 14 and through the hollow transverse pins 30,

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32 to assemble the housing 12 into the lower receiver 14. Thus, the pins 30, 32 retain the hammer 36 and trigger member 38 in the housing 12 in modular fashion, whereas the pins 46, 48 retain the trigger module 10 in the lower receiver 14.

The hammer 36 has a hammer head 50, a sear catch 52, a hammer hook 53, and a concave contact surface 51. The hammer 36 is spring biased towards a forward position by a standard AR-pattern hammer torsion spring (not shown).

The trigger member 38 has a trigger blade 54 that extends downwardly. The trigger blade 54 is the part of the trigger member 38 contacted by a user’s finger to actuate the trigger mechanism. The trigger blade 54 may be curved (as shown) or straight, as desired. The trigger member 38 has a sear 56. When the sear 56 and the sear catch 52 are engaged, the hammer 36 and trigger member 38 are in their set positions. When the sear 56 and sear catch 52 are not engaged, the hammer 36 and trigger member 38 are in their released positions. The trigger member 38 has a convex contact surface 58 that interacts with concave surface 51 on hammer 36 in a manner described below. The trigger member 38 also has a contact surface 69. The trigger member 38 is spring biased by a compression spring 59 positioned between a forward end of the trigger member 38 and the floor 20 of the housing 12 so that the trigger blade 54 is spring biased towards a forward position.

A disconnecter 60 is pivoted on the hollow transverse pin 32 upon which the trigger member 38 pivots. The disconnecter 60 has a disconnecter hook 64 and a tail 66. The tail 66 of the disconnecter 60 is spring biased upwardly away from a tail 68 of the trigger member 38 by a compression spring 67.

A locking or blocking member 72 is movably mounted to the housing 12. For example, the locking/blocking member 72 can be pivoted on a locking/blocking member pin or screw 74 that is installed in aligned openings 76 in the sidewalls 21, 22 of the housing 12. The locking member 72 has a first contact surface 78 that interacts with an engagement surface 94 in a rear portion 96 of a bolt carrier body 98 of a bolt carrier assembly 92, in a manner to be described below. The locking member 72 has a second contact surface 80 that interacts with surface 69 of trigger member 38 in a manner to be described below. The locking member 72 is spring biased by a torsion spring 82 acting between a pin 84 in the sidewalls 21, 22 and a lower portion of the locking member 72 such that surface 78 is biased rearward and surface 80 is biased forward. Alternatively, the locking/blocking member 72 can be slidably mounted to the housing 12 and spring biased forward by a compression spring.

An upper receiver 90 houses a bolt carrier assembly 92. As is well-known in the art, the bolt carrier assembly 92 (or blow-back bolt) slidably reciprocates in the upper receiver 90 and engages the breach of a barrel or barrel extension. As used herein, “bolt carrier” and “bolt carrier assembly” may be used interchangeably and include a blow-back type bolt used in pistol caliber carbine configurations of the AR-platform. The bolt carrier assembly 92 used with the embodiments of this invention can have either a standard mil-spec M16-pattern bolt carrier, a standard AR15-pattern bolt carrier, or some variation of the two, depending on the design of the locking member 72, and whether operated by a gas direct impingement system or a gas piston system. The bolt carrier assembly 92 has an engagement surface 94 in a rear portion 96 of the bolt carrier body 98. As in an ordinary AR15-pattern configuration, during rearward travel of the bolt carrier assembly 92 a lower surface 102 in a forward portion 104 of the bolt carrier body 98 contacts the face of

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the hammer head 50 causing the hammer 36 to pivot rearward. Rearward travel of bolt carrier assembly 92 also moves engagement surface 94 rearward and away from surface 78 of locking member 72. The action of spring 82 causes locking member 72 to pivot in a first direction from a first position wherein surface 80 of locking member 72 does not impede upward movement of surface 69 of trigger member 38 to a second position wherein surface 80 of locking member 72 does impede upward movement of surface 69 of trigger member 38 thus preventing the trigger blade 54 from being pulled by the user. During forward travel of the bolt carrier assembly 92 the engagement surface 94 of the bolt carrier body 98 contacts the surface 78 of the locking member 72 to pivot the locking member 72 in a second opposite direction from the second position to the first position.

A three position safety selector 110 has safe, standard semi-automatic, and forced reset semi-automatic positions. When in the safe position (safety selector indicator 111 pointing forward), a wide semi-circular portion 112 of the safety selector 110 prevents the trigger blade 54 from being pulled (FIGS. 4A, 4B, and 7). When in the standard semi-automatic position (safety selector indicator 111 pointing upward), a flat portion 114 of the safety selector 110 permits the trigger blade 54 to be pulled. The disconnecter 60 can pivot with the trigger member 38 and the disconnecter hook 64 can catch the hammer hook 53 during rearward pivoting travel of the hammer head 50. (FIGS. 5A and 5B). When in the forced reset semi-automatic position (safety selector indicator 111 pointing rearward), a narrow semi-circular portion 116 permits the trigger blade 54 to be pulled but prevents the disconnecter 60 from pivoting with the trigger member 38 thus preventing the disconnecter hook 64 from catching the hammer hook 53 during rearward pivoting travel of the hammer head 50. (FIGS. 6A and 6B). In other words, in the forced reset semi-automatic position, the disconnecter 60 is “disabled” in that the disconnecter hook 64 is unable to catch the hammer hook 53 during cycling of the bolt carrier assembly 92.

Referring now to FIGS. 8A-8D, with the safety selector 110 set in the standard semi-automatic position, rearward finger pressure on the trigger blade 54 causes the trigger member 38 to rotate clockwise. Rotation of the trigger member 38 causes the sear 56 to disengage from the sear catch 52 of the hammer 36. This allows the hammer 36 to drop by spring force onto the firing pin 99 of the bolt carrier assembly 92, discharging an ammunition cartridge (not shown), and causing the action to cycle by moving the bolt carrier assembly 92 rearward. Rearward travel of the bolt carrier assembly 92 frees the locking member 72 to pivot such that surface 80 is moved into a blocking position. Rearward travel of the bolt carrier assembly 92 also causes the lower surface 102 to contact the face of the hammer head 50 and pivot the hammer 36 counter-clockwise. During pivoting travel of the hammer 36 surface 51 contacts surface 58 of trigger member 38 forcing trigger member 38 to pivot counter-clockwise. Also during pivoting travel of the hammer 36 the disconnecter hook 64 catches the hammer hook 53. Forward travel of the bolt carrier assembly 92 returning to battery causes the surface 94 to contact the surface 78 of the locking member 72 to pivot the locking member 72 clockwise moving surface 80 out of the blocking position. At this point rearward finger pressure on the trigger blade 54 must be released to allow the sear 56 to engage the sear catch 52, returning the hammer 36 and trigger member 38 to their set positions. Thereafter the user can reapply rearward finger pressure on the trigger blade 54 to fire another round.

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Referring now to FIGS. 9A-9D, with the safety selector 110 set in the forced reset semi-automatic position, rearward finger pressure on the trigger blade 54 causes the trigger member 38 to rotate clockwise. The narrow semi-circular portion 116 of the safety selector 110 prevents the disconnecter 60 from rotating with the trigger member 38, thus “disabling” the disconnecter 60, preventing the disconnecter hook 64 from catching the hammer hook 53. Rotation of the trigger member 38 causes the sear 56 to disengage from the sear catch 52 of the hammer 36. This allows the hammer 36 to drop by spring force onto the firing pin 99 of the bolt carrier assembly 92, discharging an ammunition cartridge, and causing the action to cycle by moving the bolt carrier assembly 92 rearward. Rearward travel of the bolt carrier assembly 92 frees the locking member 72 to pivot such that surface 80 is moved into a blocking position. Rearward travel of the bolt carrier assembly 92 also causes the lower surface 102 to contact the face of the hammer head 50 and pivot the hammer 36 counter-clockwise. During pivoting travel of the hammer 36 surface 51 contacts surface 58 of trigger member 38 forcing trigger member 38 to pivot counter-clockwise. The bolt carrier assembly 92 thereby forces the hammer 36 and trigger member 38 to their set positions wherein the sear 56 engages the sear catch 52. Forward travel of the bolt carrier assembly 92 returning to battery causes the surface 94 to contact the surface 78 of the locking member 72 to pivot the locking member 72 clockwise. At this point the user can reapply rearward finger pressure on the trigger blade 54 to fire another round, without first manually releasing rear finger pressure on the trigger blade 54.

Thus, as the bolt carrier assembly 92 returns forward, the trigger member 38 is held in its set position by the locking member 72. The trigger member 38 cannot be pulled to release the sear/sear catch engagement, thus precluding early hammer release or “hammer follow” against the bolt carrier assembly 92 and firing pin 99 as the bolt carrier assembly 92 is returning to battery. When the bolt carrier assembly 92 has reached (or nearly reached) its closed, in-battery position, the engagement surface 94 contacts and forwardly displaces the contact surface 78 of the locking member 72, disengaging the contact surface 80 of the locking member 72 from the contact surface 69 of the trigger member 38, allowing the trigger blade 54 to be pulled. Again, this prevents early hammer release and contact of the hammer against the firing pin before the bolt is completely locked and in-battery.

While various embodiments of the present invention have been described in detail, it should be apparent that modifications and variations thereto are possible, all of which fall within the true spirit and scope of the invention. Therefore, the foregoing is intended only to be illustrative of the principles of the invention. The invention resides in each individual feature described herein, alone, and in any and all combinations and subcombinations of any and all of those features. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not intended to limit the invention to the exact construction and operation shown and described. Accordingly, all suitable modifications and equivalents may be included and considered to fall within the scope of the invention, defined by the following claim or claims.

What is claimed is:

1. A trigger mechanism for a firearm comprising:
 - a hammer having a hammer sear surface and a hammer hook and adapted to be mounted in a fire control mechanism pocket of a receiver to pivot on a transverse

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hammer pivot axis between set and released positions, the hammer adapted to be pivoted rearward by rearward movement of a bolt means;

a trigger member having a trigger member sear surface and adapted to be mounted in the fire control mechanism pocket to move between a set position and a released position, rearward pivoting of the hammer causing the trigger member to be forced to the set position;

wherein the hammer sear surface and trigger member sear surface are in engagement in the set position of the hammer and the set position of the trigger member and are out of engagement in the released position of the hammer and the released position of the trigger member;

a disconnecter having a disconnecter hook for engaging the hammer hook and adapted to be mounted in the fire control mechanism pocket to pivot on a transverse disconnecter pivot axis

a locking member adapted to be movably mounted in the fire control mechanism pocket, the locking member being movable between a first position at which the locking member mechanically blocks the trigger member from moving to the released position and a second position at which the locking member does not mechanically block the trigger member allowing the trigger member to be moved to the released position and adapted to be moved to the second position by forward movement of the bolt; and

a safety selector adapted to be movably mounted in the fire control mechanism pocket to move between at least a safe position, a standard semi-automatic position, and a forced reset-semi-automatic position;

wherein in the standard semi-automatic position, rearward movement of the bolt means causes rearward pivoting of the hammer such that the disconnecter hook catches the hammer hook, at which time a user must manually release pressure on the trigger member to free the hammer from the disconnecter to permit the hammer and the trigger member to pivot to the set positions so that the user can actuate the trigger member to fire the firearm again; and

wherein in the forced reset semi-automatic position, rearward movement of the bolt means causes rearward pivoting of the hammer causing the trigger member to be forced to the set position, and the disconnecter hook is prevented from catching the hammer hook, and thereafter when the bolt means reaches a substantially in-battery position or an in-battery position the user can actuate the trigger member to fire the firearm again.

2. The trigger mechanism of claim 1, further comprising a spring which biases the trigger member toward the set position.

3. The trigger mechanism of claim 1, wherein the safety selector is adapted to be pivotably mounted in the fire control mechanism pocket to pivot on a transverse safety selector pivot axis.

4. The trigger mechanism of claim 1, wherein the locking member is adapted to be pivotably mounted in the fire control mechanism pocket to pivot on a transverse locking member pivot axis.

5. The trigger mechanism of claim 1, wherein the trigger member pivots on a transverse trigger member pivot axis between the set position and the released position.

6. The trigger mechanism of claim 1, wherein the locking member is spring biased toward the first position and

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adapted to be moved against the spring bias to the second position by contact from the bolt means during forward movement of the bolt means.

7. A trigger mechanism operable in a standard semi-automatic mode and in a forced reset semi-automatic mode for a firearm having a semi-automatic cycling action, comprising:

a hammer having a hammer sear surface and a hammer hook and adapted to pivot on a transverse hammer pivot axis between a hammer set position and hammer released position, the hammer adapted to be pivoted rearward by rearward movement of a bolt means;

a trigger member having a trigger member sear surface and adapted to move between a trigger member set position and a trigger member released position, cycling of the action causing the trigger member to be forced to the trigger member set position;

wherein the trigger member sear surface and the hammer sear catch are in engagement in the hammer set position-and the trigger member set position-and are out of engagement in the hammer released position-and the trigger member released position;

a disconnecter having a disconnecter hook for engaging the hammer hook and adapted to pivot on a transverse disconnecter pivot axis; and

a locking member adapted to be movable between a first position at which the locking member mechanically blocks the trigger member from moving to the released position when in at least one mode of operation and a second position at which the locking member does not mechanically block the trigger member allowing said trigger member to be moved to the released position and adapted to be moved to the second position by forward movement of the bolt means,

wherein in the standard semi-automatic mode, rearward movement of the bolt means causes rearward pivoting of the hammer such that the disconnecter hook catches the hammer hook, at which time a user must manually reduce pressure on the trigger member to free the hammer from the disconnecter to permit the hammer and the trigger member to pivot to the hammer set position and the trigger member set position so that the user can actuate the trigger member to fire the firearm again, and

wherein in the forced reset semi-automatic mode, rearward movement of the bolt means causes rearward pivoting of the hammer causing the trigger member to be forced to the trigger member set position, and the disconnecter hook is prevented from holding the hammer hook, and thereafter when the bolt means reaches a substantially in-battery position or an in-battery position the user can actuate the trigger member to fire the firearm again.

8. The trigger mechanism of claim 7, further comprising a spring which biases the trigger member toward the trigger member set position.

9. The trigger mechanism of claim 7, wherein a safety selector is adapted to be pivotably mounted to pivot on a transverse safety selector pivot axis.

10. The trigger mechanism of claim 7, wherein the locking member is adapted to be pivotably mounted in a fire control mechanism pocket to pivot on a transverse locking member pivot axis.

11. The trigger mechanism of claim 7, wherein the trigger member pivots on a transverse trigger member pivot axis between the trigger member set position and the trigger member released position.

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12. The trigger mechanism of claim 7, wherein the locking member is spring biased toward the first position and adapted to be moved against the spring bias to the second position by contact from the bolt means during forward movement of the bolt means.

13. The trigger mechanism of claim 7, further comprising a safety selector that is a separate part from the locking member.

14. A trigger mechanism for a firearm operable in at least a standard semi-automatic mode and a forced reset semi-automatic mode, comprising:

a hammer having a hammer sear catch and a hammer hook and adapted to pivot on a transverse hammer pivot axis between a set position and a released position, the hammer adapted to be pivoted rearward by rearward movement of a bolt means;

a trigger member having a trigger member sear and adapted to move between a set position and a released position, the trigger member being forced to the set position as a result of cycling action of the bolt means, such that the trigger member sear and the hammer sear catch are in engagement in the set position of the hammer and the set position of the trigger member and are out of engagement in the released position of the hammer and the released position of the trigger member;

wherein the trigger member sear and the hammer sear catch are in engagement in the set position of the hammer and the set position of the trigger member and are out of engagement in the released position of the hammer and the released position of the trigger member,

a disconnecter having a disconnecter hook for engaging the hammer hook and adapted to pivot on a transverse disconnecter pivot axis; and

a locking member adapted to be movably mounted, the locking member being movable between a first position at which the locking member mechanically blocks the trigger member from moving to the released position and a second position at which the locking member does not mechanically block the trigger member allowing the trigger member to be moved to the released position and adapted to be moved to the second position by forward movement of the bolt means,

wherein in the standard semi-automatic mode, rearward movement of the bolt means causes rearward pivoting of the hammer such that the disconnecter hook holds the hammer hook, at which time a user must manually reduce pressure on the trigger member to free the hammer from the disconnecter to permit the hammer and the trigger member to pivot to the set positions so that the user can pull the trigger member to fire the firearm again; and

wherein in the forced reset semi-automatic mode, rearward movement of the bolt means causes the trigger member to be forced to the set position, and the disconnecter hook is prevented from holding the hammer hook, and thereafter when the bolt means reaches a substantially in-battery position or an in-battery position the user can actuate the trigger member to fire the firearm again.

15. The trigger mechanism of claim 14, further comprising a safety selector, movement of which selects between at least standard semi-automatic mode and forced reset semi-automatic mode.

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16. A trigger mechanism for a firearm comprising:

a hammer having a hammer sear catch and a hammer hook and adapted to pivot on a transverse hammer pivot axis between a hammer set position and a hammer released position, the hammer adapted to be pivoted rearward by rearward movement of a bolt means;

a trigger member having a trigger member sear and adapted to move between a trigger member set position and a trigger member released position, the trigger member being forced to the trigger member set position as a result of cycling action of the bolt means;

wherein the trigger member sear and the hammer sear catch are in engagement in the hammer set position and trigger member set position and are out of engagement in the hammer released position and the trigger member released position;

a disconnecter having a disconnecter hook for engaging the hammer hook and adapted to pivot on a transverse disconnecter pivot axis;

a locking member adapted to be movably mounted, the locking member being movable between a first position at which the locking member mechanically blocks the trigger member from moving to the trigger member released position and a second position at which the locking member does not mechanically block the trigger member allowing the trigger member to be moved to the trigger member released position and adapted to be moved to the second position by forward movement of the bolt means; and

a safety selector adapted to be movably mounted to move between at least standard semi-automatic position and forced reset semi-automatic position, wherein in the standard semi-automatic position, rearward movement of the bolt means causes rearward pivoting of the hammer such that thereafter the disconnecter hook holds the hammer hook, after which a user must reduce rearward pressure on the trigger member before the trigger member can be actuated to fire the firearm again, and

wherein in the forced reset semi-automatic position, rearward movement of the bolt means causes the trigger member to be forced to the set position, the disconnecter hook is prevented from holding the hammer hook, and thereafter, when the bolt means reaches a substantially in-battery position or an in-battery position, the trigger member can be actuated to fire the firearm again.

17. A trigger mechanism for a semi-automatic firearm, comprising:

a hammer comprising a hammer hook;

a disconnecter comprising a disconnecter hook for holding the hammer hook;

a trigger member, wherein the trigger member can be is forced into a trigger set position responsive to rearward motion of a cyclic semi-automatic action of the semi-automatic firearm; and

a locking member configured to move between a block position and a non-block position, wherein the block position mechanically blocks the trigger member from moving from the trigger set position to a trigger released position, wherein the non-block position permits the trigger member to be moved from the trigger set position to the trigger released position, wherein the locking member is moved into the block position during rearward motion of the cyclic semi-automatic

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action and moved into the non-block position during forward motion of the cyclic semi-automatic action, and wherein:

in a standard semi-automatic mode, after cycling of the action and while the trigger member is in the trigger released position, the trigger mechanism is configured such that the disconnecter hook holds the hammer hook, at which point, rearward pressure on the trigger member must be reduced before the trigger member can be actuated, and

in a forced reset semi-automatic mode, the disconnecter hook is prevented from holding the hammer hook, and the trigger member can be actuated when the cyclic semi-automatic action reaches a substantially in-battery position or an in-battery position.

18. The trigger mechanism of claim 17, wherein the cyclic semi-automatic action comprises a bolt.

19. The trigger mechanism of claim 17, wherein the hammer is configured to pivot on an axis substantially perpendicular to an axis of the cyclic semi-automatic action.

20. The trigger mechanism of claim 17, wherein the hammer is configured to pivot between a hammer set position and a hammer released position.

21. The trigger mechanism of claim 17, wherein the disconnecter is configured to pivot on an axis substantially perpendicular to an axis of the cyclic semi-automatic action.

22. The trigger mechanism of claim 17, wherein the trigger member is configured to pivot on an axis substantially perpendicular to an axis of the cyclic semi-automatic action.

23. The trigger mechanism of claim 17, wherein the trigger member is configured to pivot between the trigger set position and a trigger released position.

24. The trigger mechanism of claim 17, wherein the hammer is configured to pivot rearwardly responsive to rearward motion of the cyclic semi-automatic action.

25. The trigger mechanism of claim 17, wherein the hammer comprises a hammer sear surface and the trigger member comprises a trigger sear surface, and wherein the hammer sear surface and the trigger sear surface are in engagement when, simultaneously, the hammer is in a hammer set position and the trigger member is in the trigger set position.

26. The trigger mechanism of claim 17, wherein the locking member is configured to pivot on an axis substantially transverse to a reciprocation axis of the cyclic semi-automatic action.

27. The trigger mechanism of claim 17, further comprising a spring which biases the trigger member toward the trigger set position.

28. The trigger mechanism of claim 17, comprising a safety selector, wherein the safety selector is configured to be pivotably mounted to pivot on a transverse axis of the semi-automatic firearm and substantially perpendicular to an axis of the cyclic semi-automatic action.

29. The trigger mechanism of claim 17, comprising a safety selector, wherein the safety selector is selectable between at least the standard semi-automatic mode and the forced reset semi-automatic mode.

30. The trigger mechanism of claim 17, comprising a safety selector that is separate from the locking member.

31. The trigger mechanism of claim 17, wherein the locking member is biased by a spring toward the block position.

32. A trigger mechanism for a semi-automatic firearm operable in at least a standard semi-automatic mode and a forced reset semi-automatic mode, comprising:

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a disconnecter;

a trigger member, wherein the trigger member is forced into a trigger set position responsive to rearward motion of a cyclic semi-automatic action of the semi-automatic firearm; and

a locking member configured to move between a block position and a non-block position, wherein the block position mechanically blocks the trigger member from moving from the trigger set position to a trigger released position, wherein the non-block position permits the trigger member to be moved from the trigger set position to the trigger released position, wherein the locking member is moved into the block position during rearward motion of the cyclic semi-automatic action and moved into the non-block position during forward motion of the cyclic semi-automatic action;

a safety selector, wherein the safety selector is selectable between at least the standard semi-automatic mode and the forced reset semi-automatic mode; and wherein:

in the standard semi-automatic mode, rearward pressure on the trigger member must be reduced to disengage a hammer from the disconnecter before the trigger member can again be actuated; and

in the forced reset semi-automatic mode, the trigger member is forced to the trigger set position and can be actuated without reducing pressure on the trigger member to fire another round when the cyclic semi-automatic action reaches a substantially in-battery position or an in-battery position.

33. The trigger mechanism of claim 1, wherein the bolt means comprises a bolt carrier assembly.

34. The trigger mechanism of claim 7, wherein the bolt means comprises a bolt carrier assembly.

35. The trigger mechanism of claim 14, wherein the bolt means comprises a bolt carrier assembly.

36. The trigger mechanism of claim 16, wherein the bolt means comprises a bolt carrier assembly.

37. A trigger mechanism operable in a standard semi-automatic mode and in a forced reset semi-automatic mode for a firearm having a semi-automatic cycling action, comprising:

a hammer having a hammer sear surface and a hammer hook and adapted to pivot on a transverse hammer pivot axis between a set position and released position, the hammer adapted to be pivoted rearward by a rearward phase of the semi-automatic cycling action;

a trigger member having a trigger member sear surface and adapted to move between a set position and a released position;

wherein the trigger member sear surface and the hammer sear surface are in engagement when the hammer and trigger member are each in their respective set position and are out of engagement when either the hammer or trigger member is not in their respective set position;

a disconnecter having a disconnecter hook and adapted to pivot on a transverse disconnecter pivot axis; and

a locking member adapted to be movable between a first position at which the locking member mechanically blocks the trigger member from moving to the released position when in at least one mode of operation and a second position at which the locking member does not mechanically block the trigger member allowing said trigger member to be moved to the released position and adapted to be moved to the second position by a forward phase of the semi-automatic cycling action; wherein in the standard semi-automatic mode, the rearward phase of the semi-automatic cycling action causes

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a rearward pivot of the hammer to a position where the hammer hook is past the disconnecter hook, the hammer sear surface is not in engagement with the trigger member sear surface, and, thereafter, rearward pressure on the trigger member must be reduced to permit the hammer and the trigger member to pivot to their respective set positions where the hammer sear surface engages with the trigger member sear surface, so the trigger member can be actuated to fire the firearm again; and

wherein in the forced reset semi-automatic mode the disconnecter hook is prevented from catching the hammer hook and the rearward phase of the semi-automatic cycling action causes (1) rearward pivoting of the hammer to a position where the hammer hook is past the disconnecter hook, (2) the trigger member to be forced to its respective set position, and (3) the hammer sear surface to be not in engagement with the trigger member sear surface, and thereafter, the hammer forwardly pivots to its respective set position with the hammer hook passing the disconnecter hook, the hammer sear surface engages with the trigger member sear surface, and when the forward phase of the semi-automatic cycling action reaches an in-battery position, rearward pressure on the trigger member the trigger member does not need to be released to actuate the trigger member to fire the firearm again.

38. A forced reset trigger mechanism, comprising:
a hammer having a hammer hook and adapted to pivot on a transverse hammer pivot axis;
a disconnecter having a disconnecter hook and adapted to pivot on a transverse disconnecter pivot axis;
a trigger member; and
a safety selector adapted to be movable between a standard semi-automatic position and a forced reset semi-automatic position,
wherein when the safety selector is in the standard semi-automatic position and the trigger member is rearwardly actuated, and after the hammer pivots rearward to a position where the hammer hook is past the disconnecter hook, rearward pressure on the trigger member must be reduced to permit the trigger member to then be actuated to fire a firearm.

39. A forced reset trigger mechanism, comprising:
a hammer having a hammer hook and adapted to pivot on a transverse hammer pivot axis;
a disconnecter having a disconnecter hook and adapted to pivot on a transverse disconnecter pivot axis;
a trigger member; and
a safety selector adapted to be movable between a standard semi-automatic position and a forced reset semi-automatic position,
wherein, when in either position, when the trigger member is pulled rearward, cycling of a firearm action rearwardly pivots the hammer to a position where the hammer hook is past the disconnecter hook,
wherein if the safety selector is in the standard semi-automatic position, rearward pressure on the trigger member must be reduced to permit the trigger member to then be actuated to fire a firearm, and
wherein, if the safety selector is in the forced reset semi-automatic position, the trigger member is forced to move to a full reset position against rearward pressure on the trigger member and the rearward pressure on the trigger member does not need to be reduced to actuate the trigger to fire the firearm.

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40. A forced reset trigger mechanism, comprising:
a hammer having a hammer hook and adapted to pivot on a transverse hammer pivot axis;
a disconnecter having a disconnecter hook and adapted to pivot on a transverse disconnecter pivot axis;
a trigger member; and
a safety selector adapted to be movable between a standard semi-automatic position and a forced reset semi-automatic position, wherein, when in either position, when the trigger member is pulled rearward, cycling of a firearm action rearwardly pivots the hammer to a position where the hammer hook is past the disconnecter hook,
wherein, if the safety selector is in the standard semi-automatic position, rearward pressure on the trigger member must be reduced to permit the trigger member to then be actuated to fire a firearm, and
wherein, when the safety selector is in the forced reset semi-automatic position, the hammer contacts the trigger member and forces the trigger member to move to a full reset position against rearward pressure on the trigger member and the rearward pressure on the trigger member does not need to be reduced to actuate the trigger to fire the firearm.

41. A forced reset trigger mechanism, comprising:
a trigger member configured to pivot about a transverse pivot axis and having a thickness defined between opposing lateral side surfaces; and
a disconnecter positioned laterally adjacent to the trigger member.

42. The trigger mechanism of claim 41, wherein a combined lateral width of the trigger member and the disconnecter is sized to fit within a fire control mechanism pocket.

43. The trigger mechanism of claim 41, wherein the trigger member includes a relieved portion extending inward from one of the opposing lateral side surfaces, the relieved portion being configured to receive at least a portion of the disconnecter.

44. A forced reset trigger mechanism, comprising:
a trigger member configured to pivot about a transverse pivot axis and having opposing lateral side surfaces; and
a disconnecter disposed laterally adjacent to the trigger member,
wherein the trigger member includes a reduced-thickness region defined at one of the opposing lateral side surfaces, and the disconnecter is received at least partially within the reduced-thickness region such that the trigger member and the disconnecter collectively define an overall lateral width.

45. A forced reset trigger mechanism, comprising:
a trigger member configured to pivot about a transverse pivot axis; and
a disconnecter positioned laterally adjacent to the trigger member,
wherein the trigger member defines a lateral accommodation space, and the disconnecter occupies at least a portion of the lateral accommodation space such that the trigger member and the disconnecter overlap laterally.

46. A forced reset trigger mechanism, comprising:
a trigger member configured to pivot on a transverse trigger pivot axis, a forward of the trigger member comprising a downward oriented stop surface configured to abut an arresting surface that stops travel of the trigger when the trigger is pulled.

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47. The forced reset trigger mechanism of claim 46, wherein the arresting surface is an interior surface of a trigger cassette housing.

48. A forced reset trigger mechanism, comprising:

a hammer having a hammer hook;

a disconnecter having a disconnecter hook;

a trigger member; and

a safety selector adapted to be movable between a standard semi-automatic position and a forced reset semi-automatic position, wherein when the safety selector is moved from the standard semi-automatic position and into the forced reset semi-automatic position, the disconnecter is moved into a position where, after the hammer hook passes the disconnecter hook during firearm cycling, a reduction in rearward pressure on the trigger member is not required to fire a next shot.

49. A forced reset trigger mechanism, comprising:

a hammer having a hammer hook;

a disconnecter having a disconnecter hook;

a trigger member; and

a safety selector adapted to be movable between a standard semi-automatic position and a forced reset semi-automatic position, wherein when the safety selector is moved from the standard semi-automatic position and into the forced reset semi-automatic position, a portion of the safety selector moves the disconnecter into a position so as to prevent the disconnecter hook from catching the hammer hook where, after the hammer hook passes the disconnecter hook during firearm cycling, a reduction in rearward pressure on the trigger member is not required to fire a next shot.

50. A trigger mechanism operable in a standard semi-automatic mode and in a forced reset semi-automatic mode for a firearm having a semi-automatic cycling action, comprising:

a hammer, having a hammer sear surface and a hammer hook, adapted to pivot on a hammer pivot axis between a hammer set position and a hammer released position, the hammer adapted to pivot rearward by a rearward phase of the semi-automatic cycling action;

a trigger member, having a trigger member sear surface, adapted to move between a trigger set position and a trigger released position;

wherein the trigger member sear surface and the hammer sear surface are in engagement when the hammer and trigger member are both in their respective set position and are out of engagement when either the hammer or trigger member is not in its respective set position;

a disconnecter, having a disconnecter hook for engaging the hammer hook, adapted to pivot on a disconnecter pivot axis; and

a locking member adapted to be movable between a first position, where the locking member mechanically blocks the trigger member from moving from the trigger set position to the trigger released position, and a second position, where the locking member does not mechanically block the trigger member;

wherein said locking member is adapted to be moved from said first position to said second position by a forward phase of the semi-automatic cycling action;

whereas, in the standard semi-automatic mode, the trigger mechanism is configured such that rearward pressure on the trigger member causes the trigger member to move from the trigger set position toward the trigger released position, this movement causes the hammer to

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move from the hammer set position to the hammer release position, thereafter the hammer is positioned to pivot rearward;

whereas, the semi-automatic cycling action rearwardly pivots the hammer to a position where the hammer hook is below the disconnecter hook;

following rearward pivot of the hammer from the hammer release position and while there is rearward pressure on the trigger member, the hammer hook is configured to engage the disconnecter hook, and thereafter the rearward pressure on the trigger member must be reduced to allow the hammer hook to pivot forward above the disconnecter hook and for the trigger member sear surface to engage with the hammer sear surface;

whereas, in the forced reset semi-automatic mode, the trigger mechanism is configured such that the disconnecter hook is rearwardly displaced such that it cannot engage the hammer hook and rearward movement of the hammer causes the trigger member to move from the trigger released position to the trigger set position despite rearward pressure on the trigger member; and whereas thereafter, the hammer returns to the hammer set position such that the hammer sear surface and the trigger member sear surface are engaged.

51. In a forced reset trigger mechanism, an assembly, comprising:

a trigger housing configured to be mounted in a fire control mechanism pocket of a firearm, the housing supporting a locking member, the locking member configured to be movable between a first position and a second position, wherein in the second position the locking member blocks the trigger from being actuate, and

a safety selector capable of at least standard semi-automatic mode and forced reset semi-automatic mode.

52. A forced reset trigger assembly for installation within a fire control pocket of a firearm, comprising:

a trigger housing configured to be receivable within the fire control pocket;

a trigger member pivotally supported by the trigger housing;

a locking member movably supported by the trigger housing and movable relative to the trigger member, the locking member movable between:

(a) a blocking position in which movement of the trigger member is prevented; and

(b) a non-blocking position in which the trigger member is permitted to move; and

a selector having at least two discrete operating positions including:

(i) a standard semi-automatic position; and

(ii) a forced-reset position in which the trigger assembly operates in a forced reset firing mode.

53. A forced reset trigger mechanism, comprising:

a trigger member configured to pivot about a transverse axis;

a hammer;

a disconnecter operatively associated with the trigger member and the hammer; and

a locking member operatively associated with the trigger member,

wherein cycling of the action causes the trigger member to be forced to the set position in at least one operating mode; and

wherein the trigger mechanism is configured such that, when combined with a selector having an alternate selectable position, the trigger mechanism is enabled

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for a forced reset operating mode corresponding to the alternate selectable position.

54. A forced reset trigger mechanism, comprising:

a trigger member configured to pivot about a transverse axis;

a hammer;

a disconnector operatively associated with the trigger member and the hammer;

a locking member operatively associated with the trigger member;

wherein cycling of the action causes the trigger member to be forcibly returned to a set position in at least one operating mode; and

wherein the trigger mechanism includes a selector interface structured to cooperate with a selector having at least two discrete selectable positions including:

(i) a standard semi-automatic position; and

(ii) a forced-reset position,

such that rotation of the selector to the forced reset position enables said forced reset operating mode.

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55. A forced reset trigger mechanism, comprising:

a trigger member pivotable about a transverse axis;

a hammer;

a disconnector operatively associated with the trigger member and the hammer;

a locking member operatively associated with the trigger member;

wherein cycling of the firearm action causes the trigger member to be returned to a set position; and

wherein the trigger mechanism includes a selector interface structured to cooperate with a selector rotatable between at least two discrete positions including:

(i) a semi-automatic position in which the trigger resets without forced forward drive; and

(ii) a forced-reset position in which cycling of the action positively drives the trigger member forward to the set position.

* * * * *

EXHIBIT F



Super Safety

3D Printed Active Trigger System

1 INTRODUCTION

The Super Safety is a mechanism that actively resets the trigger of a firearm to allow the operator to fire again, quickly, and efficiently.

The Super Safety has been designed to operate with AR-15 pattern firearms that use a mil-spec bolt carrier and fire control group.

Two versions of the cam are included, the single mode cam and the dual mode cam. The single mode cam has two positions, safe and active reset. The dual mode cam has three positions, safe, active reset, and passive reset. Each has its own advantages, which will be explained.

When 3D printed in PA12-CF the Super Safety can last several hundred rounds. Optimally it is manufactured from a wear resistant steel.

This document contains the information needed to manufacture the Super Safety, as well as understand it's function.

Several companion documents are referenced from this document. They can be found in the same folder as this document.



Figure 1 17-4 SS Dual Mode Cam.

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3 HOW IT WORKS

The detailed description below was taken from a provisional patent, hence the rather general language used. Reference numbers are used to reference a part, feature, or assembly shown in one or more of the supplemental figures. The basic function will be described first, and then the safety and dual mode mechanisms will be described. Note that the figures illustrate the single mode version.

3.1 FIGURES

See the included document "Figures.pdf." for the remaining figures 1 through 13.

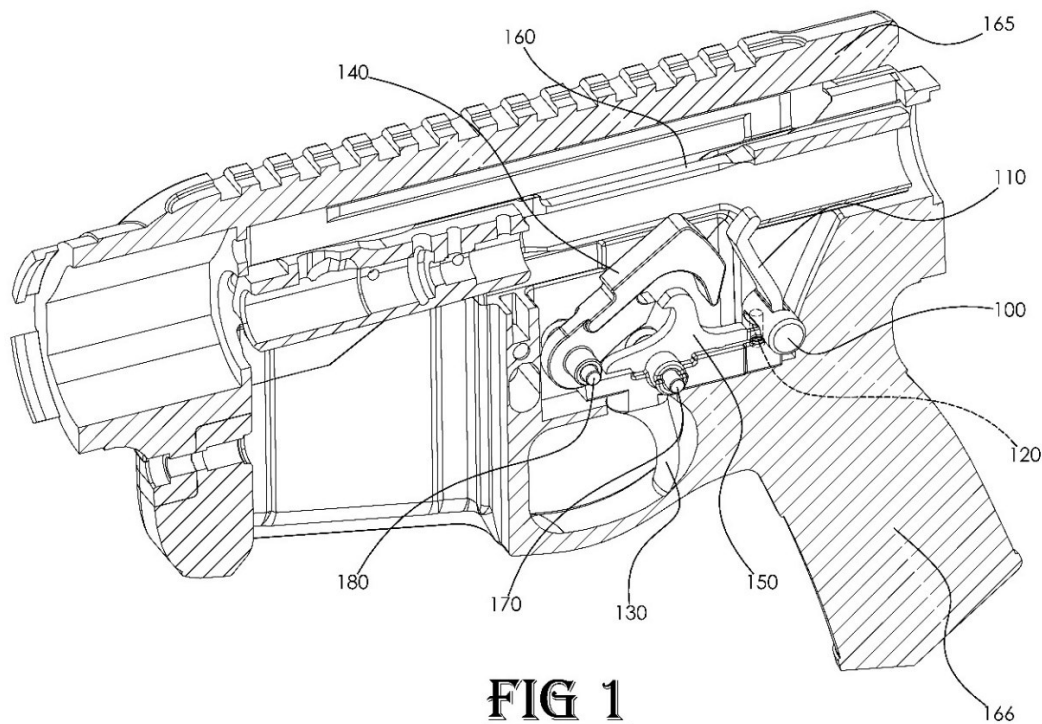


FIG 1

3.2 BASIC FUNCTION

In FIG 1, an assembled AR-15 fire control group is shown along with the mechanism. The cam **100** is installed into the receiver **166** in the place of a standard safety. The lever **110** is fastened to the cam **100** by a dovetail **330** and **250**. The trigger **130** and disconnecter **150**, are pivotally mounted to the receiver **166** by a transverse pin **170** and biased forward by a spring (not shown). The hammer **140** is pivotally mounted to the receiver **166** by a transverse pin **180** and biased forward by a spring (not shown). The detent **120** is contained in a passage within the

receiver **166** and is biased against the cam **100** by a spring (not shown). The bolt carrier **160** reciprocates within the upper receiver **165**.

In FIG 2 the fire control group and the mechanism are shown in the ready state. This is when the hammer **140** is cocked and the trigger **130** is forward, in the reset position. The firearm is ready to fire. When the trigger bow **390** is pulled to the rear by the operator, the trigger sear **410** releases the hammer sear **430**, allowing the hammer **140** to swing forward under spring pressure. The striking surface of the hammer **450** strikes the firing pin (not shown) which then fires the weapon. As the trigger bow **390** is pulled, the tail of the trigger **380** moves up into the cam **100**. The cam follower **270** slides against the cam surface **190**, rotating the cam **100** forward until the upper surface of the trigger **200** is resting in the relief area **210**. The disconnecter **150** is pivoted forward about its pivot **480** congruent with the motion of the trigger.

In FIG 3 the fire control group and mechanism are in the fired state. This is when the hammer **140** is fallen and the trigger bow **390** is pulled. As the bolt carrier **160** moves to the rear under gas pressure, the hammer cam point **520** pivotally displaces the hammer **140** back down into the former ready state. The tail of the hammer **460** may push the lever **110** out of its path as it swings back, this is not critical to the operation of the mechanism. The disconnecter sear on the hammer **460** snaps past and may engage with the disconnecter sear **500**. The hammer **140** is held down by the hammer cam surface **530** as the bolt carrier **160** continues to move rearward. As the bolt carrier continues to move rearward the hammer cam point **520** presses against the reset surface of the lever **340**, rotating the lever **110** rearward. As the lever **110** rotates rearward it transfers torque to the cam **100** via the dovetail joint **330**. As the cam **100** rotates the cam surface **190** slides against the cam follower **270**, moving the tail of the trigger **380** down, rotating the trigger **130** back into the former ready position. The trigger sear **410** can now engage the hammer sear **430**. The disconnecter **150** pivots back rearward about its pivot **480** congruent with the motion of the trigger **130**. The disconnecter sear on the hammer **460** may no longer engage with the disconnecter sear **500**.

In FIG 4 the fire control group and mechanism are in the reset position. The bolt carrier **160** is in its most rearward position, the lever **110** is held to the rear by the hammer cam surface **530** and the cam is rotated so that the neutral surface **260** is against the top surface of the trigger tail **200**. The trigger **130** is held in the reset position by the cam **100** and cannot be pulled by the operator as the neutral surface **260** is blocking the triggers tail **380** from moving up. As the bolt carrier **160** moves forward again under spring pressure, the hammer **140** is released by the hammer cam surface **530** and the hammer sear **430** engages the trigger sear **410**, preventing the hammer **140** from falling. As the bolt carrier **160** moves forward the rear surface of the bolt carrier **510** presses against the tip of the lever **350** rotating the lever **110** forward. The dovetail joint does not immediately transfer torque from the lever to the cam. The lever **110** pivots in the cam **100** until the void **220** is filled. Once the void is filled the hammer can transfer torque to the cam via the upper and lower contact surfaces **240** and **230**. Note that the void **220**, the lower contact surface **240**, and the upper contact surface **230**, are shown on arbitrary sides of the dovetail **330**, these features may be on either side of the dovetail **330** depending on which direction the lever **110** is moving. The amount that the lever **110** rotates in the dovetail **330** before transferring torque to the cam **100** is such that as the bolt carrier **160** completes its forward movement, the cam **100** rotates the neutral surface **260** away from the cam follower **270** and to a point where the cam follower **270** begins to slide against the cam surface **190**.

Once the cam **100** moves into this position the trigger bow **390** can be pulled again by the operator as previously described.

3.3 SAFETY

In FIG 6 a cut away view of the cam **100**, trigger **130**, and detent **120** are shown from the rear. The detent head **310** slides against the detent track **280**. The detent **120** and detent track **280** serve two purposes, preventing the cam **100** from rotating out of its intended range of motion, and selecting different cam profiles that engage with the cam follower **270**. In this example two cam profiles are implemented, the active cam profile consisting of the surfaces **210**, **190**, and **260**, and the safety cam profile **300**. The safety cam **300** is of a round and neutral profile. If the left side of the cam **290** is pressed by the operator, the cam **100** will transversely shift to the right and be held in the right position by the detent track **280** and detent **120**. In this example when the cam **100** is resting to the right the active surface of the cam can engage with the cam follower **270** and the mechanism will function as described previously. If the right side of the cam **320** is pressed by the operator, the cam **100** will transversely shift to the left and be held in this position by the detent track **280** and the detent **120**. In this example when the cam **100** is resting to the left the safety cam profile **300** engages with the cam follower **270** and prevents the trigger **130** from being pulled regardless of what position the cam is rotated to. In other words, by pressing the right side **320** or the left side **290** the manual safety can be engaged or disengaged. When the cam **100** is transversely shifted to the right or left, the lever **110** is held approximately in the center of the firearm by the walls of the receiver **166**. The cam can move transversely in the firearm independent of the lever, as the dovetail on the lever **250** can move transversely within the dovetail slot on the cam **330**.

3.4 DUAL MODE

The cam **100** can be expanded to support more cam profiles. The detent track **280** would be widened to support another position, and another cam profile would be added to the cam **100** alongside, or in between the current profiles, **300** and **210**, **190**, and **260**. An example of this would be to add a second neutral profile similar to the safety profile **300**, but of a smaller diameter. If this profile was selected by transversely sliding the cam **100** to the proper position, it would be of a small enough diameter to not engage the cam follower **270** regardless of what position the cam was rotated to. This would result in the fire control group functioning as before, but without the cam **100** actively resetting the trigger **130**. This would allow the operator to fire precise single shots more effectively. Because of geometric constraints on the AR platform, the tail of the trigger **380** and the cam follower **270** would need to be made narrower.

4 REQUIRED RESOURCES

All parts, tools, and materials will be described here. It is important to source all of the needed resources to ensure that the project is successful.

4.1 PARTS

A complete, functioning, AR-15 with a mil-spec bolt carrier and fire control group will be required. Keep in mind that the trigger and safety detent will be irreversibly modified. You may want to obtain spares of these parts.

The cam and lever will need to be obtained as well, presumably you will be 3D printing these.

The printed parts, as well as the modified trigger and detent, may be available in kit form.

4.2 FILAMENT

The filament required must have specific properties. High stiffness, excellent abrasion resistance, and preferably the ability to print via a 0.25 mm nozzle without clogging. The only material found to meet these properties is the Polymaker PA12-CF. This filament is highly recommended.

PLA+, PC, ABS, PETG, and other more common filament lack the required abrasion resistance. PA6 filaments lack the needed stiffness. Many carbon fiber filaments will clog when printing with the small 0.25 mm nozzle.

4.3 TOOLS

A 3D printer with an all metal hot end capable of printing the PA12-CF. A small nozzle is highly recommended to ensure the required level of detail. A 0.25 mm hardened nozzle is optimal. A 0.4 mm nozzle will work, but more hand fitting will be required.

A computer with slicing software. Prusa Slicer is highly recommended.

A Dremel tool with grinding wheels for modifying the trigger and detent.

Fine sanding and polishing paper for finishing the trigger and detent, as well as fitting the Cam and Lever. 320, 600, and 1500 grit paper are good choices. Leather or cardboard with polishing compound is also helpful for the final touch.

Miscellaneous punches and tools for disassembling and reassembling the firearm.



5 MAKING THE PRINTED PARTS

This is where you will have to decide whether you will print the single or dual mode cam. The dual mode cam is selectable between standard spring reset, same as any mil-spec fire control group, and active reset, allowing fast and efficient firing. The single mode cam has a much wider bearing surface, and will last longer before wearing out. In practice, when printed in PA12-CF, the single mode cam will last around 500 cycles, and the dual mode cam will last about 100. Optimally the dual mode cam should be made from steel. If you are printing the cam in PA12-CF, then the single mode cam would be the best option.

5.1 GENERAL PRINT SETTINGS

The same basic print settings are used for the cam and the lever:

0.25 mm nozzle:

- 0.10 mm layer height.
- 0.25 mm external perimeter line width.
- 0.20 mm top layer line width
- 0.30 mm for all other widths.
- 50% triangle infill.
- Four top and bottom layers.
- Very low print speeds. Less than 1 mm³/s flow rate.

0.4 mm nozzle:

- 0.10 mm layer height.
- 0.40 mm external perimeter line width.
- 0.40 mm top layer line width
- 0.45 mm for all other widths.
- 50% triangle infill.
- Four top and bottom layers.
- Very low print speeds. Less than 1 mm³/s flow rate.

If you are using a different nozzle size, such as 0.2 mm or 0.35 mm, the above line widths may need to be slightly modified.

Filament Settings:

- Manufacturer recommended temperatures.
- As little cooling as possible. Start with 0% and only increase if needed.

Using a bed adhesive, such as Magigoo, is highly recommended to prevent print failure.

5.2 PRINT ORIENTATION

Both parts come pre-orientated. The cam should be printed on its end with the markings facing up. The lever should be printed on one of its sides.

5.3 SUPPORT MATERIAL

Only the cam will require support material. A support enforcer STL is included with each cam. They act in the same way as paint on supports. The areas of the part that the enforcers overlap with are supported, other areas are not. This ensures that the minimal amount of support is added.

5.3.1 How to Use Support Enforcers

In Prusa Slicer (and Bambu Studio) enforcers are added by right clicking on the part > Add Support Enforcer > Load. Then you will select the file for the enforcer, included in the same folder as the part. After this is done select “Support for Enforcers Only” in Prusa or one of the “Manuel” support modes in Bambu.

In Cura you will import the enforcers same as the part, and then under the “Per Model Settings” select “Print as Support”. After this is done, you can select the modifiers and part and merge them together by right clicking and selecting “Merge Models”.

5.3.2 Support Settings

- Organic or Tree support.
- Two interface layers.
- 0.10 mm interface pattern spacing.
- 0.07 mm Z separation.
- 0.25 mm XY separation.

5.4 CAM SETTINGS

- The cam should be printed on a raft using the same interface settings as the support.
- Four walls should be used with a 0.25 mm nozzle.
- Three walls should be used with a 0.4 mm nozzle.
- Use paint on seams to ensure that no seams are in the dovetail groove. They will interfere with fit and function. Seams should be placed on the outside diameter, in places where they will not affect strength, such as the edge of the dovetail groove. If paint on seams are not available, use random seam position.

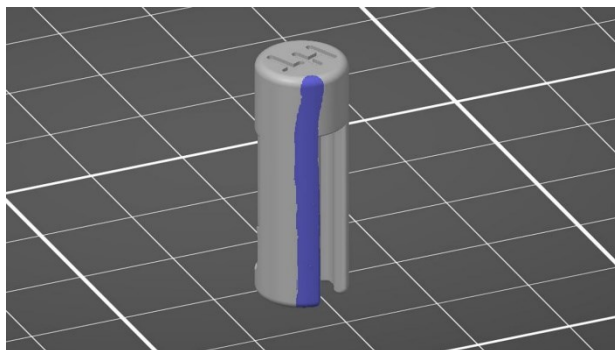


Figure 5. Proper use of the paint on seam with the cam.

5.5 LEVER SETTINGS

- The lever should be printed on a raft using the same interface settings as the support.
- Six walls should be used with a 0.25 mm nozzle.
- Four walls should be used with a 0.4 mm nozzle.
- Use paint on seams to ensure that no seam is on the dovetail. Seams should be placed along the back surface of the lever. If paint on seams is not available, use random seam position.

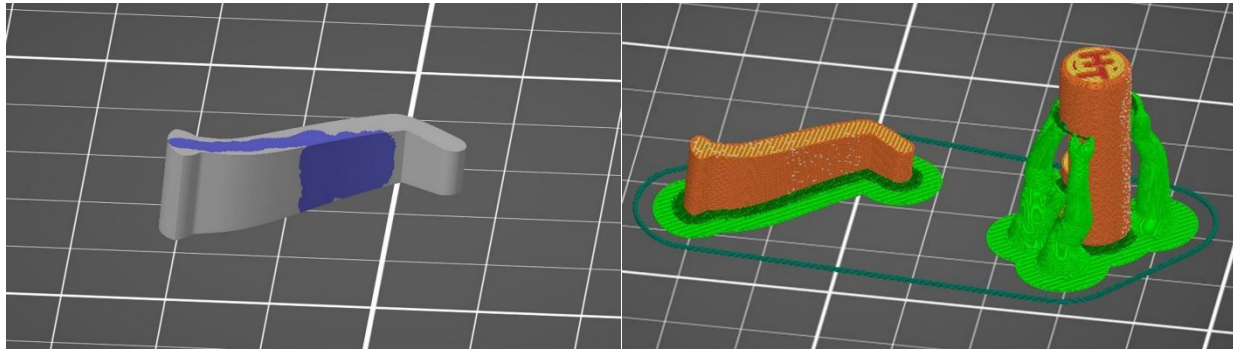


Figure 6 and 7. Proper use of paint on seam with the lever. Parts properly sliced.

6 MAKING THE MODIFIED PARTS

The extent of the modifications to the trigger will depend on whether or not the single or dual mode cam is used. When using the single cam, fine sandpaper is all that is needed to form the profile on the triggers tail. When using the dual cam, the Dremel tool will be needed to remove the right side of the tail completely. Decide on the cam, and then move forward with trigger modification.

If you have not already done so, remove the fire control group and safety group from the AR-15 lower.

6.1 TRIGGER

Lay out your sand paper on a flat hard surface.

6.1.1 Single Mode

Starting with the 320 grit paper, use a stroking motion to round the end of the trigger. The goal is to create a small radius, and then a curved drop off.

Achieving the proper profile is important to ensure that excessive force is not required to reset the trigger, and so that the cam can properly lock the trigger when the bolt carrier is out of battery. If the curve is cut too far forward, the cam may slip when trying to lock the trigger. If the curve is too small, excessive force will be required, possibly resulting in a failure of the lever.

Some triggers already have a drop off from the factory, this will make your job easier.

Be sure to hold the trigger with its center plane perpendicular to the surface, so that both sides of the triggers tail are ground evenly.

Once the desired shape is achieved, use the 600 and 1500 grit paper to smooth and polish the surface. If desired, you can complete this with the leather and polishing compound for a mirror finish. The smoother the surface, the less it will wear down the cam.



Figure 8 and 9. Proper sanding technique. Completed single mode trigger.

See the included drawing "Single Mode Trigger.pdf."

6.1.2 Dual Mode

To make the dual mode trigger, we will start with an already modified single mode trigger. Follow the above steps to create one.

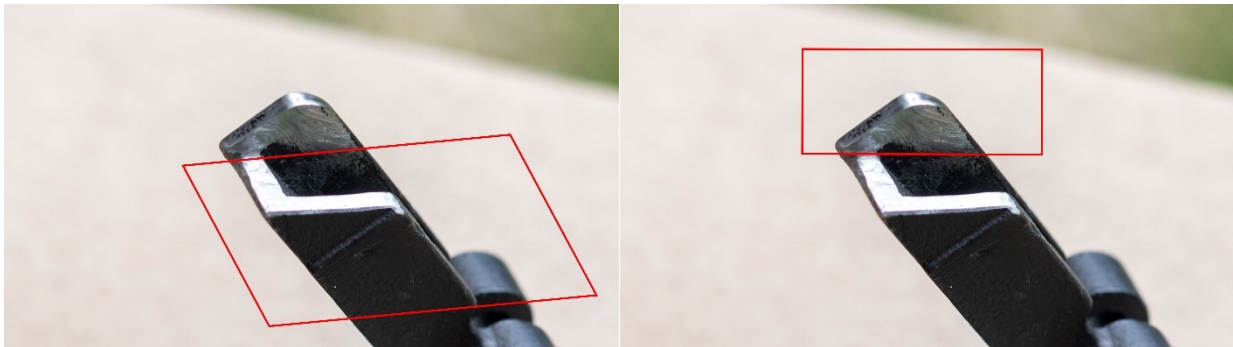


Figure 10 and 11. First cut from side. Second cut from top.

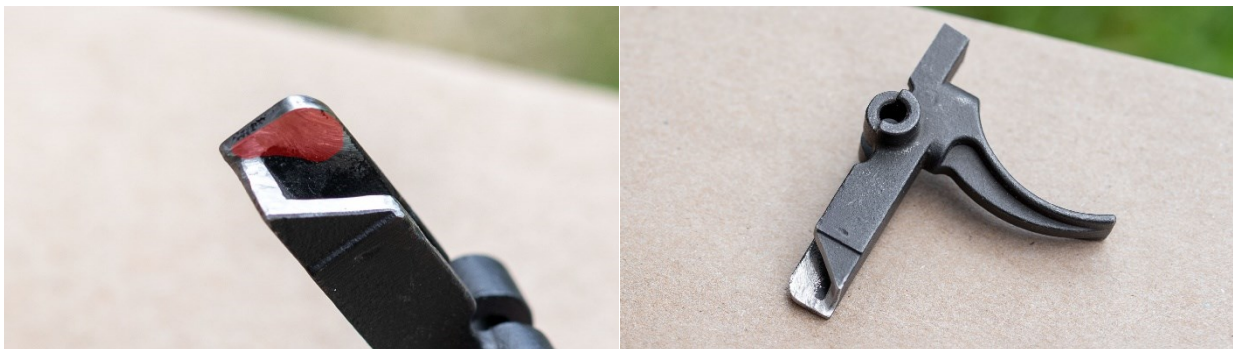


Figure 12 and 13. Final adjustment grind. Completed trigger.

Using the Dremel tool, cut away the right side of the trigger tail. The left 0.080" or so should be left untouched. Frequently cooling the trigger in water is important to prevent loss of the triggers temper.

It is best to start cutting from the right side of the trigger, and then finish from the top and rear. Some extra material should be left on the left side, and this should be removed through careful grinding, this ensures you don't over cut.

The above figures illustrate where to cut. The most important part is to not effect the cam surface you created when doing the single mode grinding.

See the included drawing "Dual Mode Trigger.pdf."

6.2 DETENT

Use the Dremel tool to remove the sharp tip from the detent. Then proceed with the 320 grit paper to round the top off more. Be careful not to remove too much material, you only want to convert the conical surface to a spherical surface, not shorten the detent.

Once the basic shape is formed, proceed with the 600 grit paper to create a smooth and uniform surface. Be sure not to blunt the edges where the spherical surface meets the parallel walls of the detent, this edge should remain sharp.

Once the surface is smooth and uniform, use the 1500 grit paper to polish it to a shine. If desired, you can complete this with the leather and polishing compound for a mirror finish.



Figure 14. Completed detent.

See the included drawing "Detent.pdf."

7 ASSEMBLY

Reinstall the fire control group, using the now modified trigger. The parts should be installed as they would on any other AR, including the disconnecter and disconnecter spring.

7.1 FITTING THE PARTS

Before proceeding with the assembly, the cam and lever must be test fitted. The cam must run smoothly in the safety hole in the lower, and the lever must move freely within the cam.

If the cam is too tight in the lower, it should be sanded on all of its outside diameter surfaces until it fits smoothly.

The dovetail on the lever should slide into the dovetail groove on the cam with only slight friction. The lever should be able to turn forward and backwards within the cam by 10 to 15 degrees. If the lever is tight, or can not turn within the cam, it should be sanded to fit. This is easier said than done.

Before sanding the lever, try running it back and forth a number of times along the length of the groove. This removes burrs and may be enough to create the proper fit. When doing this, hold pressure first to one side of the lever, and then the other. This ensures both sides are equally smoothed. The procedure should always be used when test fitting.

Sandpaper should be bent over the corner of a table or wooden block to form a tight bend. This can be used to remove small amounts of material from the sides of the lever. The curved bottom of the cam should also be sanded. Frequently test the fit to insure that the sanding is not over done.

Another option is to reprint the lever with slightly adjusted XY Size Compensation. This is a setting within Prusa Slicer that shrinks back the walls of an object. A small negative number should be used to do this, such as -0.025 mm.



Figure 15. Test fitting the lever in the cam.

7.2 FINAL ASSEMBLY

The hammer should be cocked back during this process.

Slide the cam in from the left side of the lower, as you do so, hold the lever inside of the lower above where the cam is inserted. The dovetail groove on the cam should slide over the dovetail on the lever, locking the two together. Be sure to hold the cam in the proper orientation, with the crook at the end facing to the rear.

Hold the cam in as you install the detent and detent spring. Once the detent is in place, and under spring force, the installation is complete. Steel cams should be lubricated with oil prior to use, otherwise galling against the trigger is a possibility. PA12-CF cams do not require lubrication.



Figure 16. Super Safety installed in a lower.

7.3 TESTING

Conduct a basic function test prior to installing the upper. With the hammer cocked, move the lever forward, then pull the trigger, being sure to catch the hammer in it's fall. Continue holding the trigger down as you pull the hammer back into the cocked position, it should catch on the disconnecter. As you continue to hold the trigger, move the lever to the rear, simulating the action of the bolt carrier. The trigger should be forced back forward into the reset position, and the hammer should be released from the disconnecter. With the lever all the way to the rear, attempt to pull the trigger, it should be locked. Continue pulling the trigger as you move the lever back forward, as the cam unlocks, the trigger should move to the rear, releasing the hammer. Be sure to catch the hammer in it's fall.

If the system does not function as described above, investigate why before continuing. Section eight has troubleshooting details on each possible issue. However, best way to troubleshoot is to understand in detail how the system works. Read section three.

After the basic test, install the upper and test again by pulling the trigger and racking the bolt carrier. The trigger should be reset each time the carrier moves to the rear, and unlocked each time the bolt moves into battery. Once all dry fire testing is passed, then you may test fire the system.

8 TROUBLESHOOTING

There are several malfunctions that can manifest. These are addressed here.

8.1 FAILURE TO FIRE

This normally occurs after a string of fire. The hammer has fallen, but the primer was not ignited. A light primer strike is typical. This is due to hammer follow, or in other words, the hammer being dropped before the bolt is into battery.

There are two modes of malfunction that will cause a failure to fire.

The most common is the cam being rotated out of the locked position prior to the bolt moving into battery. This is caused by the lever not having enough movement within the cam. The bottom of the lever should be sanded until it has more play.

The second cause is the locked position being too small. In other words, the cam is rotated at the right time, but the hammer rides the cam down into the fired position too soon. This is caused by a worn cam or improperly ground trigger. Inspect the cam, and reevaluate the profile of the trigger tail.

8.2 FAILURE TO RESET

The trigger is not actively reset when the active cam is engaged. The spring reset will continue to function as if the passive mode is selected. This is caused by the cam not resetting the trigger far enough to move the disconnecter away from the hammer. The disconnecter continues to hold the hammer back throughout the cycle.

There are two modes of malfunction that will cause a failure to reset.

The first is when the cam is not rotated far enough to the rear. In other words, the cam is not rotated into the locked position. The result is that the trigger will not be sufficiently reset to allow the hammer to be released from the disconnecter. This can be caused by an overly flexible or broken lever, or too much play between the lever and the cam.

The second is when the cam is worn, or the lower is out of spec. The cam is rotated fully to the rear locked position, but fails to reset the trigger. If the locking surface on the cam is worn down, it will not have sufficient diameter to depress the tail of the trigger by the required amount. The same goes for the lower, if the selector switch hole on the lower is too large, the cam can shift upwards and fail to move the tail of the trigger down sufficiently.

8.3 BROKEN LEVER OR CAM

The lever may break, resulting in a failure to actively reset the trigger, or even a jammed firearm. The edges of the dovetail groove on the cam may also fail for the same reason. The cause of this is typically excessive force on the lever due to an improperly ground trigger. A lack of lubrication when using a steel cam can also result in excessive force.

9 LEGAL

The Super Safety is not a machine gun. The Super Safety cannot be used to convert a firearm to a machine gun.

A “Machinegun” is defined in Federal Law as:

“...Any weapon which shoots, is designed to shoot, or can be readily restored to shoot, automatically more than one shot, without manual reloading, by a single function of the trigger.”

The Super Safety requires two functions of the trigger for every round fired:

1. The trigger must be pulled by the operator. A round is fired.
2. The trigger is reset by the cam. The trigger can now be pulled again by the operator.

The Super Safety does not meet the requirements needed for it to be a machine gun.

For a more detailed technical analysis written by Dan O’Kelly, see the included document “Legal Brief.pdf.”