UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF WYOMING

ABC IP, LLC, a Delaware limited liability company, and RARE BREED TRIGGERS, INC., a Texas corporation, and *Plaintiffs*, v. PEAK TACTICAL, LLC d/b/a PARTISAN TRIGGERS, a Wyoming limited liability company, and NICHOLAS NORTON, an individual, *Defendants*.	Case No. 2:26-cv-00018-KHR **REBUTTAL DECLARATION OF JOHN NIXON**

I, John Nixon, declare and state as follows:

I. INTRODUCTION AND SUMMARY OF OPINIONS

1. I submit this declaration in rebuttal to the declaration of Brian Luettke ("Luettke Decl.") which is attached as Exhibit Q to Plaintiffs' Memorandum in Support of Their Motion for Temporary Restraining Order and Preliminary Injunction in this action.

2. I have been asked to address Mr. Luettke's opinions, including his contention that the Partisan Disruptor (the "Accused Product") infringes (i) claim 4 of U.S. Patent No. 10,514,223 ("the '223 patent"), (ii) claim 4 of U.S. Patent No. 11,724,003 ("the '003 patent"), (iii) claim 3 of U.S. Patent No. 12,036,336 ("the '336 patent"), and (iv) claim 1 of U.S. Patent No. 12,016,807 ("the '807 patent") (collectively, "the Asserted Patents"), and his further contention that the Accused Product does not practice U.S. Patent No. 9,146,067 ("the '067 Patent"). In addition, I have been asked to, and do, opine on the invalidity of the Asserted Patents, the meaning of the phrases "assisted reset trigger" and "forced reset trigger," and whether the RBT FRT-15L3 infringes claim 19 of the '067 Patent.

3. My analysis and opinions are based on the materials cited herein and my experience in firearms design, testing, and forensic engineering. I am compensated at the rate of $525 per hour for my work in this matter, including analysis, preparation, and testimony. The content of my testimony and the payment of my fees are not dependent in any way on the outcome of this case, and I have no financial interest in any party to this litigation.

4. My opinions may be summarized as follows:

a. Given the breadth of pre-priority products and references, including the ’067 Patent and the 3MR commercial product sold as early as 2013-2014, and based on the Asserted Patents’ prosecution histories I reviewed, several highly relevant references do not appear to have been considered by the examiners for the Asserted Patents. Based on my preliminary review of these prior art references, it is my opinion that the Asserted Patents are invalid as either anticipated and/or rendered obvious by these references.

b. Claim construction is necessary before infringement can be reliably decided because phrases in the asserted claims are ambiguous and outcome-determinative, including at least: “substantially in-battery.”

c. Even under Plaintiffs’ framing, the Accused Products do not infringe the Asserted Patents, and the Accused Product does not meet several claim limitations. In addition, and subject to claim construction, the Accused Product differs in material ways from the Asserted Claims, including the “substantially in-battery” claim element, which, bears directly on whether each claim limitation is met.

d. “Assisted reset trigger” and “forced reset trigger” are generally synonymous in industry and regulatory usage and are generally understood as marketing terms

rather than terms used to classify different types of triggers. In the industry there is no accepted understanding or nomenclature that divides "assisted reset" and "forced reset," as these terms are often used interchangeably. (Ex. Q ¶¶ 16–18). In purely technical terms, an assisted reset trigger is reset by application of a force to the trigger, and a forced reset trigger is reset by application of a force to the trigger. Both products fully reset the trigger and are therefore identical in function. Both products achieve the same outcome (fast trigger reset) in the same way (by moving the trigger forward utilizing the energy in the bolt carrier group, via the hammer, to force the trigger forward into the reset position).

e. The Accused Product practices at least '067 Patent claim 19 (selector-based adjustment of trigger travel distance via stop structures). Mr. Luettke's contrary view is conclusory and lacks any actual analysis of this issue. (Ex. Q ¶ 44; Ex. R at 31; Dkt. 7 at 20).

f. For the same reasons the Accused Product practices claim 19 of the '067 Patent, Plaintiffs' product (e.g., FRT-15L3) infringes claim 19.

II. QUALIFICATIONS

5. My qualifications relevant to this proceeding and Declaration are summarized in this section, with additional detail provided in my curriculum vitae, which is attached as **Exhibit 1**, hereto.

6. I am originally from the United Kingdom, where I worked as a scientist and professional engineer for the UK Ministry of Defence, conducting weapons systems research, design, development, performance testing, system design evaluation, mid-life improvement, reverse engineering, and forensics.

7. I have a First Class Honors Degree in Mechanical Engineering (recognized in the US under the terms of the Washington Accord) from the University of Greenwich, London, United Kingdom. I also have a Master's Degree in Business Administration from Henley Management College, Brunel University, London, United Kingdom. I completed a four-year engineering apprenticeship, and obtained additional specialized education and training in the area of firearms, firearm components/accessories, suppressors/silencers, ballistics, wound ballistics, and explosives at the UK Royal Military College of Science. I am registered as a professional engineer (EUR ING) in approximately thirty European nations.

8. I have been working in the area of firearms, firearm components/accessories, trigger mechanisms, suppressors/silencers, ballistics, wound ballistics, and explosives for almost 40 years. I have extensive experience in weapons systems research, design, development, performance assessment, and system design evaluation. My work has included materials selection, heat treatment, and manufacturing technique evaluation and specification, including as applied to triggers. From 1986 to 1999, I was employed by the United Kingdom Ministry of Defence. My positions included; from 1986 to 1990, I served as a project engineer, small arms and ammunition; from 1990 to 1992, I served as a project manager, ammunition department; from 1992 to 1995, I served as a project manager, guns; and from 1995 to 1999, I served as a general/project manager, rocketry, missiles, pyrotechnics and explosives department; and as manager, legal services department (specializing in forensic firearms and ballistics).

9. During that time, my firearms and ballistics duties with the British Government included the following: (1) serving as an expert consultant/witness in over 200 legal cases; (2) designing gun components and accessories; (3) foreign weapon systems evaluation and performance assessment including weapon systems reverse engineering, materials analysis,

microscopic analysis, and comparison to NATO equivalents; (4) gun and component design optimization; (5) materials and process selection to optimize gun and ammunition performance; and (6) testing of various gun mechanisms and ammunition for criminal trials.

10. Likewise, my ammunition duties at the Ministry of Defence included research, assessment, design, development and reverse engineering of ammunition components and complete rounds in calibers ranging from small arms to 120mm tank and 155mm artillery. I also provided forensic firearms and ballistics services to the United Kingdom criminal justice system and civil courts.

11. In addition to my experience detailed above, with respect to triggers and trigger mechanics, my experience includes system design evaluation, instrumentation research and specification, testing and evaluation, and test data analysis and interpretation.

12. From 1996 to 2000, I was also a self-employed consultant, providing technical forensic and business advice to a variety of clients. From 2000 to 2004, I was employed as an adjunct professor at the Indiana Institute of Technology, lecturing in advanced courses in bachelor's and master's degree programs. I am currently a consultant with Athena Research and Consulting, providing technical and forensic research and consulting.

13. I am an internationally board-certified forensic engineering scientist via the International Board of Forensic Engineering Sciences (IBFES), which is accredited by the Forensic Specialties Accreditation Board (FSAB). I am a Fellow of the Institution of Mechanical Engineers, a Member of the National Society of Professional Engineers, a Fellow of the Chartered Management Institute, and a member of several other technical and professional societies. In 2013, I was elected to Fellowship of the American Academy of Forensic Sciences (AAFS) and received achievement awards from AAFS in 2017 and 2022. I am an NRA certified pistol and personal

protection instructor, and an NRA certified range safety officer. I have published numerous papers in the areas of firearms, firearm components/accessories, suppressors/silencers, trigger mechanisms, ballistics, wound ballistics, and explosives, and have delivered training seminars to attorneys, students, investigators, law enforcement personnel, engineers and forensic scientists. I have conducted extensive engineering research on firearms, weapons systems, firearm components, trigger mechanisms and accessories, and explosives, and have filed patents for innovations in munitions design. I have served as President of the Indiana Society of Professional Engineers, Section Chair in the American Academy of Forensic Sciences. I and am a director of the Forensic Specialties Accreditation Board and am current president of IBFES.

III. MATERIALS CONSIDERED

14. In forming my opinions, I reviewed, among other things:

a. Luettke Decl. (Dkt. 7-17, Ex. Q);

b. Plaintiffs' TRO/PI Motion (Dkt. 7);

c. The Asserted Patents (Dkt. Nos. 1-1 through 1-4) and the relevant portions of the Asserted Patents' prosecution histories;

d. Plaintiffs' infringement claim charts for the Accused Product (TRO Ex. W; Ex. X; Ex. Y; and Ex. Z.);

e. The '067 Patent and relevant portions of its prosecution history (Ex. R);

f. The documents and other sources of information detailed throughout this declaration, including the prior art references cited and/or attached hereto; and

g. The Declaration of Michael Stakes.

IV. OPINIONS REGARDING MR. LUETTKE'S QUALIFICATIONS

15. I have reviewed Mr. Luettke's disclosed background and the description of his experience as reflected in his declaration and supporting materials. Mr. Luettke states that he has

a BA degree, not a science or engineering degree, and claims no comprehensive structured technical training, such as an engineering apprenticeship and/or engineering work experience. Based on that information, it is my opinion that Mr. Luettke's professional experience does not align with the technical skillset ordinarily associated with a person of ordinary skill in the art ("POSITA") for AR-pattern fire control mechanisms and trigger system design in general.

16. Mr. Luettke's background includes work at the Bureau of Alcohol, Tobacco, Firearms and Explosives ("ATF"). However, I understand that his ATF work was not in the agency's firearm classification function. As a result, whatever general firearms exposure that role may have provided, it does not establish specialized expertise in the engineering, kinematics, timing, and tolerance stack-ups that govern the operation of AR-pattern trigger mechanisms, particularly in the "reset-assistance / reset-forcing" space at issue here.

17. More importantly, nothing in Mr. Luettke's disclosed qualifications indicates that he has experience in technically evaluating, designing, engineering, or developing trigger mechanisms, whether AR-pattern triggers or otherwise. In my opinion, the issues in this case are fundamentally mechanical and require engineering analysis of component geometry, movement, contact surfaces, timing during cycling, and the interaction among the bolt carrier group, hammer, disconnector, and trigger components. Experience in firearm policy, compliance, or enforcement, standing alone, does not substitute for specialized engineering or design experience in this field.

18. Mr. Luettke claims no experience applying patent law concepts to physical devices in the manner required for a reliable infringement or invalidity analysis. Specifically, nothing in his disclosed qualifications suggests prior work performing claim-by-claim infringement analyses, evaluating whether an accused device meets each limitation of an asserted claim, or conducting structured validity analyses (including analysis of prior art references and products against specific

claim limitations). While experts may of course learn aspects of litigation practice, the absence of demonstrated experience in patent claim analysis and validity/infringement methodology is significant in a case where the outcome turns on precise claim language and element-by-element mapping.

19. These gaps matter because Mr. Luettke's opinions depend not merely on general firearms familiarity, but on: (i) identifying the correct claimed structures in a complex mechanism; (ii) analyzing whether specific mechanical interactions actually occur (including timing relative to bolt carrier travel, "set position" and "substantially in-battery" operation); and (iii) tying those technical facts to the claim language with a disciplined, all elements approach. In my opinion, an expert who lacks trigger design/engineering experience is at a meaningful risk of substituting labels, generalizations, or assumptions for the rigorous analysis required.

20. Accordingly, based on the information presently available to me regarding Mr. Luettke's background and experience, it is my opinion that he does not possess the level of scientific/technical design/engineering expertise in AR-pattern trigger mechanisms that would qualify him as a POSITA in the relevant field of the Asserted Patents' trigger technology. His failure to recognize that the terms "assisted reset" and "forced reset" are the same beast by a different name provides a good example of his technical limitations.

21. My understanding of patent law is that the issue of "obviousness" and what is disclosed by a patent and prior art is done from the perspective of a POSITA. In addition, claim construction, a necessary component for an infringement analysis, also is done from the perspective of a POSITA. Because obviousness, claim construction, and infringement are assessed from the perspective of a POSITA, it is my opinion that he is not qualified to render an opinion on obviousness, claim construction, or infringement.

V. TECHNICAL BACKGROUND OF ASSISTED/FORCED RESET TRIGGERS

22. Baseline operation in an AR-pattern semi-automatic fire control system: In an AR-pattern semi-automatic firearm, the action cycles by propellant gas impingement-initiated movement of the bolt carrier immediately following ammunition discharge. As the bolt carrier moves rearward, the hammer is re-cocked and captured by fire control components, and the shooter must repeatedly pull and release the trigger to fire successive shots in semi-automatic operation. In that basic operating environment, the timing and interaction among the bolt carrier, hammer, disconnector, and trigger components determines whether the trigger is (i) returned to a set position allowing another pull, and (ii) prevented from potential unintended continued firing (what Mr. Luettke calls "runaway fire").

23. Baseline operation in an AR-pattern semi-automatic fire control system relies on a small, well-defined set of parts that have been standard for decades. In my extensive experience evaluating, testing, dissecting, and rebuilding AR-pattern mechanisms, the following components typically appear in civilian-legal semi-automatic AR-15 family fire control groups. None of them is novel to the Asserted Patents or Asserted Claims; they are the ordinary building blocks of the platform:

a. Trigger body (including the trigger shoe and the trigger nose/sear surface): pivots on the trigger pin to restrain and release the hammer.

b. Hammer (with a sear notch (sometimes referred to as the front sear) and a disconnector hook): pivots on the hammer pin; its striking face impacts the firing pin

c. Disconnector (with a hook): pivots on the trigger pin and uses its coil spring to provide the force to capture the hammer during cycling so that semi-automatic operation remains one-shot-per-pull.

d. Safety selector (manual selector) and its detent and spring: rotates between “safe” and “fire” to mechanically block trigger movement.

e. Springs:

i. Hammer spring (torsion, two legs): biases the hammer forward for firing.

ii. Trigger spring (torsion): biases the trigger forward to reset.

iii. Disconnector spring (coil): biases the disconnector into proper engagement with the hammer hook.

f. Pins:

i. Trigger pin and hammer pin: define the pivot axes; standard dimensions/location per mil-spec prints (or custom).

g. Receiver interfaces:

i. Lower receiver fire-control pocket and transverse pin bores: standardized geometry that locates the FCG parts.

ii. Selector bore and detent channel: standardized features that locate/retain the safety selector.

h. Bolt carrier group interfaces:

i. Carrier lower surface and tail region that cock the hammer.

ii. Buffer and action spring (in the receiver extension) that return the carrier to battery and set the timing the FCG must accommodate.

24. Additional known, platform-standard features often used or discussed with triggers include the bolt catch, takedown/pivot pins, and (in select-fire rifles) an auto-sear/out-of-battery safety; gating devices long known in the art to prevent release until the action is closed. Automatic variants may incorporate a burst fire mechanism (typically 3 shot). Whether the auto-sear is present

or absent, the AR platform's semi-automatic timing is governed by the same basic parts listed above.

25. From a mechanical and design standpoint, these components and their interactions are the baseline AR-pattern architecture. The Asserted Patents recite these same standard parts, (hammer, trigger body, sear surfaces, disconnector, springs, pins, selector) and their ordinary functions. In my view, and based on decades of hands-on work across mil-spec FCGs and commercial "drop-in" modules, the mere presence or identification of these components is not an advance; it is the expected, conventional component set for the AR family.

26. Priority-date context and why the pre-priority landscape matters here: The '223 Patent has an earliest possible priority date of September 29, 2017, and the later asserted patents ('003, '807, and '336 Patents) have earliest possible priority dates of January 10, 2022. As explained below, well before both dates, and particularly long before January 10, 2022, the public domain already contained: (i) publicly described, commercially sold AR-platform trigger systems marketed to achieve materially faster cadence through cycling-driven reset assistance (including designs expressly described as using bolt-carrier/bolt-group cycling to assist or force reset), (ii) modular "drop-in" fire control housings, (iii) selector-driven "modes" beyond conventional safe/semi, (iv) locking members, more commonly referred to as out-of-battery safeties and/or auto-sears, and (v) long-standing engineering concepts in which a recoiling/reciprocating firearm component forces the trigger forward against the shooter's finger pressure and then frees it upon completion of return travel. These concepts map directly onto the "forced reset / reset assistance" design space and Mr. Luettke's infringement framing. In my opinion, the pre-priority record establishes that the core technological concepts recited in the asserted claims were not new; they

were already in the public domain through both long-standing patents and well-publicized commercial products.

27. Long-standing ("early patent") disclosures: The concept of using energy from a firearm's cycling parts to move the trigger forward against the shooter's finger pressure, and then release/free the trigger once the cycling part completes its return travel, predates the asserted patents by many decades.

28. **Michal II (Exhibit 2)**: For example, U.S. Patent No. 2,139,691 (issued to Michal on Dec. 13, 1938) explicitly claims, in a "machine-gun"/converter context, "means, under the influence of the recoil of the slide, to … move the trigger forward against the pressure of the trigger-finger of the operator," and "means, under the influence of the counter-recoil of the slide, to free the trigger for firing, under the influence of continued pressure of the trigger-finger." (U.S. Pat. No. 2,139,691, claim 2; *see also* claims 4–5 (similar "move trigger forward" and "release upon completion of counter-recoil" language).)

29. **Michal I (Exhibit 3)**: Similarly, U.S. Patent No. 2,056,975 (issued to Michal on Oct. 13, 1936) likewise claims "means, under the influence of the recoil of the slide, to … move the trigger forward against the pressure of the trigger-finger of the operator," and "means, under the influence of the counter recoil of the slide, to free the trigger for firing, under the influence of continued pressure of the trigger-finger." (U.S. Pat. No. 2,056,975, claim 1.)

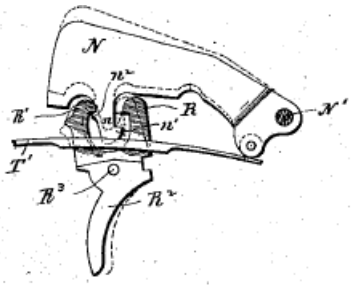
30. **Hyde (Exhibit 4)**: And, U.S. Patent No. 2,367,280 (issued to Hyde on Jan. 16, 1945) discloses (among other things) trigger mechanisms and safety means for automatic rifles, including mechanical arrangements that assure sear return and include safety structures to hold the trigger mechanism inoperative. (*See* U.S. Pat. No. 2,367,280 at p.2, 1:14-23 ("A further object is to provide a novel trigger mechanism adapted for adjustment to either of two positions to control

the firing mechanism of an automatic rifle so as to render the latter capable of either single shot or continuous firing. A still further object is to provide a novel trigger mechanism for controlling the sear of a rifle whereby the sear is automatically returned to operative position after each shot is fired regardless of the position of the trigger.").) Hyde's safety means (and similar devices) function as mechanical gating to hold the trigger/sear inoperative until the action is ready (closed, i.e., fully in battery), analogous to the Asserted Patents' spring-biased locking member. While these early patents are not AR-specific, they demonstrate that key engineering concepts at the heart of the Asserted Patents: (i) mechanically using cycling energy to influence trigger reset, (ii) holding a trigger system inoperative during defined portions of the firearm's cycle, and (iii) freeing the trigger at a defined cycle completion point, were well known in the public domain decades before 2017 and 2022.

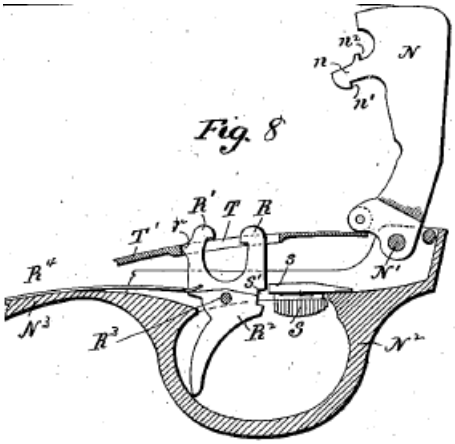
31. **Browning (Exhibit 5)**: Also reflecting how old these "gating" concepts are, John M. Browning's U.S. Patent No. 659,507 (1900)[1] teaches precisely the sort of cycle-timed mechanical interlocks used by the Asserted Patents. Browning discloses a recoil-operated arm in which the carrier is positively held in a non-permissive state and only freed when the action completes its return stroke: "In order to prevent the carrier from being unlocked before the barrel and barrel extension have completed their forward movement … I employ a sliding lock, or, as I prefer to term it, an 'inertia-piece' Q," constructed and operated "to temporarily lock the said catch P." Browning expressly describes the forward stroke completion as the unlocking condition; functionally equivalent to "as the bolt carrier reaches … in-battery." That inertia piece "stands

[1] In addition to this Browning patent, I am aware of numerous other patents issued to Browning concerning relevant subject matter here, including those related to trigger mechanisms. Given the time constraints necessarily imposed by the case posture, I have not had a chance to review or analyze these additional Browning patents.

practically still" as the receiver moves under recoil and counter-recoil, thereby keeping the feeding/locking train interlocked until closure and then releasing it at the appropriate point. This is precisely the kind of out-of-battery gating the Asserted Claims describe as a locking member moved into a permissive state as the bolt group comes into battery. Browning further provides a trigger-blocking safety keyed to the state of the firing mechanism: "For the purpose of locking the trigger so that it cannot be moved in either direction I employ a sliding safety-catch S" arranged so the catch "can only be" engaged "when the hammer is cocked," again tying trigger permissibility to the mechanical state of the action. And to ensure one shot per trigger function, Browning's double-sear arrangement (with cocking and safety notches) requires trigger reset between shots, "limit[ing]" the firearm's "automatic action … to the reloading of a single cartridge." In substance, Browning taught more than a century ago that (i) cycling parts can and should control when a trigger is mechanically blocked or freed, and (ii) interlocks should prevent premature release until the action is closed. Those are the same functional components that the Asserted Patents recast for an AR-pattern module under the labels "locking member," "mechanically blocks," and "as the bolt carrier reaches a substantially in-battery position."



(507 - Fig. 7)



(507 - Fig. 8)

32. Mr. Luettke uses "substantially in-battery position" to mark the cycle point at which a trigger-blocking/locking structure can permissibly move such that the trigger member may be moved to a released position. In the older recoil/counter-recoil references above, the same functional concept is described as completion of counter-recoil (i.e., return travel completion) and "free[ing] the trigger for firing" only at that completion point. (*E.g.*, Michal I and Michal II, quoted above). This cycle-timed unlocking mirrors the Asserted Patents' claim language that ties the locking member's movement to bolt-carrier closure at substantially in-battery. In my opinion, the "release upon completion of counter-recoil" framework it discloses the "substantially in-battery" gating concept, and its construction, Mr. Luettke emphasizes.

33. **Remmington Model 11**: In addition to these early patents, the Remington Model 11 (described in Browning) trigger group is illustrative as a pre-priority example of the same "reset-forcing + out-of-battery gating" architecture. As shown in the Remington Model 11 trigger group exemplar photo, which was provided to me, the trigger includes a rearward "hump"/projection behind the hammer that is part of the trigger member itself, thus disclosing the one-piece trigger member/reset level combination claimed in the Asserted Patents. In the operating cycle, an out-of-battery safety sear/locking structure holds the trigger to prevent firing until the bolt closes. Upon firing, as the bolt recoils and the hammer is reset, the hammer's rearward travel causes it to contact the trigger's hump/projection, which in turn forces the trigger member forward against the shooter's finger pressure and resets it. The out-of-battery safety/locking structure then keeps the trigger in a ready/locked condition until the bolt returns to a closed (in-battery) condition, at which point continued trigger pressure can again result in firing. In my opinion, this legacy trigger group exemplifies that the mechanisms repeatedly implicated in the Asserted Claims, and emphasized by Mr. Luettke (including a trigger member feature contacted by the hammer during

cycling that forces forward trigger movement, and an out-of-battery locking/safety structure that prevents firing until the bolt is closed/in battery), have long been known in the public domain. Videos of the Remmington Model 11, which were provided to me and which I have reviewed to confirm my understanding of how this firearm functions, demonstrate the relevant functionality of the Remmington Model 11. *See* **Exhibits 9 and 10**.

34. **Bonner (Exhibit 6)**[2]: In addition to these decades' old teachings, by 2014–2015, U.S. Patent No. 9,829,263 (issued to Bonner on Nov. 28, 2017), taught the very hammer to trigger contact reset mechanism claimed in the Asserted Patents. Specifically, Bonner taught a "rapid

[2] Based upon my preliminary review, this reference was not disclosed in the prosecution of the '223 Patent.

reset" semi-automatic trigger that temporarily transfers hammer spring force to the trigger to urge it back to its set position, reducing the time the user must release finger pressure between shots. In Bonner's primary embodiment, a cam member is seated in the trigger body with defined first and second cam surfaces; during cycling the bolt carrier drives the hammer rearward (via the hammer's striking surface), and the hammer surface engages the trigger-mounted cam surfaces, depressing the cam and then camming the trigger body forward into reset so the trigger sear re-engages the hammer sear notch (see, e.g., Figs. 7–13; hammer surface 28 contacting cam surfaces 46/41 associated with the trigger body). Bonner expressly characterizes the mechanism as "temporarily transfer[ring] hammer spring force to the trigger … resulting in the urging of the trigger to its reset position," and discloses multiple packaging options that were recognized in the art as design choices: a plunger-type cam mounted in the trigger body; a pivotal cam (Fig. 17); alternative sear placements (Fig. 18); and an embodiment with the cam member on the hammer body engaging a trigger surface (Fig. 19). Bonner confirms industry understanding that (i) reset can be driven by contact during cycling between the hammer and a surface associated with the trigger to force/assist the trigger into reset, specifically in Fig. 19, and (ii) whether that contact surface is an integral portion of the trigger member or a separate insert/lever is a matter of implementation, not a change in principle. In short, Bonner discloses the very hammer to one-piece-trigger-member contact geometry and cycling-driven reset behavior at issue here, and teaches that the same components "could be arranged and designed in a wide variety of different configurations" to accomplish that function.

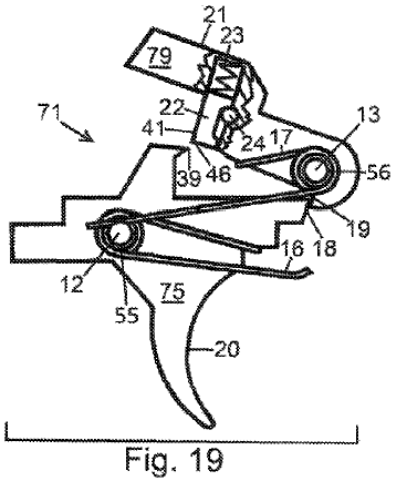


Fig. 19

Bonner (263) Fig. 19

35. Conventional "Locking" Devices (Auto-Sear/Out-of-Battery Safety): The Asserted Patents repeatedly describe a "locking bar" or "locking member" that is spring-biased to a blocking position and moved by bolt-carrier contact into a non-blocking position "as the bolt carrier reaches a substantially in-battery position." In my opinion, this is the applicants' nomenclature for what the art has long and commonly referred to as an auto-sear or out-of-battery safety, i.e., a mechanical gating device that prevents hammer release (or trigger movement to the released position) until the action is safely closed. Such components are standard in the field and function to ensure that the hammer cannot release out of battery and follow the bolt carrier group home; the bolt-carrier contact simply toggles the device into a permissive state when the firearm is in battery. These devices and their blocking/unblocking behavior were widely and universally known in the art well before the priority dates of the Asserted Patents. *See, e.g.*, Browning, *supra*.

36. The pre-priority market was crowded with "faster semi-auto" triggers using bolt-carrier energy, reset-assistance, and multi-mode selectors: Years before the Asserted Patents' priority dates, the marketplace included a prominent, publicly described product, the TAC-CON 3MR trigger, that was explicitly marketed as enabling faster follow-up shots through a positive reset mechanism tied to the firearm's cycling action, i.e., the bolt carrier group.

37. The Tac-Con 3MR was publicly described, commercially sold, and ATF-reviewed pre-2017. Indeed, by late 2013 through 2014, the Tac-Con 3MR designed and sold by Michael Stakes was publicly described and marketed as a drop-in trigger system with three-mode fire control system (safe/semi/assisted reset) aimed at reducing split times and increasing firing cadence while still requiring a trigger pull per shot. (*See, e.g.*, Elwood Shelton, "Tac-Con 3MR Triggers Aiming at Speed, Accuracy," *Gun Digest* (Jan. 2, 2014).[3] ("The system consists of safe, semi-automatic and the Tac-Con patented 3rd Mode of operation. It's the 3rd Mode that makes 3MR special, providing a positive trigger reset, reducing split times between shots. In short, the trigger resets itself for the next shot, even while there is finger pressure still on it.")

38. Trade and industry publications described the Tac-Con 3MR as employing a "positive reset" that "resets itself for the next shot, even while there is finger pressure still on it," and described the 3MR as "ATF approved." (Shelton, *Gun Digest* (Jan. 2, 2014).) The same basic "positive reset" concept was repeatedly described as achieved by transferring force from the bolt carrier through the trigger assembly (i.e., cycling energy is utilized to force reset), which aligns

[3] https://gundigest.com/gun-reviews/gun-accessories/tac-con-3mr-trigger

directly with the broader "reset assistance / forced reset" design space. (*See, e.g.*, *American Rifleman* (Jan. 14, 2014) (describing "positive reset … achieved by transferring the force from the bolt carrier through the trigger assembly").)[4]

39. An ATF Firearms Technology Branch review letter describing the Tac-Con design (the "ATF Approval Letter" materials provided here) explains, in substance, that a "reset lever" works in cooperation with the trigger, disconnector, and hammer and that, during cycling, the hammer engages the reset lever to assist forward trigger movement to facilitate rapid reset. (ATF Firearms Technology Branch letter regarding Tac-Con 3MR, describing reset-lever operation and reset assistance; **Exhibit 7**.)

40. In addition, a Small Arms Review article from 2014 describes the 3MR's "reset lever" as a key mechanism feature and describe the hammer engaging that reset lever during bolt group cycling, which in turn applies force assisting the shooter's finger forward to facilitate a very fast reset. (Todd Burgreen, "Tactical Fire Control Tac-Con 3MR Trigger: Hype or True Enhancement?," *Small Arms Review* (Feb. 21, 2014) (Article ID 2429), describing reset-lever operation and the bolt-group cycling interaction.)[5]

[4] https://www.americanrifleman.org/content/tac-con-3mr-trigger-system/

[5] https://archive.smallarmsreview.com/display.article.cfm?idarticles=2429

41. Small Arms Review also described the Tac-Con 3MR as a self-contained module/chassis containing the fire control parts with drop-in installation, and described its purpose as reducing time between shots through a very quick and positive reset. The article describes the 3MR as follows:

> The Tac-Con trigger and selector gives the user a new 3rd mode of fire. The new selector has three positions just like an M16 style rifle. It can be rotated so that it points to the rear which would be the full-auto position on a select-fire gun but with the Tac-Con trigger this 3rd position gives the host gun a very quick and positive reset that dramatically reduces the time between shots. This positive reset characteristic is achieved by transferring energy from the bolt carrier back through the trigger assembly to assist the trigger back onto the sear. Doing this gives the host gun the fastest reset time possible.

(Chris A. Choat, "TAC-CON 3MR Trigger," *Small Arms Review* (May 16, 2014) (Article ID 2646) (module/chassis; drop-in; quick/positive reset).)[6]

[6] https://archive.smallarmsreview.com/display.article.cfm?idarticles=2646

42. Additional 2014–2015 trade coverage reinforces that "assisted reset" terminology and "positive reset / reduced split times" concepts were public well before 2017 and 2022. The trade publications produced here (including Shooting Illustrated and Shooting Sports Retailer materials) describe Tac-Con's assisted-reset concepts and the objective of dramatically reducing split times through a positive reset in an AR-platform fire control system. (Shooting Illustrated, "Tac-Con Introduces AR-15 and AK-Platform Triggers," (posted on or about Nov. 25, 2014) (assisted-reset fire position; positive reset; reduced split times).)[7]; (Shooting Sports Retailer materials dated Sept. 4, 2014 regarding Tac-Con/3MR.)[8]

43. Additional contemporaneous coverage in an NRA publication reinforces that the bolt-carrier-energy "positive reset" concept was openly described in the public domain years before the '223 Patent's September 29, 2017, earliest possible priority date (and long before the

[7] https://www.shootingillustrated.com/content/tac-con-introduces-ar-15-and-ak-platform-triggers/

[8] https://www.shootingsportsretailer.com/gear/video-review-tac-con-3mr-trigger-1

January 10, 2022, earliest possible priority date of the later Asserted Patents). In January 2014, *American Rifleman* described the Tac-Con 3MR as a "drop-in, 3-mode fire control system" and stated that the "3rd mode provides a positive reset that dramatically reduces the split times between shots." The article further explains, in explicit bolt-carrier terms, that "[t]he positive reset characteristic is achieved by transferring the force from the bolt carrier through the trigger assembly to assist the trigger back onto the front sear." (American Rifleman, "Tac-Con 3MR Trigger System," Jan. 14, 2014.)[9]

44. That same bolt-carrier-force-transfer description was repeated in subsequent public reporting, further demonstrating that the concepts at issue were not obscure or confidential, but were continuously described in mainstream publications well before January 10, 2022. In May 2015, *Shooting Illustrated* described TacCon's 3MR as having two "fire" positions, with the "3rd Mode" providing a "positive reset" that reduces time between shots, and explained that "[t]his reset is achieved by transferring the force from the bolt carrier through the trigger assembly to assist the trigger back onto the front sear." (Shooting Illustrated, "TacCon's 3MR Trigger," May 15, 2015.)[10]

45. The RifleFirePower.com March 2014 materials produced here further demonstrate that by early 2014 the 3MR and its reset-assistance concepts were being discussed in consumer-accessible format, i.e., not hidden, not experimental, and not limited to confidential engineering channels. (RifleFirePower.com "March 2014 DIY UPGRADE", by David Bahde; **Exhibit 8**.)

46. Based on the materials I have reviewed in this matter, the Tac-Con 3MR trigger is identified as the commercial embodiment of the '067 Patent and was sold as early as 2014, placing

[9] https://www.americanrifleman.org/content/tac-con-3mr-trigger-system/

[10] https://www.shootingillustrated.com/content/taccon-3mr-trigger/

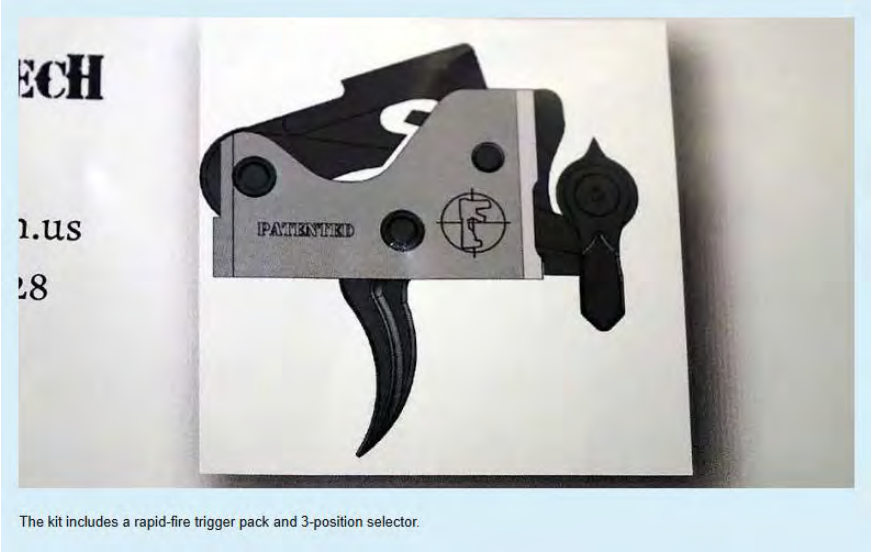
it well before September 29, 2017 (the ’223 earliest possible priority date) and well before January 10, 2022 (the later asserted patents’ earliest possible priority date).

47. In forming my opinions, I reviewed the declaration of Michael Stakes, the named inventor of the ’067 Patent and co-founder of Tac-Con, the company that commercialized the 3MR. Based on the Stakes declaration, it is my understanding that the 3MR concept was conceived in 2012 and moved rapidly into formal development in 2013. Mr. Stakes filed the ’067 Patent application on June 17, 2013; ATF’s Firearms Technology Branch reviewed the design and issued a letter on October 8, 2013, describing how the reset lever and hammer interaction “forces the shooter’s finger forward” to enable rapid reset. Tac-Con launched the 3MR commercially on November 12, 2013, with first production and sales occurring in 2013–2014 and broad industry coverage throughout 2014–2015, and the ’067 patent issued on September 29, 2015. To address heavy-use timing issues reported by some users, Mr. Stakes built and tested a version of the 3MR with out-of-battery locking/gating safety prototype in 2015–2016. It is also my understanding from Mr. Stakes’ declaration that, as early as 2016, he contemplated adding a one-piece, integrated trigger/reset-surface design of the type disclosed in the Asserted Patents, but elected not to commercialize it given then-current ATF regulations and classifications (concerned that it would be viewed as simulating automatic fire).

48. In addition to widespread coverage of the 3MR trigger, the pre-priority marketplace was also crowded with other “faster semi-auto” trigger approaches that, while mechanically distinct from an FRT/ART, further show that the field was mature and saturated well before January 10, 2022. For example, in September 2015, *RECOIL* reported that Franklin Armory had announced triggers using a third selector position in which the trigger “allows an AR to fire a round both when the trigger is pressed and released” (i.e., a pull-and-release firing concept

intended to increase cadence). (RECOIL, "Franklin Armory Releases 'Binary Firing System,'" Sept. 29, 2015.)[11] Although binary triggers are mechanically distinct from "forced/assisted reset" mechanisms, their widespread use of selector-controlled modes underscores that selector variation was routine and obvious by 2015.

49. Likewise, public reporting at SHOT Show 2016 described another drop-in rapid-fire trigger that increased cadence using a different mechanical approach, again illustrating a well-developed pre-2022 market for triggers aimed at faster follow-up shots. In January 2016, *GunsAmerica Digest* described Fostech's "Echo" trigger as an ATF-approved "drop-in rapid-fire trigger" for AR-15-pattern rifles that produces "It's a trigger that fires on the initial pull and then again on the reset" i.e., a mechanism designed to achieve rapid "double-taps" through trigger-cycle mechanics rather than through conventional semi-automatic trigger feel. (GunsAmerica Digest, "Fostech's 'Echo' Trigger Fires Rapid-Fire Double-Taps," Jan. 21, 2016.)[12]



Fostech Echo

[11] https://www.recoilweb.com/franklin-armory-releases-binary-firing-system-73759.html

[12] https://gunsamerica.com/digest/fostechs-echo-trigger-fires-rapid-fire-double-taps/

[13]

Echo Trigger Installed in Strike Industries Illustration Rig

50. By 2021, still before January 10, 2022, the market was publicly using "hard-reset" terminology to describe a mechanism that forces the trigger into a reset/neutral position, underscoring that "forced reset" concepts were not newly introduced by the Asserted Patents. A September 22, 2021, GlobeNewswire press release announcing Big Daddy Unlimited's "Wide Open Trigger" describes it as a "plug-and-play, drop-in replacement trigger for the AR-15 platform," and states that the trigger is "designed to shorten the length and time a trigger needs to reset itself" by using elastic energy of a spring carrier; importantly, it states: "When compressed, the spring carrier forces the trigger into a neutral or reset position." (GlobeNewswire, "Introducing the Wide Open Trigger," Sept. 22, 2021.)[14]

[13] https://www.ar15.com/forums/ar-15/How-the-Fostech-Echo-controls-timing---short-video-/118-709932/

[14] https://www.globenewswire.com/news-release/2021/09/22/2301309/0/en/Introducing-the-Wide-Open-Trigger.html

 [15]

51. Taken together, the pre-priority record reflects a crowded, mature technological field of forced/assisted reset triggers long before the asserted priority dates. Decades-old patents and products described and embodied mechanisms in which cycling energy moves a trigger forward against the operator's finger pressure and frees the trigger only upon completion of return travel (fully in-battery); the same cycle-timing and "readiness" gating concepts Mr. Luettke now frames as infringing the Asserted Patents. And, years before September 29, 2017 and well before January 10, 2022, widely circulated publications repeatedly described AR-platform triggers that achieve a "positive reset" by "transferring the force from the bolt carrier through the trigger assembly" to assist the trigger back into the hammer sear notch and reduce split times, while other commercially publicized designs pursued faster cadence using multi-mode selectors and pull/release mechanics. By 2021, still pre-2022, the market was openly advertising "hard-reset" triggers that "force the trigger into a neutral or reset position." In my opinion, this history shows that the foundational concepts and building blocks described by the Asserted Patents were long in the public domain, reinforcing that the Asserted Patents are invalid as either anticipated and/or rendered obvious over what was already known and publicly described.

[15] https://www.theoutdoorwire.com/releases/5b6cfb8c-0039-4100-ad16-7a801478e14d/

52. **Summary**: In view of the expedited posture (i.e., only a few days), I have not had the opportunity to perform a full, element-by-element mapping of every embodiment and product cited in this Technical Background. Nonetheless, based on my limited review of the publicly available patents, publications, and commercial materials summarized above, the record collectively, and in several instances individually, appears to disclose or render obvious the core features recited in the Asserted Patents. In particular, long-standing references teach cycling-driven trigger reset via hammer-to-trigger-member contact, out-of-battery gating unlocked by the bolt carrier at or near full battery, and three-position selector switch systems that disable the disconnector to achieve an assisted/forced reset mode. Given this landscape and the overlap in componentry and function, it is my preliminary opinion that these references create dispositive, anticipatory and/or obviousness issues for the Asserted Patents, subject to further claim-by-claim analysis as discovery proceeds.

VI. OPINIONS

Legal Standards:

53. I am not a lawyer but have rendered opinions in patent cases on many occasions and have been informed of the applicable law by counsel. I understand that a determination of patent infringement requires a two-step analysis: first, the patent claims are to be properly construed; and second, a determination is to be made as to whether the claims read on the accused product.

54. I understand that patent infringement is assessed by comparing the properly construed patent claims to the accused product or method. In forming my opinions, I apply an element-by-element methodology, meaning I evaluate whether each limitation of an asserted claim is met by the accused product as properly construed.

55. I understand that to establish literal infringement, every limitation of an asserted claim must be met by the accused product exactly (either expressly or inherently). If even one limitation of the claim is not met, there is no literal infringement of that claim.

56. I understand that the meaning of claim terms is ordinarily evaluated from the perspective of a person of ordinary skill in the art at the relevant time, and that claim meaning is informed primarily by the intrinsic record (the claim language itself, the specification, and the prosecution history). In my technical analysis, I focus first on what the claim language actually requires and whether the accused mechanism satisfies those requirements as a matter of structure, operation, and timing/synchronization.

57. I understand that "infringement" is not determined by whether an accused product is broadly similar in overall purpose, marketing description, or category label (e.g., whether someone calls a product an "FRT" or "ART"). Rather, the legal question is whether the accused product meets each claim limitation as properly construed.

58. I understand that opinions about infringement must be based on evidence and reliable technical reasoning. In this matter, I relied on the materials I was provided, including the asserted patent claims, the parties' descriptions and materials concerning the accused product(s), and Mr. Luettke's declaration and claim charts. Where additional discovery, testing, or inspection may reveal information bearing on the operation of the accused product(s), I reserve the right to supplement or revise my technical opinions consistent with the Court's schedule and rules.

59. I understand that the burden of proving infringement rests with Plaintiffs and must be established by a preponderance of the evidence.

60. I further understand that invalidity must be proven by clear and convincing evidence in district court litigation. Anticipation requires that a single prior-art reference disclose,

expressly or inherently, all limitations of the claim arranged as in the claim. Obviousness may be shown by a combination of references from the perspective of a person of ordinary skill in the art as of the effective filing date. I understand that the obviousness inquiry is a flexible, common-sense analysis that asks whether a POSITA would have had a reason to combine known elements to achieve the claimed invention with a reasonable expectation of success, taking into account the ordinary creativity of the POSITA. I also understand that objective indicia (secondary considerations) such as commercial success, long-felt but unmet need, failure of others, copying, and industry praise may be relevant where supported by evidence, and are considered as part of the obviousness analysis.

61. My role as a technical expert is to provide opinions grounded in engineering principles, utilizing my scientific knowledge, engineering education, training, and experience, consistent with the governing legal standards as I understand them.

Summary of the Asserted Patents' Prosecution History:

62. Based on my review of the prosecution histories of the Asserted Patents, it is my opinion that the patent examiner failed to locate and consider highly relevant prior art that was available at the time of examination, including the '067 Patent and the extensive commercial and trade publication history described above. This failure materially undermined the examiner's validity analysis that led to the patents' allowance.

63. The '223 Patent: The prosecution history reveals significant deficiencies in the examiner's prior art analysis. Based on my review, applicant did not disclose the '067 Patent in their September 27, 2018, Information Disclosure Statement, and the examiner's searches failed to locate this directly relevant reference. The examiner initially rejected the claims under 35 U.S.C. § 102 based on Foster (US20170219307A1), but ultimately allowed the claims after Applicant

argued that Foster "fails to disclose any means for forcing the trigger member to return to the set position." (Aug. 13, 2019 Response.)

64. The examiner's allowance was based on finding that Foster did not disclose a trigger member "having a surface positioned to be contacted by the hammer when the hammer is displaced by cycling of the bolt carrier, the contact causing the trigger member to be forced to the set position." The examiner noted in the interview summary that "an updated search for such functionality resulted in discovery of only US 2018/0066911 to Graves, cited by Applicant, as relevant art," but found that Graves also failed to disclose the claimed structural features. (Oct. 23, 2019, Notice of Allowance.)

65. This analysis was fundamentally flawed because the '067 Patent, as well as the plethora of prior art discussed above, which was not before the examiner, expressly discloses the exact "forced trigger reset" functionality that the examiner identified as the basis for allowance. In my opinion, had the examiner located and considered the '067 Patent, the '223 Patent application would not have been allowable over this prior art.

66. The '003, '336, and '807 Patents: The prosecution of this patent family reflects an even more concerning lack of substantive examination. When filing the first application in this family ('003 Patent), Applicant submitted an Information Disclosure Statement containing 147 total references, including the '067 Patent buried among this extensive list. Given that patent examiners typically spend only approximately 20 hours total on examining an application (("USPTO Has Opportunities to Improve its Patent Examination Process and to Advance Patent Decision-Making" Final Report) No. OIG-22-010-I, Dec. 2, 2021), including reading the application, conducting prior art searches, reading and analyzing the prior art results, and comparing prior art to the claims, it would be practically impossible for the examiner to

meaningfully review and consider 147 references (including the ’067 Patent and ’223 Patent, which is prior art to the later Asserted Patents) within the time constraints of examination.

67. Consistent with this resource limitation, the examiner issued no Office Action whatsoever for the ’003 Patent and proceeded directly to a Notice of Allowance without any substantive prior art analysis. The same pattern occurred with the ’336 Patent. For the ’807 Patent, the only examination consisted of a “double patenting” rejection, with the examiner concluding that the claims were “not patentably distinct” from the ’003 and ’336 Patents, because they claim “substantially the same firearm trigger mechanism with safety selector moving between safe, standard semi-automatic and forced reset semi-automatic” with only “minor, obvious and non-patentable differences.”

68. Impact on Validity Analysis: The prosecution history demonstrates that none of the Asserted Patents received the rigorous prior art analysis required for a reliable validity determination. The examiner in the ’223 Patent specifically searched for “forced reset” functionality but failed to locate the ’067 Patent or the extensive trade publication history documenting commercial products with such functionality years before the asserted priority dates. (Oct. 23, 2019, Examiner’s Search Strategy and Results.) The later patents received essentially no prior art analysis at all. Based on the plethora of prior art identified and described in this report in the previous section, the Asserted Patents would not have survived a thorough validity examination that considers the full scope of available prior art, including the ’067 Patent, the TAC-CON 3MR commercial embodiment, and the extensive pre-priority trade publication history described above.

69. It is my opinion that, under a proper, thorough invalidity analysis of the Asserted Patents in light of a fully developed prior art record, the Asserted Patents will be found invalid as either anticipated or rendered obvious by the prior art.

Invalidity of the Asserted Patents:

70. Based on the information presently available to me, and based on the prior art I have been able to locate and review to date on such short notice given the expedited nature of TRO/Preliminary Injunction matters, it is my opinion that the Asserted Patents are likely invalid. It is difficult for me to see how the claims in the Asserted Patents would have been considered novel and nonobvious, as the claim elements and "points of novelty" identified by the patent examiner were either not new or, at most, minor, obvious variations based on design preferences. Likewise, the core functional components and their arrangement in the trigger mechanism reflected in the Asserted Claims were publicly described decades ago and, in modern form, were publicly described and implemented in commercial trigger products well before the relevant priority dates, including in numerous references not considered by the patent examiners of the Asserted Patents. My opinions are grounded in the substantial body of pre-priority technical publications and commercial products that disclose or demonstrate the same general category of technology at issue here: namely, AR-pattern trigger mechanisms designed to increase cadence or reduce split times through altered reset behavior and/or cycling-driven interactions well before the asserted priority dates.

71. The Asserted Claims repeatedly focus on (i) a trigger being reset/returned forward through cycling events (including hammer/trigger member/bolt carrier interactions) and (ii) a mechanism that prevents firing until the action is sufficiently closed, i.e., a concept Plaintiffs' expert frames as a "legal compliance feature" to prevent "runaway fire." Those same concepts appear in early firearm patents and in modern commercial "fast reset" triggers that predate the priority dates relevant here.

72. For example, a 1936 patent describes "forcing the trigger … forward against the pressure of the trigger-finger." (Michal I.) A 1938 patent describes "utilizing the motion of the recoiling parts of a fire-arm, acting against the natural resiliency of the trigger-finger … to discharge the same in regular sequence." (Michal II.) A 1945 patent expressly teaches "safety means cooperating with the trigger actuated control mechanism … for holding the cocking member … against release." (Hyde.)

73. In modern commercial form, the Tac-Con 3MR platform, and other relevant prior art described above, publicly describes both (i) cycling-energy transfer used to assist trigger reset and (ii) an out-of-battery safety concept to prevent firing until the firearm is "ready." In describing the engineering path to the commercial 3MR, it is my understanding that the company pursued a design that utilized the movement and energy from the bolt carrier to assist in resetting the trigger, and that the concept involved the carrier pushing the hammer rearward and transferring the energy, by way of a reset lever attached to the trigger, to the trigger itself. (*See* Stakes Decl.; '067 Patent) The out-of-battery safety concept was, at the time, well known to simply be a device that doesn't allow the trigger to be pulled until the weapon is ready. In addition, the ATF Firearms Technology Branch letter regarding the 3MR likewise states: "the hammer contacts the reset lever during cocking, which applies force to the trigger, forces the shooter's finger forward, and allows the trigger to reset rapidly." (**Exhibit 7** at 2.)

74. These prior art disclosures, spanning both early patents and modern patents and pre-priority commercial triggers, bear directly on the words chosen in the Asserted Claims and they indicate on even this preliminary prior art record that the Asserted Claims are either anticipated and/or rendered obvious through their capture of technology that was already well known and publicly described.

75. In the attached preliminary charts (**Exhibits 11–14**), I identify the specific prior art disclosures that correspond to each claim element of the Asserted Claims, which, in my opinion at this time, either alone or in combination, render the Asserted Claims anticipated and/or obvious.

76. As detailed in **Exhibit 11**, it is my opinion that the asserted limitations of claim 4 of the ’223 Patent are either (i) expressly disclosed in the cited references, or (ii) inherently disclosed by the operation of the prior art mechanisms in the AR-pattern and semi-automatic contexts, and (iii) to the extent any structural components or operations differ, would have been obvious to a POSITA at the time to implement in the predictable manner taught by the cited references. Additionally, several of these elements are standard AR-style triggering/firing componentry and mechanics that were ubiquitous and well understood prior to the earliest possible priority date, as reflected in the Tac-Con 3MR publications and the ’067 Patent.

77. As detailed in **Exhibit 12**, it is my opinion that the limitations of claim 4 of the ’003 Patent are either expressly disclosed by the cited references or inherently disclosed by their operation in the AR-pattern and semi-automatic contexts, and, to the extent any structural components or operations differ, would have been obvious to a POSITA at the time to implement in the predictable manner taught by the cited references. Additionally, several of these elements (e.g., housing pin bores, hammer/trigger sear interfaces, disconnector hook pivoting on the trigger pin, bolt-carrier-driven hammer pivot) are standard AR-style triggering/firing mechanics that were ubiquitous and well understood prior to the earliest possible priority date, as reflected in the Tac-Con 3MR publications and the ’067 Patent.

78. As detailed in **Exhibit 13**, it is my opinion that the limitations of claim 3 of the ’336 Patent are either expressly disclosed by the cited references or inherently disclosed by their operation in the AR-pattern and semi-automatic contexts, and, to the extent any structural

components or operations differ, would have been obvious to a POSITA at the time to implement in the predictable manner taught by the prior art. Additionally, several elements (e.g., housing pin bores, hammer/trigger sear interfaces, disconnector hook pivoting on the trigger pin, bolt-carrier-driven hammer pivot) are standard AR-style triggering/firing mechanics that were ubiquitous and well understood prior to the earliest possible priority date, as reflected in the Tac-Con 3MR publications and the ’067 Patent.

79. As detailed in **Exhibit 14**, it is my opinion that the limitations of claim 1 of the ’807 Patent are either expressly disclosed by the cited references or inherently disclosed by their operation in AR-pattern and semi-automatic contexts, and, to the extent any structural components or operations differ, would have been obvious to a POSITA at the time to implement in the predictable manner taught by the prior art. Several limitations (hammer/trigger sear interfaces; transverse pivots; disconnector pivot and hook engagement; bolt-carrier-driven hammer pivot) are standard AR-style triggering/firing mechanics, well understood and ubiquitous before the earliest possible priority date, as reflected in the ’067 Patent, the ATF letter, and the Tac-Con 3MR publications.

80. My validity opinions at this stage are necessarily preliminary and based on the limited time and information available. I have not yet completed the full prior-art search and analysis that would ordinarily be performed in a comprehensive validity study, including review of complete prosecution histories, full claim chart mappings of each asserted claim to each prior art reference/product, and any additional relevant art that may be uncovered through continued investigation and discovery. Nonetheless, even at this early stage, the prior art I have located on short notice is sufficient to establish that these types of trigger mechanisms were well-known and

widely discussed by the relevant dates, and therefore the Asserted Claims are likely invalid and/or rendered obvious.

81. I reserve the right to supplement, refine, or expand these opinions as additional information becomes available, including through discovery, inspection of relevant products, review of additional publications, and review of the prosecution histories and any prior art not yet analyzed.

Claim Construction is Necessary Prior to Addressing the Infringement Claims:

82. Mr. Luettke offers definitive infringement conclusions while treating several claim phrases as having self-evident "plain meanings." In my opinion, which is necessarily preliminary given the time constraints imposed, that approach is not defensible here because the asserted claims turn on precise mechanical timing and interaction in an AR-pattern operating cycle, i.e., what happens during bolt carrier forward/rearward travel, and when (or as) the bolt carrier group returns to battery. The claim language itself confirms that these timing and interaction requirements are central to the asserted inventions. *See, e.g.,* U.S. Patent No. 10,514,223, claim 4 (locking bar moved when "contacted by the bolt carrier reaching a substantially in-battery position"); U.S. Patent No. 11,724,003, claim 4 (locking member moved "by contact from the bolt carrier during forward movement … as the bolt carrier reaches a substantially in-battery position," and subsequent firing "thereafter when the bolt carrier reaches the substantially in-battery position" without manually releasing the trigger member); U.S. Patent No. 12,274,807, claim 1 (same timing/contact structure); U.S. Patent No. 12,036,336, claim 3 (same).

83. In mechanical systems like these, small differences in timing windows, contact relationships, dimensions, geometry, tolerances, and physical interference determine whether a given limitation is satisfied. Where a claim uses terms that reasonably allow more than one

meaning, especially terms that set the "gate" for when a mechanism must unlock or must prevent movement, claim construction is necessary. Without construction, different readers can (and often do) apply different meanings, and each meaning can change the infringement result.

84. In my opinion, this case presents exactly that problem. For each asserted claim, there are phrases that are both (i) reasonably susceptible to more than one meaning, (ii) potentially dispositive of infringement, and (iii) indeterminate in that no dimensions or dimension windows are specified. Until those phrases are construed, an element-by-element infringement analysis cannot be performed in a technically rigorous way.

85. "Substantially In-Battery Position": Each of the Asserted Claims (claim 4 of the '223 Patent, claim 4 of the '003 Patent, claim 3 of the '336 Patent, and claim 1 of the '807 Patent) requires that the locking member is moved when contacted by the bolt carrier reaching "a substantially in-battery position," and ties that event to a change in what the user can do: pull the trigger. (*See, e.g.,* '223 Patent, claim 4.) The claims thus use "substantially in-battery position" as a timing gate for the unlocking condition that permits trigger release.

86. In my opinion, "substantially in-battery position" is not a phrase with only one reasonable meaning in the context of an AR-pattern operating cycle. Reasonable interpretations include at least: (1) a meaning close to fully in battery (i.e., at or essentially at the in-battery condition), versus (2) a meaning that includes a broader band of near-battery positions during forward travel. Both interpretations are plausible as a matter of plain language, but they are materially different in engineering terms because they point to different phases of bolt carrier forward motion and different mechanical states of the action with inherent user safety implication, and including the ability of the trigger to be pulled at a certain point in bolt carrier placement.

87. The phrase also raises a second critical ambiguity: whether the claim requires the bolt carrier contact/unlocking to occur at the moment the carrier "reaches" that substantially in-battery condition (a narrow dimensional/timing window), or whether unlocking earlier would suffice so long as the carrier later becomes substantially in-battery. For example '223 Patent, Claim 4's use of "when contacted … reaching" is a temporal linkage, and reasonable readers can disagree on how tight that linkage must be. ('223 Patent, claim 4.) The answer directly affects infringement because many mechanisms may unlock at different points during closing.

88. For these reasons, and in particular because the asserted claims repeatedly hinge on whether and when the bolt carrier reaches a "substantially in-battery position," I conclude that the meaning of that phrase is both disputed and potentially outcome-determinative. In my opinion, claim construction of "substantially in-battery position" is therefore necessary before any reliable infringement analysis can be performed. Further, given the current stage of this case, I expressly reserve the right to identify additional claim terms requiring construction and to assert any and all other claim construction positions not addressed herein as discovery, expert analysis, and the Court's claim construction proceedings continue.

The Accused Product Does Not Infringe:

89. Mr. Luettke's direct infringement opinions depend heavily on assumptions about how the Accused Product's components interact with the bolt carrier, the hammer, a "locking bar," and the trigger member during cycling, particularly at the point he describes as the bolt carrier reaching a "substantially in-battery position." Those assumptions matter because the asserted claims do not merely require "something that resets quickly." They require specific structures and specific mechanical relationships among the bolt carrier, the locking structure, the disconnector (if present), and the trigger member.

90. Based on the information presently available to me, and setting aside the claim construction issues identified above, I disagree with Mr. Luettke's conclusion that the Accused Product satisfies every limitation of each asserted claim.

91. Non-Infringement of claimed Semi-Automatic Function: In the standard semi-automatic mode, each of the Asserted Claims uses materially identical "whereupon" timing language that ties disconnector capture to the hammer's rearward pivot caused by the bolt carrier's rearward movement. For example, the claims recite: "whereupon in said standard semi-automatic position, rearward movement of the bolt carrier causes rearward pivoting of said hammer such that ***said disconnector hook catches said hammer hook***, 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" ('807 Patent, claim 1 (emphasis added); '336 Patent, claim 3 (same); '003 Patent, claim 4 (same)).

92. Based on my analysis of the Accused Product CAD images (supplied), during the hammer's rearward pivot with the trigger held (i.e., during the claimed event), the disconnector does not "catch" the hammer hook. As shown in Semi-Auto Non-Infringement Fig. 1, below, indicated in the red circle, the disconnector's camming interface contacts/deflects during rearward travel, but it does not transition into a positive latch state at that time.

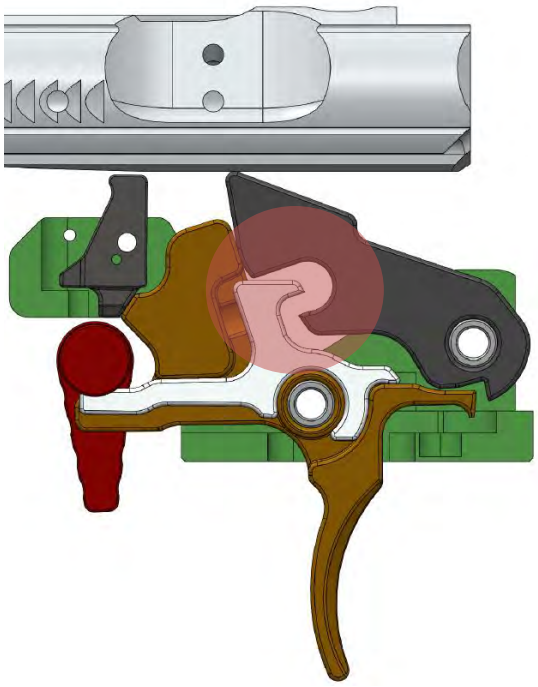


Fig. 1 - Semi-Auto Non-Infringement

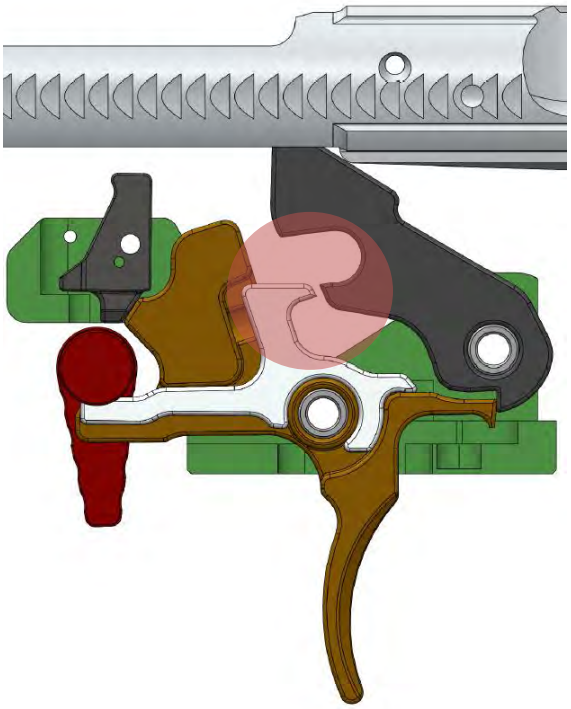


Fig. 2 - Semi-Auto Non-Infringement

93. In the Accused Product, engagement between the disconnector hook and the hammer hook can occur only later, with subsequent user action (release/re pull as the cycle permits). *See* Semi-Auto Non-Infringement Fig. 2 (depiction of no disconnector/hammer hook engagement prior to subsequent user action). Because the Asserted Claims expressly require that "rearward movement of the bolt carrier" and the hammer's "rearward pivoting" result "such that said disconnector hook catches said hammer hook" at that time, and the Accused Product does not do so, and this limitation is not met in the standard semi-automatic position ('807 Patent, claim 1; '336 Patent, claim 3; '003 Patent, claim 4).

94. Additionally, these asserted claims require that, in the standard semi-automatic position, "rearward movement of the bolt carrier causes rearward pivoting of said hammer such that said disconnector hook catches said hammer hook," before the user releases the trigger to free the hammer and allow re-engagement of the sear surfaces (see, e.g., '807 Patent, claim 1; '336

Patent, claim 3; ’003 Patent, claim 4). This language ties disconnector capture to the rearward pivot event caused by the bolt carrier’s rearward movement. Based on my analysis of the Accused Product, during the hammer’s rearward pivot with the trigger held, the precise time identified in the claims, the disconnector does not “catch” the hammer hook. The disconnector’s camming interface contacts/deflects during rearward travel, but it does not transition into a positive latch state at that time. In the Accused Product, capture of the hammer by the disconnector occurs, if at all, only after the carrier travels forward (return stroke) and presents the geometry for engagement, and only with continued user input and/or sustained trigger pressure to maintain the relative positions necessary for the disconnector hook to engage the hammer. It does not catch on rearward movement.

95. Non-Infringement of claimed Forced Reset Function: Separately, in the forced reset mode, the Asserted Claims require that the hammer’s rearward pivot “caus[es] said trigger member to be forced to said set position,” followed by permissive firing “thereafter when the bolt carrier reaches the substantially in battery position” (’807 Patent, claim 1; ’336 Patent, claim 3; ’003 Patent, claim 4). The patents themselves define the “set position” in the claims’ “wherein” clause as the state “wherein ***said sear and sear catch are in engagement*** in said set positions of the hammer and trigger member and are out of engagement in said released positions of said hammer and trigger member” (’807 Patent, claim 1; ’336 Patent, claim 3; ’003 Patent, claim 4) (emphasis added). In the Accused Product, however, when the hammer’s rearward movement imparts the forced reset impulse, the trigger member is driven forward, but at that moment ***the sear and sear catch are not in engagement*** and the locking/gating member remains in its blocking orientation, as depicted below.

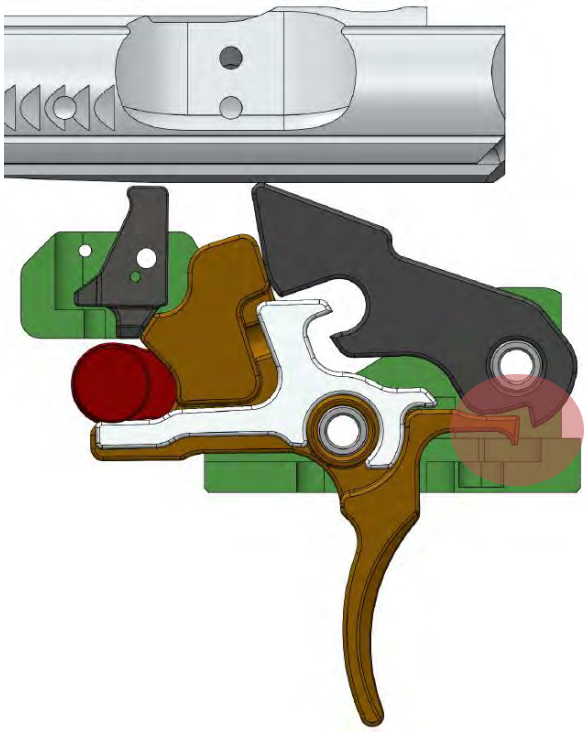


Fig. 1 - Forced Reset Non-Infringement

96. The user cannot "pull said trigger member to fire the firearm" at that instant; permissive firing only occurs later, after bolt carrier gating near battery and user action. Thus, at the claimed time of the forced reset impulse, the Accused Product is not in the patents' defined "set position," and the "causing … to be forced to said set position" requirement is not satisfied ('807 Patent, claim 1; '336 Patent, claim 3; '003 Patent, claim 4).

97. The same "set position" problem exists in the '223 Patent's claim 4, which likewise requires that "the trigger member hav[e] a surface positioned to be contacted by the hammer when the hammer is displaced by the bolt carrier when cycled, the contact causing the trigger member to be forced to the set position" ('223 Patent, claim 4). As noted above, the claims define "set position" as sear/sear catch engagement in the set state and non-engagement in the released state. In the Accused Product, at the time of hammer to trigger contact (i.e., when the hammer is displaced by the bolt carrier and imparts the forced reset impulse), the sear and sear catch are not

engaged and firing is not permissive; the locking member remains in its blocking orientation until the carrier returns toward the substantially-in-battery position. Because the ’223 Patent’s claim requires “the contact causing the trigger member to be forced to the set position,” and the Accused Product is not in the defined “set position” at the time of that contact, this limitation is likewise not met (’223 Patent, claim 4).

98. “Substantially In-Battery Position”: In my expert opinion, all four Asserted Claims turn on the same gating concept: a locking structure that “mechanically blocks” the trigger until the bolt carrier reaches a “substantially in-battery position,” at which point the locking structure is moved by bolt-carrier contact into a non-blocking state that allows the trigger to be pulled rearward. The precise meaning and timing of “substantially in-battery position,” and the required causal relationship (“by contact from the bolt carrier”), are outcome-determinative here. These phrases must be construed before any reliable infringement analysis can be performed.

99. The claims themselves make clear that the locking structure’s transition to the permissive state is tied to bolt-carrier travel and a specific cycle phase:

a. ’223 Patent, claim 4: “a locking bar pivotally mounted in the housing and spring biased toward a first position in which the locking bar mechanically blocks the trigger member from moving to the released position, and movable against the spring bias to a second position when contacted by the bolt carrier reaching a substantially in-battery position in which the trigger member can be moved by an external force to the released position.”

b. ’003/’336/’807 Patents: “said locking member spring biased toward said first position and adapted to be moved against said spring bias to said 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 … thereafter when the bolt carrier reaches the substantially in-battery position the user can pull said trigger member to fire the firearm without manually releasing said trigger member."

100. The specifications of the Asserted Patents repeatedly use similar, but not identical, formulations—underscoring both the importance and the ambiguity of the timing window at issue:

a. '223 Patent, specification: "An upper end of the locking bar 62 … [is] engaged by the engagement surface 54 of the bolt carrier body 58 when the bolt carrier assembly 52 is at or near its in-battery position (as shown in FIG. 3). Contact between the engagement surface 54 and upper end of the locking bar 62 causes the locking bar 62 to pivot into a first position (FIG. 3) against a biasing spring 70 and allows pivotal movement of the trigger member 26." And: "When the bolt carrier assembly 52 has reached (or nearly reached) its closed, in-battery position (shown in FIG. 3), the engagement surface 54 of the bolt carrier tail portion 56 contacts and forwardly displaces the upper end of the locking bar 62, disengaging the second contact surface 32 of the trigger member 26, allowing the trigger 26 to be pulled a second time."

b. '003/'336/'807 Patents, shared specification language: "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… 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." And: "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."

101. From an engineering perspective, small differences in the timing of bolt-carrier forward travel matter. The claims tether the unlocking event to "contact from the bolt carrier … as the bolt carrier reaches a substantially in-battery position" ('003/'336/'807 Patents), or "contacted by the bolt carrier reaching a substantially in-battery position" ('223 Patent). The specifications, however, describe both earlier contact "during forward travel" and the final unlocking "when the bolt carrier assembly … has reached (or nearly reached) its closed, in-battery position."

102. In my opinion, a person of ordinary skill in the art would recognize that these formulations can reasonably be read in more than one way, and that the choice among those readings will determine the infringement outcome. With a narrow construction, requiring that the locking structure's transition to the permissive state occur "when the bolt carrier assembly … has reached (or nearly reached) its closed, in-battery position," with the cause being direct contact from the bolt carrier at that time, the patentee's own specification language ("at or near its in-battery position"; "has reached (or nearly reached) its closed, in-battery position") provides the anchor. Under this construction, infringement would require competent evidence that the accused mechanism's locking member is in fact "moved against [its] spring bias to [the] second position by contact from the bolt carrier … as the bolt carrier reaches a substantially in-battery position," and that only "thereafter … the user can pull" the trigger. Absent such evidence, the limitation is not met.

103. On a broader construction, where "as the bolt carrier reaches a substantially in-battery position" is construed to encompass a wider band of forward travel before final closure, the "during forward movement" phrase in the claims ('003/'336/'807 Patents) and "at or near" phrasing in the specifications might capture earlier contact events. That broader reading risks disconnecting the claimed causal gating (unlocking only at or near in-battery) from the more general "during forward travel" contact described in the specifications. If adopted, such a construction could expand the scope of the limitation substantially and potentially capture mechanisms that do not tie the unlocking event to the firearm's "in-battery" readiness in the way the claims require.

104. Finally, if the phrase "substantially in-battery position" is found to lack objective boundaries in this context, there are serious questions as to whether the limitation can be applied with reasonable certainty to any accused mechanism. I am not offering a legal conclusion, but from a technical standpoint the record underscores that the infringement question rises or falls on this timing phrase.

ART and FRT Are Synonymous:

105. Mr. Luettke states that "forced reset triggers" are semi-automatic trigger mechanisms that "fully reset the trigger after each shot," "forcing the trigger back into the forward position," and that "assisted reset triggers reset the trigger only partially." He then concludes that the Partisan Disruptor (and the Rare Breed product) are "forced reset triggers, not assisted reset triggers," because "in both products the trigger is forced back into its reset position with each shot." (Luettke Decl. ¶ 16.)

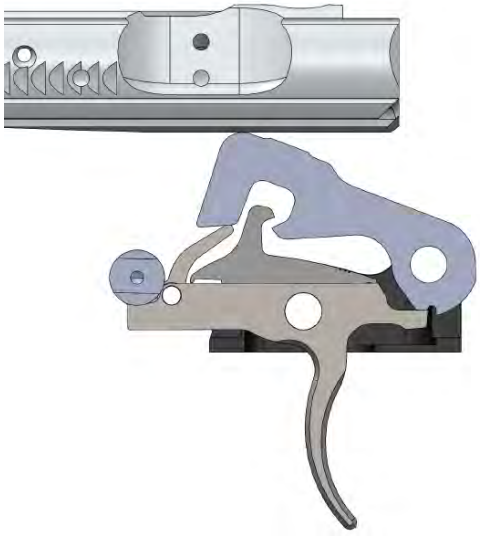
106. In my opinion, this attempted bright-line distinction between "forced" and "assisted" reset is not a technically meaningful boundary as a matter of AR-pattern fire control

system mechanics. Based on my experience and my review of the materials in this case, the industry does not recognize "assisted reset trigger" (ART) and "forced reset trigger" (FRT) as distinct technical categories. Instead, they are marketing labels that describe the same underlying phenomenon: the firearm's cycling transfers energy through the fire-control parts to force the trigger forward toward reset more aggressively than the baseline trigger return spring alone.

107. First, from an engineering standpoint, both phrases describe the same fundamental phenomenon: the trigger's return toward reset is influenced by energy and motion generated during the firearm's cycle; through interactions among the bolt carrier group, hammer, and/or trigger body. In that environment, "assisting" the reset and "forcing" the reset are not separate categories; they describe the same design goal using different words (in both cases a force is applied to the trigger, thereby resetting it). A POSITA would recognize that "assisted reset" and "forced reset" are shorthand descriptors for a class of mechanisms in which cycling-driven interaction forces the trigger toward reset more aggressively than a baseline semi-automatic trigger.

108. Indeed, contemporaneous technical reporting on the same product consistently frames the reset as "assisted" by bolt-carrier energy. Small Arms Review reports: "The positive reset characteristic is achieved by transferring the force from the boll carrier through the trigger assembly to **assist** the trigger back onto the front sear enabling split times that rival automatic rates of fire once familiarized with operation." (Small Arms Review by Todd Burgreen, p. 1.) (emphasis added) Shooting Illustrated likewise states: "positive reset… is achieved by transferring the force from the bolt carrier through the trigger assembly, instantaneously **assisting** the trigger back onto the sear." (Shooting Illustrated, Nov. 25, 2014, p. 1.) (emphasis added). Those publications use "assist" explicitly and make clear the mechanism is energy transfer from the bolt carrier through the hammer/trigger components.

109. Second, the ATF's description of the 3MR employs "forced" language while explaining an assisted-reset mechanism. (*See* **Exhibit 7**). The ATF letter states: "the trigger unit consists of a housing, hammer, trigger, disconnector, selector, springs, and reset lever that are designed to be used in an AR-15 type platform." It further explains: "when the selector was placed in the horizontal position (apex at 3 o'clock), the reset lever pivots forward, and the hammer engages/contacts the lever during the cycling of the rifle. In this position, the hammer contacts the reset lever during cocking, which applies force to the trigger, forces the shooter's finger forward, and allows the trigger to reset rapidly." (*Id.*) That description of "applies force to the trigger" and "forces the shooter's finger forward" is the exact phrasing commonly associated with "forced reset," yet it is describing the 3MR's reset-lever design—an ***assisted*** reset as presented in the '067 Patent's specification. And it is precisely as the 3MR functions (see the below image showing the 3MR being fully reset as a result of the "assisted reset" technology):



110. Specifically, the '067 Patent's specification repeatedly and expressly characterizes the design as "assisted-reset." For example: "This particular trigger mechanism 20 allows selection between safe, semi-automatic, and assisted-reset semi-automatic modes of fire or operation." It

teaches that "hammer tail 46 of striking end 45 of hammer 40 encounters/strikes arm 53 of reset lever 50," and that reset lever 50 acts on cam surface 35 to pivot the trigger disconnector assembly raising trigger nose 24 to its set position. The specification summarizes: "In sum, arm 53 of reset lever 50 intercepts hammer 40… The contact interaction between hammer 40 and reset lever 50… ***assists in resetting trigger*** disconnector assembly 39… The accelerated resetting… quickens the rate of semi-automatic fire…" (US 9,146,067 B2, specification (emphases added).) In addition, the '067 Patent explains the presence of a constant trigger return spring, stating: "Trigger assembly 21 has the customary and well-known trigger spring that acts on trigger body 23 so as to keep constant tension on trigger body 23 and thus trigger 27…" (US 9,146,067 B2, specification.) As a matter of mechanics, when cycling adds energy through the hammer/reset-lever path to move the trigger toward its set position, that energy necessarily "assists" the ever-present return spring force; the exact point the patent and the publications make.

111. The presence of a constant trigger return spring in these mechanisms underscores why the added cycling energy/force is, by definition, "assistive." The spring always biases the trigger forward; when the cycling imparts additional energy through the hammer/reset-lever path, that energy augments the spring's bias and accelerates the return. Whether one calls that "assisted" or "forced" reset is a matter of marketing language, not of a distinct or meaningful technical category.

112. Third, Mr. Luettke's conclusion that the Partisan Disruptor must be an "FRT" rather than an "ART" because "the trigger is forced back into its reset position with each shot" effectively collapses the two terms into a subjective description of feel. In many cycling-assisted reset designs, the shooter experiences a strong forward impulse on the trigger during cycling; describing that impulse as "assistance" or as "forcing" is subjective and a matter of word choice, not a distinction

in the underlying mechanism. A POSITA would understand that both labels are used to describe the same core concept (cycling-driven reset assistance) and would not assume that the label itself resolves anything about infringement or about how a claimed limitation is met.

113. I therefore disagree with Mr. Luettke's opinion at paragraph 16 of his declaration that ART and FRT are separate categories and that "forced reset" triggers "fully" reset while "assisted reset" only "partially" reset (a "partial" reset would defeat the intent of the mechanism in that reset time would not be minimized). Mr. Luettke presents no technical support for that asserted distinction, and, as noted elsewhere, he has not demonstrated notable design or engineering experience with trigger mechanisms that would inform such a categorical taxonomy. By contrast, the '067 Patent's assisted-reset specification, the ATF's description of the 3MR mechanism, and the contemporaneous technical reporting all describe the same underlying physics (cycling energy transfers through the hammer/reset lever to reset the fire-control group) and they do so using both "assist" and "force" terminology interchangeably.

114. For these reasons, it is my opinion that from an industry consumer standpoint "assisted reset trigger" and "forced reset trigger" are synonymous (or, at minimum, have substantially overlapping meanings) as shorthand descriptions for semi-automatic trigger mechanisms that use cycling-driven interactions to urge the trigger back toward reset and allow faster follow-up shots. Mr. Luettke's effort to create a rigid categorical boundary based on "full" versus "partial" reset is not technically correct or grounded and should not be relied upon.

The Accused Product Practices the '067 Patent:

115. Both Rare Breed and Defendants prominently describe their products as having a three-position selector (safe; standard semi-automatic; forced/assisted-reset), and the later-issued Asserted Patents likewise claim a three-position selector implementing these modes. The '067

Patent (issued 2015) predates those patents and describes this selector architecture in detail: the selector is movable between positions and presents different stop surfaces that are registered with, meaning aligned with, the trigger body's tail in each position; in the set/cocked condition the selector's first stop is separated from the tail by a first distance (D1) and, in the other position, a second stop is separated by a smaller distance (D2), such that in the fired position the trigger tail closes the clearance and contacts the corresponding stop to arrest further trigger movement, with distance D2 is less than distance D1, thereby reducing travel/reset in that mode ('067 Patent, FIGS. 17 & 19 and accompanying text). The other elements recited in claim 19, a hammer having a trigger notch; a trigger body with a trigger nose, a trigger tail, and a trigger; a disconnector coupled between the hammer and trigger body; and a selector movable between positions for adjusting the trigger body's travel distance, are standard AR-pattern fire-control components and, as reflected in the contemporaneous ATF classification letter and the 2013–2015 trade coverage of the Tac-Con 3MR, are plainly present in the 3MR's commercial embodiment.

116. Based on my analysis and review of the Accused Product, the same selector-controlled stop/clearance architecture and AR-standard hammer/trigger/disconnector set are similarly present in the Accused Product as advertised and as confirmed by my analysis and independent measurement. *See* Stakes Decl.

117. Mr. Luettke asserts that the Accused Product does not practice the '067 Patent, and he focuses his discussion on claim 19 in particular. (Luettke Decl. ¶ 44.) Based on the information presently available to me, including the claim language of the '067 Patent and the testing described in the Stakes Declaration, I disagree. In my opinion, the Accused Product does practice claim 19 of the '067 Patent.

118. Moreover, Mr. Luettke's analysis on this point is entirely conclusory and devoid of any supporting measurements or element-by-element mapping. He does not identify or document the selector stop geometry in either product, does not measure the set-position clearances between the selector stop surfaces and the trigger-body tail in the respective selector positions, and does not show the tail's contact with the stop in the fired position, each of which is central to claim 19 as illustrated in the '067 specification (see, e.g., FIGS. 17 and 19 and accompanying text). His declaration simply recites the claim language and asserts that "neither the RBT FRT-15L3™ nor the Partisan Disruptor feature any such differences" (¶ 45), without explaining his methodology, providing any dimensional data, caliper readings, photographs, or comparative travel-distance assessments. In my opinion, that failure to engage with the '067 Patent's specific alignment/clearance architecture renders his conclusion unsupported from a technical standpoint.

119. Claim 19 of the '067 Patent recites a selector-configured geometry that adjusts the permitted trigger body travel by changing the alignment and set-condition clearance between the selector's stop surfaces and the trigger body's tail. The dispositive facts are whether the selector, in a first position, presents a "first stop aligned with the tail of the trigger body," and, in a second position, presents a "second stop aligned with the tail of the trigger body," and whether, in the set condition, the first and second stop-to-tail clearances are different, with "the second distance … less than the first distance." *See* '067 Patent, claim 19 (requiring: "the selector has a first stop aligned with the tail of the trigger body in the first position, and a second stop aligned with the tail of the trigger body in the second position; … The first stop is separated from tail of the trigger body a first distance in the set position … and the second stop is separated from tail of the trigger body a second distance in the set position …; … the second distance is less than the first distance").

120. The ’067 Patent specification explains and illustrates this exact geometry. It identifies a “stop body 7S” with “two stops, including stop 7SA and stop 7SB” and shows that, in the selector’s first position, “stop 7SA is registered with, meaning aligned with, tail 25A,” whereas in the selector’s second position “stop 7SB is registered with, meaning aligned with, tail 25A.” It further defines “a distance D1 … between stop 7SA and tail 25A” in the set condition in the first position, and “a distance D2 … between stop 7SB and tail 25A” in the set condition in the second position, and states expressly that “Distance D2 is less than distance D1.” (US 9,146,067 B2, FIGS. 17, 19 and associated text (“stop body 7S … includes two stops, including stop 7SA and stop 7SB… In a first position of selector 70 … stop 7SA is registered with … tail 25A…. In a second position of selector 70 … stop 7SB is registered with … tail 25A…. a distance D1 is defined … [and] a distance D2 is defined…. Distance D2 is less than distance D1, wherein the travel distance of trigger body 23 in the second position … is less than the travel distance … in the first position.”).)

121. Applied to the Accused Product, the analysis is straightforward: if the selector in the Accused Product presents two different stop surfaces that, in the first and second selector positions, are respectively aligned with the trigger body’s tail, and if the set condition stop-to-tail clearances in those positions differ such that the second position’s clearance is smaller than the first position’s clearance, then the Accused Product practices the alignment and distance requirements of claim 19. Those are objective, measurable facts that can be shown with selector-positioned caliper measurements (set condition) of the stop-to-tail gap in each position. Conversely, if the selector does not present stops aligned with the tail in the respective positions, or the set-condition distances are the same (or the second is not less than the first), then claim 19

is not practiced. The specification's Figures 17 and 19 provide the template for what alignment and distance differences look like in practice.

122. As noted in the Stakes Declaration, testing confirms that the second travel distance of the trigger body is less than the travel distance of the trigger body in the first position of the selector, and that this difference in travel results in a shorter and faster reset of the trigger. That empirical result directly and literally satisfies the "two travel distances" requirement in claim 19: the selector positions produce different trigger travel behavior, with one selector position limiting (or shortening) travel relative to the other.

123. This type of measured, comparative travel-distance evidence is particularly important because it addresses the claim limitation in objective mechanical terms, how far the trigger body moves in one selector mode compared to another, rather than relying on labels or general descriptions. Where the evidence shows that the selector position changes the trigger body travel distance, and that the second travel distance is smaller than the travel distance in the first selector position, the claim's travel-distance relationship is satisfied in substance and operation.

124. Mr. Luettke's opinion does not indicate that he performed any substantive analysis, measurement, or analysis on this issue whatsoever. Instead, he simply recites the claim language in whole, claims that he "analyzed the designs" of the Rare Breed trigger and the Disruptor, and jumps to the conclusion (without any explanation or analysis) that these triggers "do not have any features that meet the [] claim requirements." Luettke Decl. at ¶ 45.

125. Accordingly, based on the present record, it is my opinion that the Accused Product practices the '067 Patent, claim 19. I reserve the right to supplement this opinion as additional product inspection, discovery, and further testing information becomes available.

RBT's FRT-15L3 Product Infringes the '067 Patent:

126. Based on the same analysis showing the Accused Product practices claim 19 of the ’067 Patent, it is my opinion that RBT’s FRT-15L3 likewise infringes claim 19. Claim 19 requires a standard AR-pattern fire-control set (hammer with a trigger notch; a trigger body with a trigger nose, trigger tail, and trigger; and a disconnector coupled between the hammer and trigger body) together with a selector that adjusts the trigger body’s travel by presenting, in different selector positions, different stop surfaces aligned with the trigger tail. In the set/cocked condition the first-position stop is separated from the tail by a first distance (D1) and the second-position stop is separated by a smaller distance (D2), such that in the fired condition the tail closes the respective clearance, contacts the corresponding stop, and arrests further movement, with distance D2 is less than distance D1. (’067 Patent, claim 19; see also Figs. 17, 19 and accompanying text.)

127. The FRT-15L3 includes the same claim-required components and selector-controlled stop/clearance architecture. As with the Accused Product, measurements described by Mr. Stakes confirm two distinct set-position clearances corresponding to the selector positions and a shorter trigger-body travel in the second position (D2 < D1), with the trigger tail contacting the respective stop to arrest movement in each mode. Given the presence of these selector-stop geometries and the undisputed AR-standard hammer/trigger/disconnector set, and consistent with the testing Mr. Stakes performed on both products, it is my opinion that the FRT-15L3 meets all limitations of claim 19 and infringes the ’067 Patent.

128. Mr. Luettke’s assertion that the FRT-15L3 does not “feature any such differences” (Luettke Decl. ¶ 45) is inconsistent with the structure and operation recited in claim 19 and, in my opinion, reflects a failure to analyze the selector/stop/travel-limiting architecture in claim 19 with the same rigor he applies to the Asserted Patents. Claim 19 is satisfied by objective mechanical facts: whether the selector provides different stop positions aligned with the trigger tail that limit

travel to different distances in different selector positions, and whether the second travel distance is less than the first. Based on the presently available information, it is my opinion that the FRT-15L3 meets these requirements and therefore practices (and infringes).

129. I reserve the right to supplement this opinion with additional detail and supporting measurements, photographs, and test results as discovery and expert analysis proceed.

I declare under the penalty of perjury that the foregoing statements and facts are true and correct to the best of my knowledge and belief. I reserve the right to amend, update, or correct this declaration as additional information/data becomes available or errors are detected.

John Nixon

30 JAN 2026

Exhibit 1

Athena Research & Consulting LLC

PO Box 66, Bippus, Indiana 46713, USA.

Curriculum Vitae (v7.07, January 2026)

Eur Ing John Nixon
CEng D-IBFES BEng(Hons) MBA FIMechE FCMI
Board Certified Forensic Engineering Scientist

Summary
Specializing in weapons systems research, consulting, and litigation support. Technical areas include firearms, ballistics, ammunition, munitions, explosives, plus related crime & accident scene reconstruction, and intellectual property. Provided sworn testimony over 100 times in numerous US state & federal courts. Published & presented numerous research papers, and delivered many training seminars to attorneys, forensic scientists, engineers, law enforcement, and investigators. Certified Range Safety Officer and Pistol & Personal Protection Instructor.

Professional Qualifications & Memberships

2016 Diplomate; International Board of Forensic Engineering Sciences (D-IBFES).
2013 Fellow; American Academy of Forensic Sciences (F-AAFS).
2011 Fellow; Chartered Management Institute (FCMI).
2005 International Society of Explosives Engineers (ISEE).
2001 Professional Licensed Member of National Society of Professional Engineers (NSPE).
2001 Registered Professional Engineer with FEANI (Eur Ing) (approx 30 countries).
2000 American Society of Mechanical Engineers (ASME).
1999 Fellow; Institution of Mechanical Engineers (FIMechE).
1997 Founder Member; Expert Witness Institute (MEWI).
1995 Vetted by the UK Law Society (expert consultant / expert witness).
1992 Institute of Materials (MIM).
1992 Qualified as a Chartered Professional Engineer with the British Engineering Council (CEng).

Offices Held & Awards

2025 -	President, International Board of Forensic Engineering Sciences.
2023 -	Director, Forensic Specialties Accreditation Board.
2021 - 2022	AAFS, Andrew H Payne Jr Special Achievement Award.
2020 - 2025	Vice President, International Board of Forensic Engineering Sciences.
2016 - 2017	AAFS, Engineering Sciences Section, Founder's Award.
2015 - 2017	AAFS, Engineering Sciences Section, Chair.
2009 - 2010	Indiana Society of Professional Engineers, State President.
2007 - 2026	Indiana Society of Professional Engineers, Anthony Wayne Chapter President.

Employment History

2000 – Now Consultant with ARC
(technical & forensic research & consulting - firearms / munitions / reconstruction)

2000 – 2004 Adjunct Professor at Indiana Institute of Technology, lecturing advanced courses on BA & BSc degree programs.

1996 - 2000 Self-employed consultant in UK (technical, forensic, and business consulting)

1986 -1999 United Kingdom Ministry of Defence, Whitehall, Westminster, London.
Scientist / professional engineer / project manager - working on guns, ammunition, missiles, rocketry, and energetic materials (explosives & pyrotechnics). Projects involved research, design, development, performance assessment, mid-life improvement, reverse engineering, and forensics.

Academic Qualifications

1997 Henley Business School, Reading University /Henley Management College, Brunel University
Master's Degree in Business Administration (MBA)

1990 University of Greenwich, London, UK / Thames Polytechnic / Woolwich Polytechnic
Bachelor's Degree in Mechanical Engineering (BEng: - with First Class Honors).
Recognized in the US under the terms of the Washington Accord

Supplementary Education and Training

95-97 Courtroom skills and report writing training courses from Bond Solon and The Academy of Experts.

86-99 Various internal and external training courses in areas such as safety, procurement management, space technology, desert survival, counter terrorism tactics, risk management, etc.

86-92 Various military technology and tactics training courses undertaken at **Royal Military College of Science** - RMCS (Cranfield University Defence Academy of the UK). These included explosives technology, ordnance and munitions design, IED design & construction, plus extensive training in ammunition & ballistics (internal, intermediate, external, and terminal – including wound ballistics).

1982 Gateshead Technical College, Gateshead, Tyne & Wear, United Kingdom.
Non-destructive testing (NDT) technology (3 months). Radiographic, ultrasonic, MPI and dye penetrant techniques.

77-81 4 year engineering apprenticeship with British Steel Corporation. (CGLI & TEC qualifications)

Patents / Patent Applications

GB 9214637.2 Plastic Tail Fin Unit
Describes new fin geometry & materials (and related manufacturing process) which improve long rod tank penetrator terminal performance, and reduce production costs. 9 July 1992.GB 9216295.7

Long Range Artillery Shell
Describes several 155mm artillery shell design concepts capable of extending maximum range to 60km by using base-bleed and rocket technology. 31 July 1992.

Also creator of numerous inventions that were not submitted for patent protection due to security restrictions.

Partial (allowable) Listing of Research Papers (UK Government 1987 - 1999)

Sept 99 A Review of Non-Destructive Evaluation Techniques Suitable for Solid Propellant Rocket Motors. UK Government Publication.
Apr 99 A Review of Non-Destructive Evaluation Techniques Suitable for Solid Propellant Rocket Motors. UK Government Publication.

Plus **at least 18 other bound UK government research / project papers** with classified titles and classified content that cannot be divulged. Individuals with appropriate security clearances may obtain a full listing of titles, and copies, from: Defence Research Information Center, Kentigern House, 65 Brown Street, Glasgow G2 8EX, United Kingdom.

Publications (non-government)

Evaluation of mono-molecular surface modifiers applied to bullets and rifle barrels, and their influence on drag, velocity, consistency, accuracy, and copper fouling. Varmint Hunter Magazine, April 1999.

Contributor to article on 32 ACP caliber suitability for self defence. American Handgunner 2002 Tactical Annual.

Major contributor to Beltway Sniper article authored by Janet Rae-Dupree, US News & World Report, October 2002.

Major contributor (including microscope photography) to Newsweek Special Report – 'The Sick World of the Snipers, The Inside Story of an Epic Manhunt. Newsweek, November 4, 2002.

Major contributor to article on 'ballistic fingerprinting' by Kyle Orland, Suburban Newsline (a publication of the University of Maryland) 2002.

An Overview of **Forensic Firearms Engineering**, Indiana Professional Engineer, Volume 69 No 6, November / December 2006, pp14-16.

Forensic Firearms Engineering - **Blame Apportionment - Products v Operators**, Indiana Professional Engineer, Volume 70 No 1, January / February 2007, pp13-17.

Forensic Firearms Engineering - **Toolmark Analysis**; Linking Cartridge Cases and Bullets to Individual Firearms. Indiana Professional Engineer, Volume 70 No 2, March / April 2007, pp13-16.

Forensic Firearms Engineering - **Terminal Effects**; The Consequences of Being on the Wrong End of a Firearm. Indiana Professional Engineer, Volume 70 No 3, May / June 2007, pp11-15.

Forensic Firearms Engineering - **Shooting Incident Scene Reconstruction: Part 1** - Bullet Impact Area Identification and Interpretation. Indiana Professional Engineer, Volume 70 No 4, July / August 2007, pp13-16.

Forensic Firearms Engineering - **Shooting Incident Scene Reconstruction: Part 2** - Bullet Hole ID and Distance Determinations. Indiana Professional Engineer, Volume 70 No 5, Sept / Oct 2007, pp13-14.

Forensic Firearms Engineering - **Shooting Incident Scene Reconstruction: Part 3** - Ejection Pattern Testing & Analysis. Indiana Professional Engineer, Volume 71 No 2, Mar / Apr 2008, pp12-15.

Forensic Engineering Analysis of Firearm Trigger Incidents. NAFE Journal, Volume XXV, No. 2, December 2008 (Published May 2010) pp. 119 to 134.

Forensic Engineering Analysis of Firearm Silencers, NAFE Journal, Volume XXVI, No. 2, December 2009 (Published October 2012), pp. 39 -50.

Forensic Firearms Engineering - **Employing Hands-on Engineering Skills, Plus Engineering Theory & Calculations, to Analyze & Resolve Complex Design & Safety Liability Issues**, Indiana Professional Engineer, Volume 75 No 4, July / August 2012, pp. 13-27.

Scientific Paper Presentations and Training Seminars Delivered

Presented over 50 continuing education courses and scientific papers between 2001 and 2018. Subjects have included firearms, ballistics, wound ballistics, tool mark comparison, ammunition, crime /accident scene reconstruction, explosives, destructive devices. Attendees have included law enforcement, investigators, attorneys, judges, engineers, scientists, medical professionals, law and forensic science students. Courses have been approved for continuing education credit in most states.

Nov 01	**Training seminar on forensic firearms, ballistics, & wound ballistics** at University of Louisville Law School. Accredited for CLE by Kentucky Bar Association.
May 02	**Lectured in forensic firearms and ballistics** at Ohio University Forensic Science School.
Apr 03	**Presented a one day training seminar on forensic firearms, ballistics, & wound ballistics** to 60+ Chicago lawyers and investigators.

Sep 03	**Training seminar in forensic firearms, ballistics, & wound ballistics** in Indianapolis. Accredited for CLE by Indiana Commission on Legal Education.
Oct 03	**Training seminar on forensic firearms & ballistics** at DePaul University, Chicago.
Dec 03	**Training seminar on forensic firearms, ballistics, & wound ballistics** in Indianapolis. Accredited for CLE by Indiana Commission on Legal Education.
Feb 04	**Training seminar on forensic firearms, ballistics, & wound ballistics** in Indianapolis. Accredited for CLE by Indiana Commission on Legal Education.
Mar 04	**Two training seminars on firearms, ballistics, & wound ballistics** (14 & 15 March 04). NLADA Life in the Balance conference, Memphis Tennessee. Accredited for CLE in most States.
Apr 04	**Keynote Speaker at Emergency Nurses Association Regional Forensic Science Conference**, Memphis TN. Accredited for CLE by the Emergency Nurses Association.
Jan 05	**Firearms & Ballistics for Law Enforcement**, Columbia City Sheriff's Department, Indiana.
Mar 05	**Training seminar on explosives** at the NDIA Annual Conference, Chicago, IL.
Mar / Apr 05	**Two training seminars on Firearms & ballistics**, at the NDIA Annual Conference, Chicago, IL.
Oct 05	**Training seminar on firearms, ballistics**, and wound ballistics at Rochester Institute of Technology NY.
Sept 06	**Two training seminars on firearms, ballistics, & wound ballistics** at the NDIA Conference in Washington DC.
Feb 07	**Accreditation v TQM, Do We Need Either, Do We Need Both ?** Paper Presented at 59th AAFS Annual Scientific Meeting, San Antonio, TX.
Apr 07	**Training Seminar on forensic firearms & ballistics**. at the 70th Annual Convention of the Indiana Society of Professional Engineers, 26 to 28 April 2007.
Jun 07	**Training seminar on firearms, ballistics & wound ballistics.** Maryland Public Defender Annual Training Seminar, 14 to 16 June 2007, Potomac, MD.
Feb 08	**Guru; Demon; Illusionist ? Is it Time for an Overhaul of Expert Qualification Procedures ?** Paper Presented jointly with Maryland Innocence Project at 60th AAFS Annual Scientific Meeting, Washington, DC.
Feb 08	**Impulsive Legislation. Adverse Consequences of Excluding Appropriately Qualified Experts from the Law making Process.** Paper Presented at 60th AAFS Annual Scientific Meeting, Washington, DC.
Feb 08	**Rush to Judgment! Do Some Forensic Scientists Jump to Conclusions, Thereby Facilitating Injustice ?** Paper Presented at 60th AAFS Annual Scientific Meeting, Washington, DC.
Jun 08	**Training seminar on forensic firearms & ballistics**. Washington DC Public Defenders 6th Annual Forensic Science Conference, Gallaudet University, June 12-13 2008.
Jul 08	**Forensic Engineering Analysis of Firearm Trigger Incidents**. Paper presented at NSPE / NAFE Annual Convention, Portland, Oregon.
Jul 08	**Training seminar on forensic firearms, ballistics & wound ballistics**. Indiana Public Defender Counsel, Indianapolis, Indiana.
Feb 09	**Time for Change? The Science & Technology Behind Firearm Trigger Mechanism Evaluation**. Paper presented at 61st AAFS Annual Scientific Meeting, Denver, Colorado.
Jan 10	**Forensic Engineering Analysis of Firearm Silencers**. Paper presented at NAFE Training Seminar, New Orleans, Louisiana.

Feb 10 **Tool Mark Creation and Transfer Issues in Firearms**. Paper presented at 62nd AAFS Annual Scientific Meeting, Seattle, Washington.

Feb 10 **Use of Supplementary Analytical Techniques in Firearm Tool Mark Analyses**. Paper presented at 62nd AAFS Annual Scientific Meeting, Seattle, Washington.

Jun 10 **Forensic Firearms & Ballistics for the legal Profession; a Continuing Education Course for Attorneys, Judges, and Professional Engineers**. Accredited by the Indiana Supreme Court Commission for Continuing Legal Education, and the Indiana Society of Professional Engineers.

Jan 11 **Forensic Firearms & Ballistics for the legal Profession; a Continuing Education Course for Attorneys, Judges, and Professional Engineers**. Accredited by the Indiana Supreme Court Commission for Continuing Legal Education, and the Indiana Society of Professional Engineers.

Feb 11 **Differing Perspectives on the Use of Experts in an Adversarial Litigation System**, Are Experts Misunderstood & Misused ? Are Court Appointed Experts the Ultimate Answer ? Paper Presented jointly with State of Minnesota PD at AAFS 63rd Annual Scientific Meeting, Chicago, IL.

May 12 **Training seminar on forensic firearms, ballistics, and wound ballistics**. Missouri Public Defender Annual Training Conference, Branson, MO.

Aug 12 **Forensic Firearms & Ballistics for the legal Profession; a Continuing Education Course for Attorneys & Judges**. Cincinnati, OH. Accredited for Continuing Legal Education in the State of Ohio.

Oct 12 **Training seminar on firearms and ammunition technology**, NLADA Life in the Balance conference, St Louis, MO. Accredited for CLE in most States.

Oct 12 **Training seminar on firearm & ammunition toolmark analysis**, NLADA Life in the Balance conference, St Louis, MO. Accredited for CLE in most States.

Oct 12 **Training seminar on improvised explosive devices & destructive devices**, NLADA Life in the Balance conference, St Louis, MO. Accredited for CLE in most States.

Feb 13 **Performance Evaluation of Firearm Silencers.** Paper presented at 65th AAFS Annual Scientific Meeting, Washington DC.

Feb 13 **Safety Evaluation of Post Manufacture Firearm Modifications.** Paper presented at 65th AAFS Annual Scientific Meeting, Washington DC.

Nov 13 **You Don't Have to Accept It in Silence: Challenging Firearms Identification Evidence, and Those Who Deliver It.** Wisconsin Public Defender Annual Training Seminar, Milwaukie WI.

Feb 14 **Was That Car Used as a Weapon ? Combining Reconstruction Skills to Answer a Critical Question.** Paper presented jointly at 66th AAFS Annual Scientific Meeting, Seattle WA.

Feb 14 **Investigation of Ear Witness Testimony with Regard to Sounds Heard During a Shooting Incident.** Paper presented at 66th AAFS Annual Scientific Meeting, Seattle WA.

Jun 14 **Forensic Firearms, Ammunition, & Ballistics.** Washington DC Public Defender Service 11th Annual Forensic Science Conference, Washington DC.

Feb 15 **A Study of Lot-to-Lot Handgun Ammunition Propellant Variables and Their Influence upon Muzzle to Target Distance Determinations.** Paper presented at 67th AAFS Annual Scientific Meeting, Orlando, FL.

Feb 15	**Investigation of 'Inert' Artillery Shell Explosion.** Paper presented at 67th AAFS Annual Scientific Meeting, Orlando, FL.
Feb 15	**Forensic Investigation of a Premature Mortar Explosion that Resulted in the Death and Maiming of Several US Marines.** Paper presented at 67th AAFS Annual Scientific Meeting, Orlando, FL.
Feb 15	**Implementing Change in a Multidisciplinary Forensic Science World.** Paper presented at 67th AAFS Annual Scientific Meeting, Young Forensic Scientists Forum (YFSF), Orlando, FL.
Sep 15	**Is the Gatekeeper Concept Failing the Justice System ? Is There a Viable Alternative ?** Paper presented at the 2015 AAFS ESS International Scientific Meeting, Toronto, Canada.
Feb 16	**Is the Gatekeeper Concept Failing the Justice System ? Is There a Viable Alternative ?** Paper presented at 68th AAFS Annual Scientific Meeting, Special Joint Session, Las Vegas, NV.
Feb 16	**Accident or Lovers Quarrel ?** Paper presented at 68th AAFS Annual Scientific Meeting, Young Forensic Scientists Forum (YFSF), Las Vegas, NV.
Aug 17	**Human Rights & the Enduring Negative Impact of Military Weapons**, International Association of Forensic Sciences, 21st Triennial Meeting, Toronto, Canada.
Feb 18	**Does Size Really Matter — Or Is How You Manipulate It More Important? A Review of Data Analysis and Presentation Tips and Tricks.** Paper presented at 70th AAFS Annual Scientific Meeting, Seattle, WA.
Feb 18	**It's a Fair System, Isn't It? Facts, Alternative Facts, and Other Litigation Influencers.** Paper presented at 70th AAFS Annual Scientific Meeting, Seattle, WA.
Feb 19	**Assessing the Construction & Performance Potential of Improvised Hand Grenades.** Paper presented at AAFS 71st Annual Scientific Meeting, Baltimore, MD.
Feb 19	**Handgun & Ammunition Performance Influencers.** Paper presented at AAFS 71st Annual Scientific Meeting, Baltimore, MD.
Mar 19	**An Introduction to Forensic Engineering**. Purdue University, Fort Wayne, IN.
Oct 19	**Forensic Engineering - The Importance of Multi-disciplinary Cooperation.** Purdue University, Fort Wayne, IN.
Feb 20	**A Comparison of Scientifically Valid & Traditional Firearm Trigger Mechanism Evaluation Techniques.** Paper presented at AAFS 72nd Annual Scientific Meeting, Anaheim, CA.
June 23	Forensic Firearms Engineering. Paper presented at the 2023 ISPE Annual Meeting, Indianapolis, IN.

Continuing Education, Training, & Development (post 2001)

Nov 01	Forensic Science conference at University of Louisville Law School.
Sept 03	Death Penalty conference, Indianapolis.
Oct 03	Conference; Ballistics; from the Shop Floor to the Courtroom, DePaul University, Chicago.
Dec 03	Forensic Science training seminar, Indianapolis.
Feb 04	Forensic Science training seminar, Indianapolis.
Sept 04	Forensic Science for Investigators, Indianapolis.
Apr 06	Forensic Science Symposium, Indianapolis.

Apr 06	Indiana Society of Professional Engineers (ISPE) Annual Convention, Indianapolis, IN.
May 06	Advanced Defensive Pistol Course.
Sept 06	SIG Factory Certified Armorer Course.
Oct 06	Forensic Investigation, Dr Henry C Lee, Carmel, Indiana.
Feb 07	American Academy of Forensic Sciences (AAFS) 59th Annual Scientific Meeting, San Antonio, TX.
Apr 07	ISPE Annual Convention, Indianapolis IN.
Jul 07	National Institute of Justice Annual Conference, Arlington VA.
Jul 07	National Academy of Forensic Engineers (NAFE) Annual Conference, Denver CO.
Feb 08	AAFS 60th Annual Scientific Meeting, Washington, DC.
Apr 08	ISPE Annual Convention, Indianapolis, IN.
Jul 08	NAFE Annual Convention, Portland, OR.
Feb 09	AAFS 61st Annual Scientific Meeting, Denver, CO.
May 09	ISPE Annual Convention, Indianapolis, IN.
Jul 09	National Society of Professional Engineers (NSPE) Annual Convention, St Louis, MO.
Jan 10	NAFE Training Seminar, New Orleans, LA.
Feb 10	AAFS 62nd Annual Scientific Meeting, Seattle, WA.
May 10	ISPE Annual Convention, Indianapolis IN.
Feb 11	AAFS 63rd Annual Scientific Meeting, Chicago, IL.
Jan 12	NAFE Training Seminar, Miami Beach, FL.
Feb 12	AAFS 64th Annual Scientific Meeting, Atlanta, GA.
Oct 12	NLADA Life in the Balance Conference, St Louis, MO.
Feb 13	AAFS 65th Annual Scientific Meeting, Washington DC.
Jun 13	ISPE Annual Convention, Indianapolis, IN.
Feb 14	AAFS 66th Annual Scientific Meeting, Seattle, WA.
Feb 15	AAFS 67th Annual Scientific Meeting, Orlando, FL.
Sept 15	AAFS ESS International Scientific Meeting, Toronto, Canada.
Feb 16	AAFS 68th Annual Scientific Meeting, Las Vegas, NV.
Jun 17	ISPE Annual Convention, Indianapolis, IN.
Feb 18	AAFS 70th Annual Scientific Meeting, Seattle, WA.
Feb 19	AAFS 71st Annual Scientific Meeting, Baltimore, MD.
Feb 20	AAFS 72nd Annual Scientific Meeting, Anaheim, CA.
Feb 21	AAFS 73rd Annual Scientific Meeting (virtual).
Jun 23	ISPE Annual Convention, Indianapolis, IN.
Dec 23	ANSI National Accreditation Board ISO / IEC 17024 Training Course.
Aug 25	ISO Training, 2 day, Mickie Rops Consulting.

Achievements & Activities

* One of the youngest people to be elected to Fellowship of the Institution of Mechanical Engineers.
* My expert report format was adopted by the Academy of Experts.
* Secretary to UK explosives safety, performance, and compatibility committees (95-98).
* NRA Certified Range Safety Officer.
* NRA Certified pistol and personal protection instructor.
* SIG Sauer Factory Certified Law Enforcement Armorer (2006 to 2009).

Exhibit 2

Dec. 13, 1938. C. J. MICHAL, JR 2,139,691

MACHINE GUN

Filed Sept. 23, 1936 5 Sheets-Sheet 1

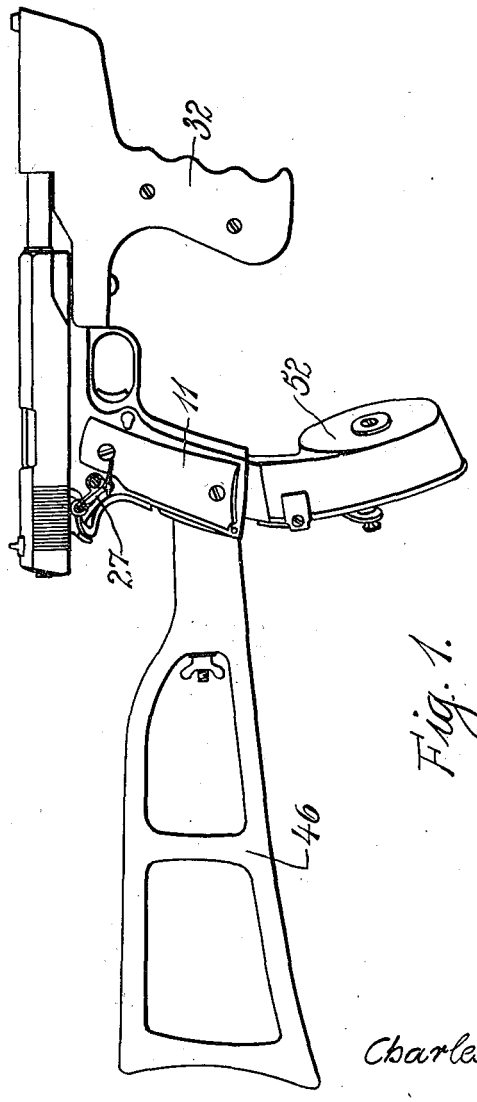


Fig. 1.

Charles J. Michal, Jr.
INVENTOR.

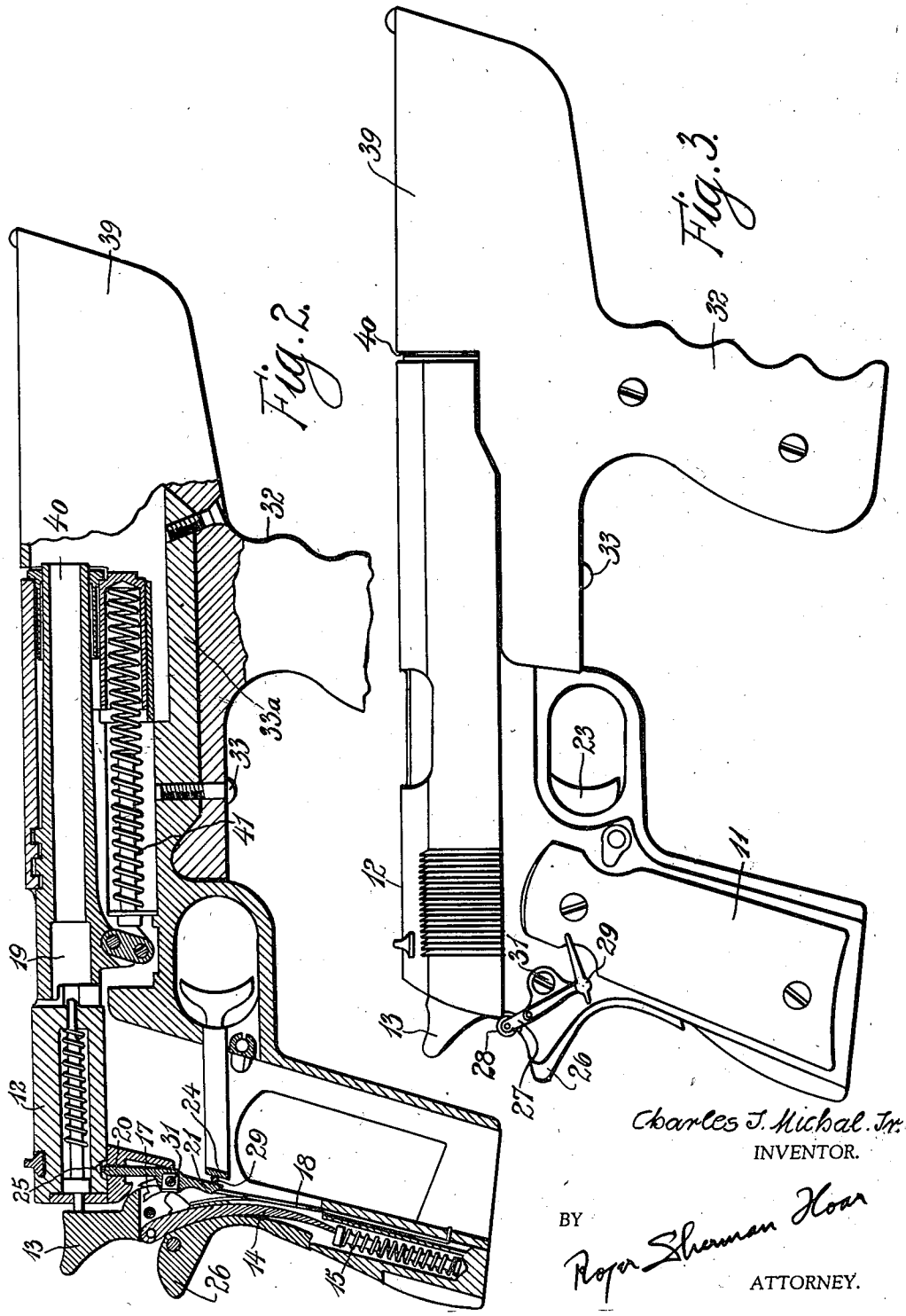
BY Roger Sherman Hoar

ATTORNEY.

Dec. 13, 1938. C. J. MICHAL, JR 2,139,691

MACHINE GUN

Filed Sept. 23, 1936 5 Sheets-Sheet 2



Charles J. Michal, Jr.
INVENTOR.

BY Roger Sherman Hoar

ATTORNEY.

Dec. 13, 1938. C. J. MICHAL, JR 2,139,691

MACHINE GUN

Filed Sept. 23, 1936 5 Sheets-Sheet 3

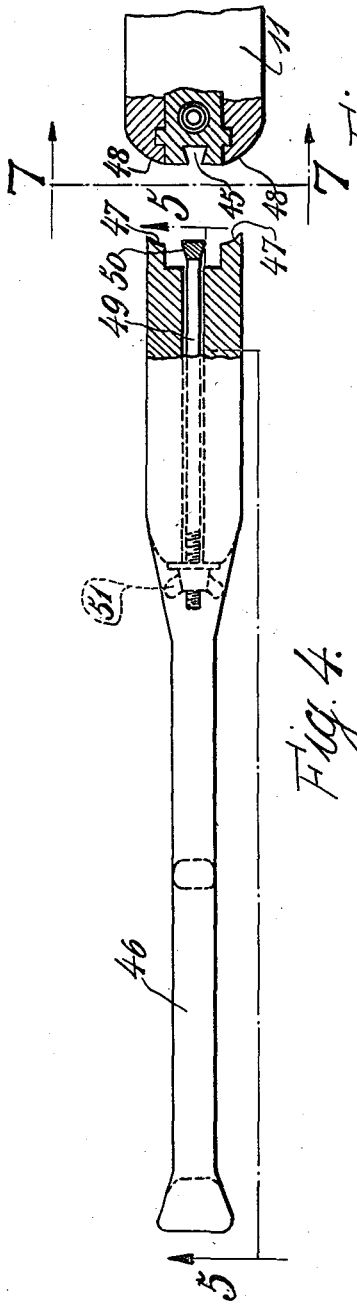


Fig. 6.

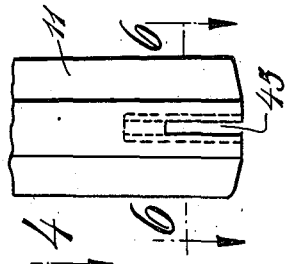


Fig. 7.

Fig. 4.

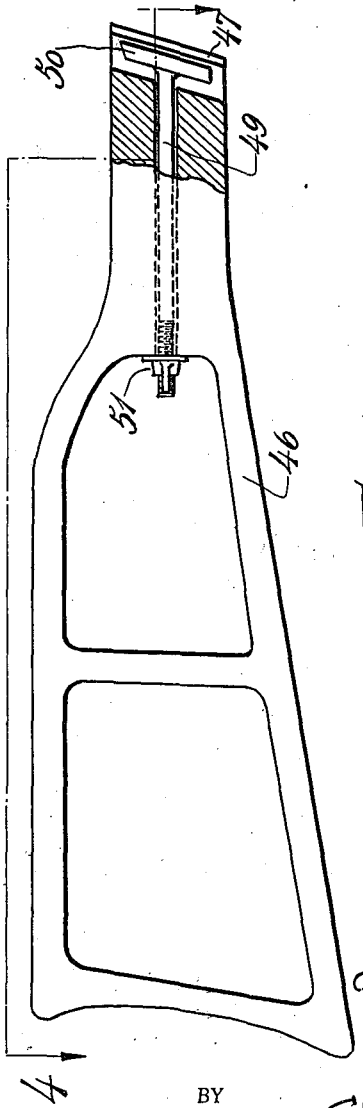


Fig. 5.

Charles J. Michal Jr.
INVENTOR.

BY Roger Sherman Hoar

ATTORNEY.

Dec. 13, 1938. C. J. MICHAL, JR 2,139,691

MACHINE GUN

Filed Sept. 23, 1936 5 Sheets-Sheet 4

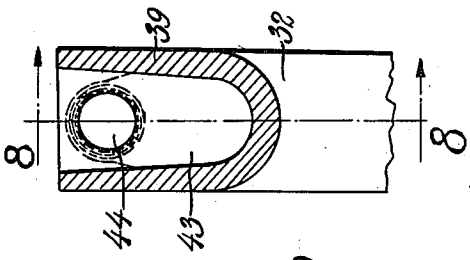


Fig. 9.

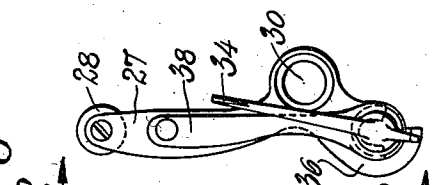


Fig. 13.

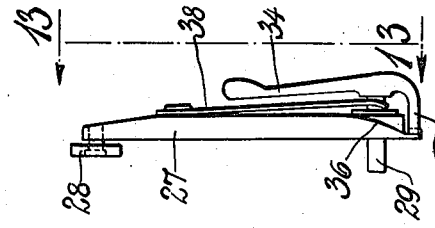


Fig. 12.

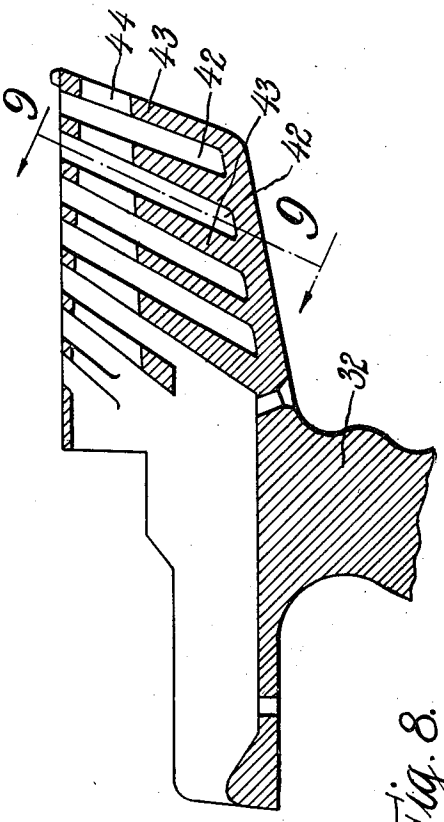


Fig. 8.

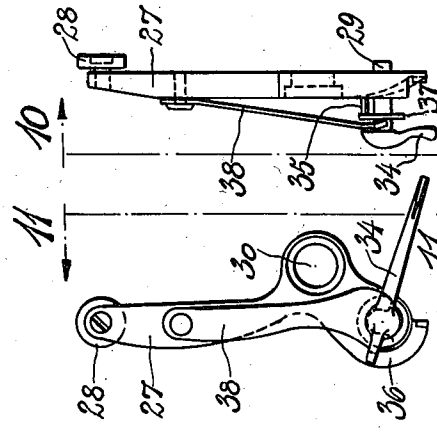


Fig. 11.

Fig. 10.

Charles J. Michal, Jr.

INVENTOR.

BY Roger Sherman Hoar

ATTORNEY.

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MACHINE GUN

Filed Sept. 23, 1936 5 Sheets-Sheet 5

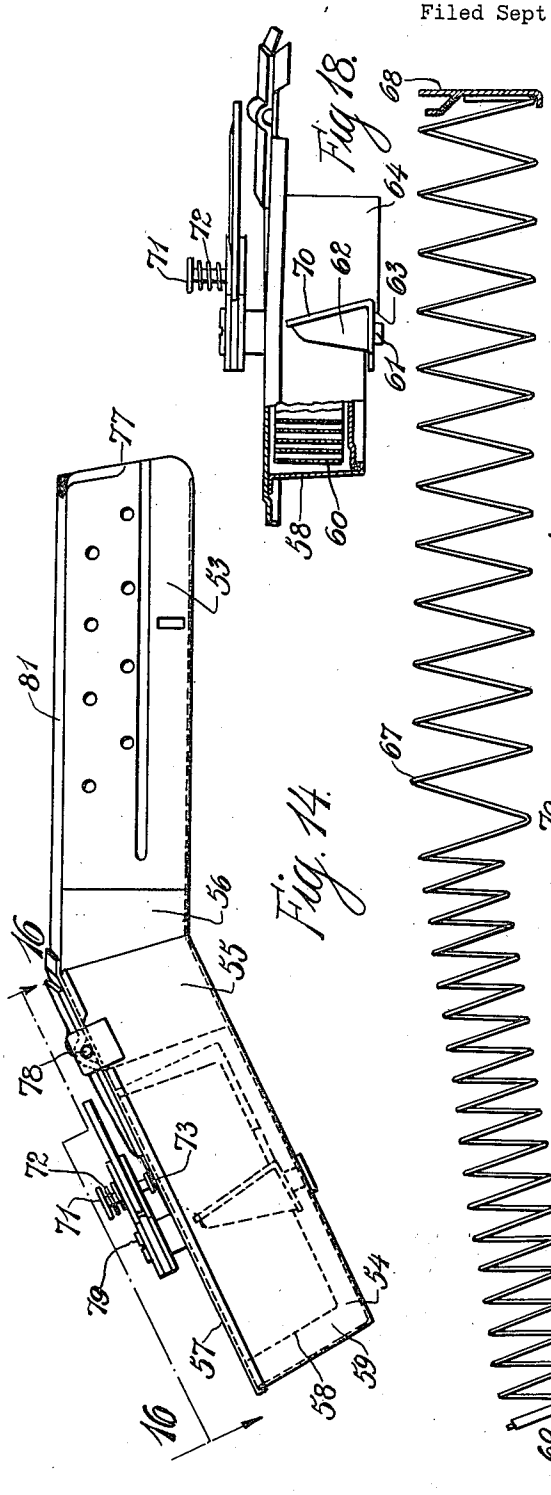

Fig. 14.

Fig. 18.

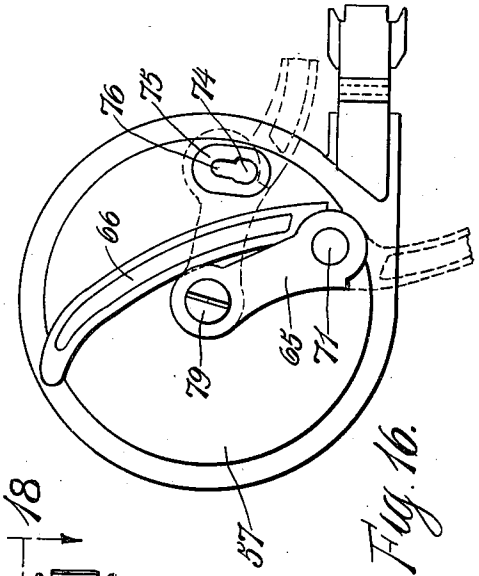

Fig. 16.

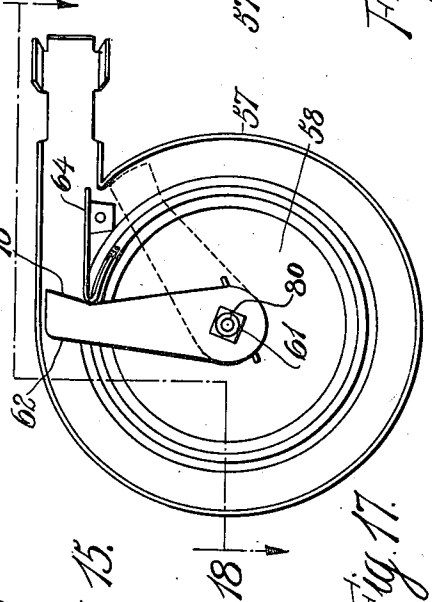

Fig. 15.

Fig. 17.

Charles J. Michal, Jr.

INVENTOR.

BY Roger Sherman Hoar

ATTORNEY.

Patented Dec. 13, 1938

2,139,691

UNITED STATES PATENT OFFICE

2,139,691

MACHINE GUN

Charles J. Michal, Jr., Hinsdale, Ill.

Application September 23, 1936, Serial No. 102,100

9 Claims. (Cl. 42—69)

My invention relates to machine-guns and to devices for converting other fire-arms into machine-guns.

More specifically my invention consists in utilizing the motion of the recoiling parts of a fire-arm, acting against the natural resiliency of the trigger-finger of the person firing the arm, to automatically release the safety mechanism of the fire-arm, and to discharge the same in regular sequence.

Still more specifically my invention consists in so constructing my converter, that the converted fire-arm can be used at will as full automatic or semi-automatic.

Also it is my object to provide means for holding the fire-arm in a safe position during automatic firing, and to provide a magazine holding many rounds, so that the full automatic features of my converted fire-arm can be utilized to the utmost.

My present invention is an improvement on that described, shown and claimed in my copending application, Serial No. 713,479, filed March 1, 1934, which has matured into U. S. Patent No. 2,056,975, dated Oct. 13, 1936.

In addition to the foregoing objects, I have worked out a number of novel and useful details, which will be readily evident as the description progresses.

My invention consists in the novel parts, and in the combinations and arrangements thereof—and especially in the converter, the magazine and the stock thereof—which are defined in the appended claims; and of which one embodiment is exemplified in the accompanying drawings, which are hereinafter particularly described and explained.

Throughout the description, the same reference number is applied to the same member or to similar members.

Figure 1 is a side elevation of my complete invention, with the slide at recoil, and with the lever of the converter set for semi-automatic fire.

Figure 2 is a vertical longitudinal section of the fire-arm per se, with the slide in the forward position.

Figure 3 is a side elevation of the fire-arm as shown in Figure 2, with the lever set for semi-automatic fire as in Figure 1.

Figure 4 is a plan view, partly in section, of the shoulder piece of my weapon, taken along the line 4—4 of Figure 5.

Figure 5 is a side elevation, partly in section, of the shoulder piece of my weapon, taken along the line 5—5 of Figure 4.

Figure 6 is a horizontal partial section of the handle of the pistol, to which the shoulder piece as shown in Figure 4 is to be attached. It is taken along the lines 6—6 in Figure 7.

Figure 7 is a rear elevation of the handle of the pistol taken along the lines 7—7 of Figure 6.

Figure 8 is a vertical longitudinal section of the forward grip of my weapon, showing the blast deflectors. It is taken along the line 8—8 of Figure 9.

Figure 9 is an inclined cross-section of the blast-deflecting portion of my forward grip, taken along the line 9—9 of Figure 8.

Figure 10 is an enlarged side elevation of my improved converter, shown in place in Figures 1 and 3. It is taken along the line 10—10 of Figure 11, and is with the lever set for semi-automatic fire.

Figure 11 is an enlarged front elevation of my converter, with the lever set for semi-automatic fire, taken along the line 11—11 of Figure 10.

Figure 12 is an enlarged rear elevation of my converter, with the lever set for fully automatic fire, taken along the line 12—12 of Figure 13.

Figure 13 is an enlarged side elevation of my converter, with the lever set for fully automatic fire, taken along the line 13—13 of Figure 12.

Figure 14 is an enlarged side elevation of the magazine of my weapon, the viewpoint being at a slant slightly to the rear of the viewpoint of Figure 1.

Figure 15 is the follower-spring of my magazine, disassembled.

Figure 16 is a rear elevation of the cover of my magazine, taken along the line 16—16 of Figure 14.

Figure 17 is the view from the inside of the cover shown in Figure 16.

Figure 18 is a side view of this cover, taken along the line 18—18 of Figure 17, it is partly cut away to show the spiral spring inside.

Referring to the drawings, and more particularly to Figure 2, it will be seen that this figure illustrates the conventional Colt automatic pistol of the United States Army, with certain modifications which will become evident as the description progresses.

The Colt pistol, although officially called "automatic", is really merely semi-automatic, i. e. autoloading and cocking only.

The normal operation of such a pistol will now be briefly sketched. Reference may be made to the well-known operation of this fire-arm for further details.

A loaded magazine (not the improved magazine

shown in Figure 1) is placed in the handle 11. This magazine normally contains nine cartridges, impelled upward by a spring; but my invention contemplates elongating this magazine so as to contain 36 cartridges, for example, in the .38-caliber model.

The slide 12 is then drawn rearward (i. e., to the left in the figure) by hand. This action swings the hammer 13 counter-clockwise, depressing the hammer-strut 14 against compression of the mainspring 15. The notch 16 on the hammer, catches on the upper point of the sear 17, the sear being forced counter-clockwise into engagement by the action of one leaf of the sear-spring 18.

The slide 12 is then let forward, under the influence of counter-recoil spring 41, thus forcing a cartridge (not shown) into the chamber 19, in a manner well-known, and not constituting a part of my invention.

While the slide 12 was in its rearward position, the lower edge of the slide, by engaging the top of the disconnector 20, forced it down so that its lower end 21 came below the lower end 22 of the sear 17. If, at such time, the trigger 23 had been pressed, the rear end 24 of the trigger slide would have pushed the lower end 21 of the disconnector harmlessly below the lower end 22 of the sear, and the pistol would not have been discharged.

But, with the slide 12 in returned forward position, and the upper end 20 of the disconnector consequently seated in the notch 25 on the lower side of the slide (the disconnector being forced upward by the second leaf of the sear-spring 18), the lower end 21 of the disconnector is now in sufficiently raised position to engage the lower end 22 of the sear if the trigger be pulled, and thus trip the point 17 of the sear out of the notch 16 of the hammer, thus permitting the hammer 13 to fall upon the firing-pin 26, and discharge the piece.

The forces of recoil throw the slide 12 rearwardly again, thus cocking the hammer 13 as before. And the counter-recoil puts another cartridge in the chamber 19.

But, although the trigger 23 still be held pressed, as the lower edge of the slide 12 forces down the head 20 of the disconnector, so that the lower end 21 of the disconnector is forced below the level of the lower end 22 of the sear, thus permitting the sear to rotate counter-clockwise to cock the piece, and preventing the continued pressure on the trigger from discharging the piece.

There is another safety device, involving the grip-safety 26, which is not involved in my invention, and hence will not be described, although its original operation is in no way impaired by the introduction of my invention.

If, after the slide has fully returned to its forward position, the trigger is released, the lower end 21 of the disconnector will move forward and upward, under the influence of the sear-spring 18, until it again engages the front edge of the lower end 22 of the sear, ready to fire upon renewed pressure of the trigger.

I have added to the conventional Colt pistol the converter 27, shown in place in Figures 1 to 3 (and the improved form of which will be described a bit later herein). 28 is its roller, 29 its pin, and 31 the screw about which it pivots.

I cut a slot in the side of the handle of the pistol for the pin 29, and insert it so that it will engage the rear of the trigger-slide 24, as shown in Figure 2. Such is the width of the trigger-slide 24 that the pin does not interfere with the disconnector 21, although it appears to do so in the figure.

Its action is as follows. The trigger 23 fires the piece as before. But, the instant that recoil takes place, the lower edge of the slide 12 engages the roller 28 of the converter 27, thus rotating it counter-clockwise, and forcing the pin 29 forward. This motion of the pin forces the trigger forward against the pressure of the trigger-finger of the man, thus disengaging the trigger-slide 24 from the disconnector 21, and permitting the disconnector to return to firing-position the instant that counter-recoil is completed.

The pin 29 holds the trigger inoperative against the pressure of the trigger-finger. But, the instant that counter-recoil is completed, the roller 28 is free to move upward again, and consequently the pressure of the trigger-finger immediately again discharges the piece.

As a result, shots occur rhythmically with the cadence of recoil and counter-recoil of the piece.

The use of my converter has quite a different result from what would obtain if the disconnector were omitted, and the trigger-slide were lengthened to bear directly against the sear. For, in that case, the sear would merely be held out of engagement with the notch on the hammer, and the hammer would return at counter-recoil, with a force which might or might not discharge the piece, and might discharge the piece before counter-recoil had been safely completed. Whereas, in my invention, the hammer is successively cocked and positively discharged; and the gun is "locked in battery" before the discharge of the cartridge. Thus my invention is in no sense an undoing of the function of the disconnector, but rather is the adding of an entirely new function and of the mechanism for performing it.

But it is well-known that the Colt pistol recoils with each shot into a position in which the hand which holds it is close to the right side of the firer's head, and the pistol is pointing diagonally upward to the rear. If, by virtue of my invention as thus far described, the second shot were to occur when the piece was in this position, the result might be disastrous.

Accordingly I have added a second handle 32, secured to the piece by screws 33, fitting into a bar 33*a* welded to the conventional Colt frame. This handle is preferably made of aluminum.

My invention, as thus far described, is identical to the stage of progress described, shown and claimed in my copending patent above identified.

I shall now describe a further improvement in my converter 27. Turning to Figures 10 to 13, we see that pin 29 is provided with a lever 34, with a projection 35, which moves on camway 36, as the lever rotates the pin. Pin 29 is also provided with a collar 37, against which bears a leaf-spring 38, tending to force the pin 29 to the right in Figure 11, and to the left in Figure 12. Thus, when the lever 34 is in the position shown in Figures 10 and 11, pin 29 is withdrawn from engagement with trigger-slide 24, and the weapon operates as a conventional Colt semi-automatic pistol, just as though my converter had not been added to it. But, when the lever 34 is in the position shown in Figures 12 and 13, pin 29 is forced by spring 38 into engagement with trigger-slide 24, and the weapon operates as a fully automatic machine-gun as in my copending patent, above identified.

I shall now describe a further improvement in my auxiliary handle 32. It is now provided with a portion 39, which projects in front of the muzzle

40 of the gun. This portion internally is made up of alternate inclined cavities 42 and inclined vanes 43. The rear vane is about 45°, and the vanes gradually become more vertical as they approach the front. Each vane has a hole 44, in line with muzzle, larger at the rear, and growing gradually smaller toward the front, until the frontmost one is just a little larger than the bullet, to permit passage of the bullet without grazing.

When the powder-blast, following the bullet out of the muzzle 40, mushrooms out immediately upon leaving the muzzle, the vanes 43 deflect it upward. The prospectively smaller holes divide the muzzle blast fairly proportionally over all the vanes. The muzzle-blast, by pressing downwardly and forwardly on the vanes, to a large extent neutralizes both the upward and the rearward kick.

As thus far described, my invention, equipped with the conventional Colt 9-shot magazine, or with the slightly elongated 18-shot magazine referred to in my above identified copending patent, can be carried in a shoulder holster, can be drawn instantly, and can be used at will either to fire single shots, or to loose a machine-gun blast without material recoil to disturb a steady aim.

But, if it be desired to use my weapon for more prolonged machine-gun fire, two further improvements of mine become pertinent.

The first of these two further improvements is the detachable shoulder-piece shown in Figures 4 to 7. It is made detachable, so that my weapon can be carried in a shoulder holster and used as a pistol, when desired.

The bottom portion of the rear edge of the handle 11 is provided with an inwardly-spreading slot 45. The forward end of the shoulder piece 46 (preferably made in skeleton construction of aluminum) has two abutments 47 to engage the sides 48 of rear of the handle 11. The forward portion of shoulder piece 46 is bored to accommodate a bolt 49, which terminates in a wedge 50. The bolt has a thumb-nut 51.

To assemble the shoulder piece, slide the wedge 50 up into the slot 45, and then tighten the thumb-nut 51.

This arrangement of mine is preferable to other means for securing a shoulder-piece to a pistol, for it will not wobble.

The second of my two above mentioned further improvements is the magazine 52 shown in Figures 14 to 18.

Part 53 is identical to the conventional Colt magazine, but with the bottom removed. Parts 54 and 55 constitute the conventional Luger magazine, consisting of a truncated conical portion 54, and a tangential portion 55. I connect these two magazines together by the intermediate portion 56. The angle (substantially 20°) at which I set the Colt magazine to the Luger magazine constitutes an important feature of my invention; as will now be explained.

It is at this point in my invention that I depart from the conventional Luger construction. In the Luger, the part which corresponds to my part 53 is materially narrower than the length of the cartridges, which accordingly lie in echelon, nose up. Luger's follower is parallel to an element of his cone, and his portions 55 and 54 join his portion 53 at such an angle that the cartridges are presented to portion 53 at the slant above referred to.

This construction requires, when filling his magazine, the insertion of the cartridges one by one, by means of a loading-tool, which is apt to get lost, and without which the owner of a Luger is helpless.

In a Colt, on the contrary, the cartridges lie with their bases very nearly parallel to the edge 81 of the portion 53, and hence may be loaded by hand through end 77, which process is much more speedy, and has no tool to lose.

Of course, I could have modified my portion 53 by inserting a false back along edge 81, and then have employed the Luger portions 54 and 55 unmodified. But this would have necessitated using the loading tool, which I was seeking to eliminate.

I determined the angle of attachment between my portions 55 and 53 as follows. Making a diagram of portions 53 and 56, I laid a cartridge in the proper position at end 77 of the diagram, and then laid other cartridges side by side upon the diagram until they reached the further end of portion 56. The angle between the base of the last cartridge, and the edge 81 of portion 53, was the angle employed by me for attaching portion 55. The reason why I could not simply employ the inclination of the base of the first cartridge, is due to a slight difference in width at point and base of the particular ammunition.

Furthermore, I found that, if a less angle were employed, the bullets would nose-down, upon emerging from end 77, and, instead of entering the chamber of the gun, would jam. Whereas, if a greater angle were employed, the magazine would not load by hand. These considerations determine the exact angle for use with any particular caliber of gun and type of ammunition. In the exemplification shown, it happens to be 22.5°.

The cover 57 of the Luger magazine has a truncated conical portion 58 which projects into the truncated conical portion 54 of the magazine, leaving between them a space 59 just wide enough to hold a row of cartridges. I have had to modify the depth of this cover, to fit American ammunition, but it remains functionally the same. Portion 58 contains a very powerful spiral spring 60. This spring is attached to shaft 61, and is initially set so as to hold follower 62 firmly against notch 63 in guide 64. Keyed to the opposite end of shaft 61, on the outside of cover 57, is lever 65. Pivoted on the outer end of lever 65 is a handle 66.

The spring 67, shown in Figure 15, is inserted with its wide end 68 in the Colt magazine 53, and its small end bearing against the face 70 of follower 62. This face is bent back by me at an angle from the conventional Luger position.

Without such bending, I found that even my careful calculation of the other angle, already discussed, would avail me nothing—the bullets would jam. The angle at which to set the follower should be substantial, practically equivalent to the other angle already discussed, or even slightly more. All this is empirical.

About twelve cartridges can be inserted in the Colt magazine in the ordinary way, until spring 67 is compressed to the utmost. To insert more cartridges, handle 66 is swung down to its extended position, shown in dotted lines at the bottom of Figure 16. It, and lever 65, are then rotated clockwise to the dotted position shown at the right in Figure 16. Plunger 71 (see Figures 14 and 18) is then depressed against its spring 72, until its foot 73, enters the wide portion 74 of the slot 75. Upon releasing the manual pres-

sure on handle 66, foot 73 catches in the narrow portion 76 of the slot.

Follower 62 is now in its fully retracted position, as shown dotted in Figure 17, and the rest of the cartridges can now be inserted by hand, at the end 77 of the magazine, against merely the light pressure of spring 67.

When the magazine has thus been charged, foot 73 is released from slot 75, and handle 66 is folded back into its normal position. The magazine is now ready for use.

It is to be understood that the cover 57 is not removed during this process, nor in fact ever except for repairs, it being secured in place by a single bolt through hole 78, and by screw 79 inserted in threaded hole 80.

All the features of my present invention contribute to a common end, namely the conversion of a Colt piston into a machine-gun. My improved converter enables this conversion to be accomplished at will, by the mere flip of a little lever 34. The optional substitution of my improved magazine enables me to use the weapon at will as a many-shot machine-gun, or as a few-shot pocket machine-gun. In either use, my combined auxiliary handle and blast-deflector is necessary to cut down the recoil and insure accurate aim. For regular machine-gun use, a shoulder-piece is necessary; but, for pocket use, would be in the way. Hence my removable shoulder-piece.

Having now described and illustrated one form of my invention, I wish it to be understood that my invention is not to be limited to the specific form or arrangement of parts hereinbefore described, except insofar as such limitations are specified in the appended claims.

I claim:

1. The combination with a semi-automatic fire-arm, in which the trigger must be released between successive shots; of means, actuated by the recoil of a recoiling part, said means consisting of a converter operatively connecting said recoiling part with the trigger, whereby to force the release of the trigger against the tension in the trigger-finger of the operator, and to permit this tension to pull the trigger upon the completion of counter-recoil; whereby the fire-arm is rendered fully automatic; and means to render the aforementioned means, while still attached to the pistol, inoperative at will.

2. In a machine-gun, having the conventional parts including stock, barrel, chamber, magazine, and means for ejecting exploded cartridges and for inserting new cartridges into the chamber, the combination of: a slide; a hammer, so proportioned and positioned that the rearward motion of the slide, under the influence of recoil, will cock the hammer; means to lock the hammer cocked; a trigger, so proportioned and positioned that, after being pulled to fire the gun, it must move forward before it will be in condition to fire again; means, under the influence of the recoil of the slide, to thus move the trigger forward against the pressure of the trigger-finger of the operator, but leave it held in operative position against the pressure of the trigger-finger of the operator; means, under the influence of the counter recoil of the slide, to free the trigger for firing, under the influence of continued pressure of the trigger-finger; and means to render the last-mentioned means, while still attached to the pistol, inoperative at will.

3. In a machine-gun, having the conventional parts including stock, barrel, chamber, magazine, and means for ejecting exploded cartridges and for inserting new cartridges into the chamber, the combination of: a slide; a hammer, so proportioned and positioned that the rearward motion of the slide, under the influence of recoil, will cock the hammer; a sear, to lock the hammer cocked; a trigger; a disconnector, so proportioned and positioned as to operatively connect the trigger to the sear when counter-recoil is completed, and to disconnect the trigger from the sear during recoil, and to maintain that disconnection until the trigger is moved forward; means, under the influence of the recoil of the slide, to thus move the trigger forward against the pressure of the trigger-finger of the operator, but leave it held in operative position against the pressure of the trigger-finger of the operator; means, under the influence of the counter-recoil of the slide, to free the trigger for firing, under the influence of continued pressure of the trigger-finger; and means to render the last-mentioned means, while still attached to the pistol, inoperative at will.

4. In a machine-gun, the combination of: a hammer; a sear; a trigger; a disconnector, so proportioned and positioned as to operatively connect the trigger to the sear when counter-recoil is completed, and to disconnect the trigger from the sear during recoil, and to maintain that disconnection until the trigger is moved forward; a recoiling part to actuate the disconnector; means, under the influence of the recoiling part, to move the trigger forward against the pressure of the trigger-finger of the operator, during recoil and hold it released until the completion of counter-recoil; and means to render the last-mentioned means, while still attached to the pistol, inoperative at will.

5. In an attachment for converting a conventional semiautomatic pistol into a machine-gun, the combination of: a plate; a pivot therefor; a projection from the upper portion of the plate, to engage the under edge of the slide of the pistol during recoil and counter-recoil, thereby forcing and holding the upper portion of the plate to the rear and its lower portion forward, and releasing and permitting the upper portion of the plate to move forward and its lower portion to move rearwardly upon the completion of counter-recoil; a projection from the lower portion of the plate, engaging the rear of the trigger of the pistol, thereby forcing and holding the trigger forward against the pressure of the trigger-finger of the person firing the pistol during recoil and counter-recoil, and releasing the trigger for firing under continued pressure of the trigger-finger upon the completion of counter-recoil; and means for withdrawing the second projection at will, while still attached to the pistol.

6. In an attachment for converting a conventional semi-automatic pistol into a machine-gun, the combination of: a pivoted element; a projection therefrom, for engaging a recoiling element of the pistol; a second projection from the pivoted element, for forcing the trigger of the pistol forward against the trigger-finger of the operator, whereby the trigger is moved into pre-firing position against the pressure of the trigger-finger of the operator and is held inoperative during recoil and counter-recoil, and is instantly released for firing under continued pressure of the trigger-finger of the operator, upon the completion of counter-recoil; and means for withdrawing the second projection at will, while still attached to the pistol.

7. In an attachment for converting a conventional semi-automatic pistol into a machine-gun, the combination of: a pivoted element; a projection therefrom, for engaging the slide of the pistol; a second projection from the pivoted element, for engaging the trigger of the pistol, whereby the trigger is moved into prefiring position against the pressure of the trigger-finger of the operator and is held inoperative during recoil and counter-recoil, and is instantly released for firing under continued pressure of the trigger-finger of the operator, upon the completion of counter-recoil; and means for withdrawing the second projection at will, while still attached to the pistol.

8. In an attachment for converting a conventional semi-automatic pistol into a machine-gun, the combination of: an actuated element, actuated by a recoiling element of the pistol; an actuating element, engaging the trigger of the pistol, to shift the trigger in the release direction against the pressure of the trigger-finger of the operator during recoil, and hold it thus shifted until the completion of counter-recoil, and thereupon to free the trigger for action under the pressure of the trigger-finger of the operator; an operative connection between the actuated element and the actuating element; and means for optionally breaking the chain of this operative connection, while leaving the attachment still attached to the pistol.

9. In an attachment for converting a conventional semi-automatic pistol into a machine-gun, the combination of: an actuated element, actuated by a recoiling element of the pistol; an actuating element, engaging the trigger of the pistol, to shift the trigger in the release direction against the pressure of the trigger-finger of the operator during recoil, and hold it thus shifted until the completion of counter-recoil, and thereupon to free the trigger for action under the pressure of the trigger-finger of the operator; an operative connection between the actuated element and the actuating element; and means for withdrawing the actuating element from engagement with the trigger, while leaving the attachment still attached to the pistol.

CHARLES J. MICHAL, JR.

Exhibit 3

Oct. 13, 1936. C. J. MICHAL, JR 2,056,975

MACHINE GUN AND CONVERTER THEREFOR

Filed March 1, 1934

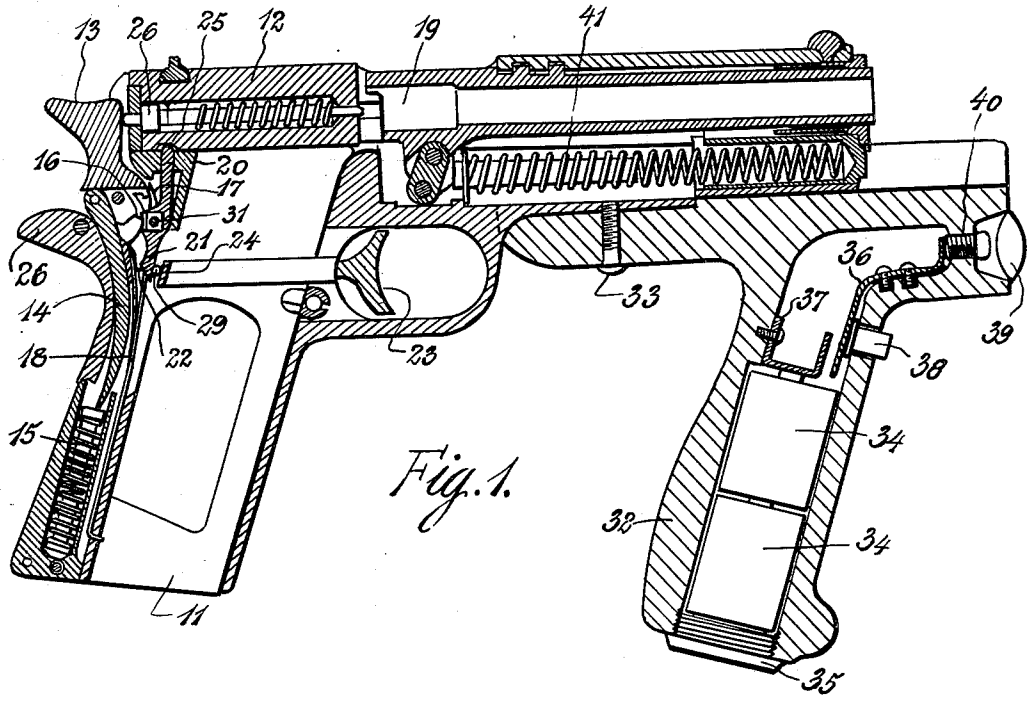

Fig. 1.

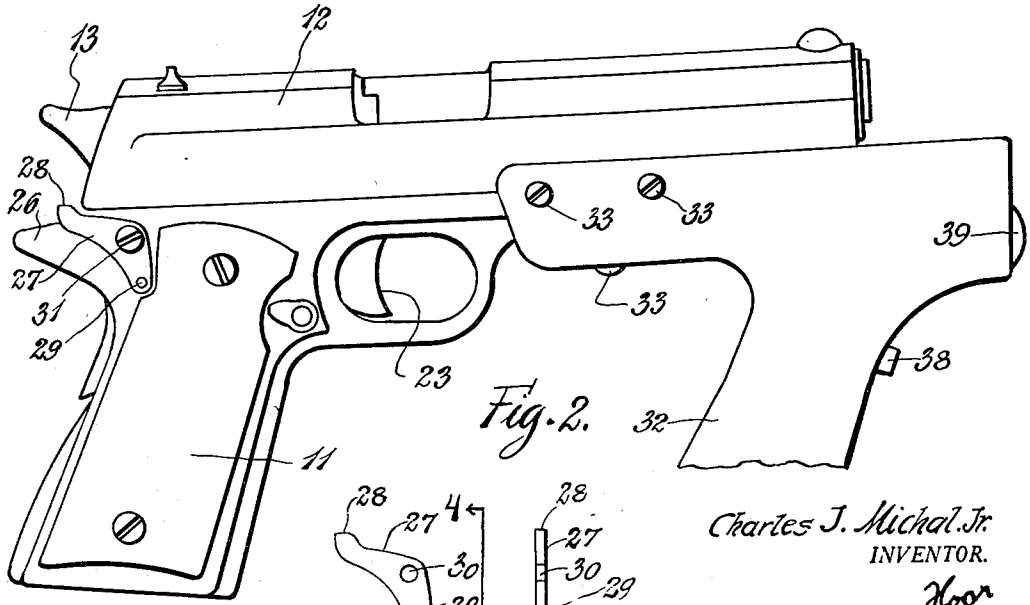

Fig. 2.

Fig. 3. Fig. 4.

Charles J. Michal Jr.
INVENTOR.

BY Roger Sherman Hoar
ATTORNEY.

Patented Oct. 13, 1936 2,056,975

UNITED STATES PATENT OFFICE

2,056,975

MACHINE-GUN AND CONVERTER THEREFOR

Charles J. Michal, Jr., Hinsdale, Ill.

Application March 1, 1934, Serial No. 713,479

9 Claims. (Cl. 42—69)

My invention relates to machine-guns and to devices for converting other fire-arms into machine-guns.

More specifically my invention consists in utilizing the motion of the recoiling parts of a fire-arm, acting against the natural resiliency of the trigger-finger of the person firing the arm, to automatically release the safety mechanism of the fire-arm, and to discharge the same in regular sequence.

Also it is my object to provide means for holding the fire-arm in a safe position during rapid firing; and, in combination therewith, means for throwing a spotting beam of light, to assist in aiming the piece.

In addition to the foregoing objects, I have worked out a number of novel and useful details, which will be readily evident as the description progresses.

My invention consists in the novel parts, and in the combinations and arrangements thereof—and especially in one certain part—which are defined in the appended claims; and of which one embodiment is exemplified in the accompanying drawing, which is hereinafter particularly described and explained.

Throughout the description, the same reference number is applied to the same member or to similar members.

Figure 1 illustrates a lengthwise vertical section of my invention.

Figure 2 illustrates a side elevation of my invention.

Figure 3 illustrates a side elevation of the converter of my invention.

Figure 4 illustrates a front elevation of the converter, taken along the lines 4—4 of Figure 3.

Referring to the drawing, and more particularly to Figure 1, it will be seen that this figure illustrates the conventional Colt automatic pistol of the United States Army, with certain modifications which will become evident as the description progresses. The Colt pistol, although officially called "automatic", is really merely semi-automatic, i. e. autoloading and cocking only.

The normal operation of such a pistol will now be briefly sketched. Reference may be made to the well-known operation of this fire-arm for further details.

A loaded magazine (not shown) is placed in the handle 11. This magazine normally contains seven cartridges, impelled upward by a spring; but my invention contemplates elongating this magazine so as to contain fourteen or more cartridges.

The slide 12 is then drawn rearward (i. e., to the left in the figure) by hand. This action swings the hammer 13 counter-clockwise, depressing the hammer-strut 14 against compression of the mainspring 15. The notch 16 on the hammer, catches on the upper point of the sear 17, the sear being forced counter-clockwise into engagement by the action of one leaf of the sear-spring 18.

The slide 12 is then let forward, under the influence of counter-recoil spring 41, thus forcing a cartridge (not shown) into the chamber 19, in a manner well known, and not constituting a part of my invention.

While the slide 12 was in its rearward position, the lower edge of the slide, by engaging the top of the disconnector 20, forced it down so that its lower end 21 came below the lower end 22 of the sear 17. If, at such time, the trigger 23 had been pressed, the rear end 24 of the trigger slide would have pushed the lower end 21 of the disconnector harmlessly below the lower end 22 of the sear, and the pistol would not have been discharged.

But, with the slide 12 in returned forward position, and the upper end 20 of the disconnector consequently seated in the notch 25 on the lower side of the slide (the disconnector being forced upward by the second leaf of the sear-spring 18), the lower end 21 of the disconnector is now in sufficiently raised position to engage the lower end 22 of the sear if the trigger be pulled, and thus trip the point 17 of the sear out of the notch 16 of the hammer, thus permitting the hammer 13 to fall upon the firing-pin 26, and discharge the piece.

The forces of recoil throw the slide 12 rearwardly again, thus cocking the hammer 13 as before. And the counter-recoil puts another cartridge in the chamber 19.

But, although the trigger 23 still be held pressed, as the lower edge of the slide 12 forces down the head 20 of the disconnector, so that the lower end 21 of the disconnector is forced below the level of the lower end 22 of the sear, thus permitting the sear to rotate counter-clockwise to cock the piece, and preventing the continued pressure on the trigger from discharging the piece.

There is another safety device, involving the grip-safety 26, which is not involved in my invention, and hence will not be described, although its original operation is in no way impaired by the introduction of my invention.

If, after the slide has fully returned to its forward position, the trigger is released, the lower end 21 of the disconnector will move forward and

upward, under the influence of the sear-spring **18**, until it again engages the front edge of the lower end **22** of the sear, ready to fire upon renewed pressure of the trigger.

I have added to the conventional Colt piston the converter **27** shown in Figures 3 and 4, in which **28** is the cam, **29** the pin and **30** the hole for the pivot-screw **31**.

I cut a slot in the side of the handle of the pistol for the pin **29**, and insert it so that it will engage the rear of the trigger-slide **24**, as shown in Figure 1. Such is the width of the trigger-slide that the pin does not interfere with the disconnector, although it appears to do so in the figure. The converter **27** is shown in position in Figure 2.

Its action is as follows. The trigger **23** fires the piece as before. But, the instant that recoil takes place, the lower edge of the slide **12** engages the cam **28** of the converter **27**, thus rotating it counter-clockwise, and forcing the pin **29** forward. This motion of the pin forces the trigger forward against the pressure of the trigger-finger of the man, thus disengaging the trigger-slide **24** from the disconnector **21**, and permitting the disconnector to return to firing-position the instant that counter-recoil is completed.

This utilization of the spring action of the trigger-finger of the man is one of the features of my invention.

The pin **29** holds the trigger inoperative against the pressure of the trigger-finger. But, the instant that counter-recoil is completed, the cam **28** is free to move upward again, and consequently the pressure of the trigger-finger immediately again discharges the piece.

As a result, shots occur rhythmically with the cadence of recoil and counter-recoil of the piece.

The use of my converter has quite a different result from what would obtain if the disconnector were omitted, and the trigger-slide were lengthened to bear directly against the sear. For, in that case, the sear would merely be held out of engagement with the notch on the hammer, and the hammer would return at counter-recoil, with a force which might or might not discharge the piece. Whereas, in my invention, the hammer is successively cocked and positively discharged. Thus my invention is in no sense a mere undoing of the function of the disconnector, but rather is the adding of an entirely new function and of the mechanism for performing it.

But it is well-known that the Colt pistol, and particularly its most popular size, the **45**, recoils with each shot into a position in which the hand which holds it is close to the right side of the firer's head, and the pistol is pointing diagonally upward to the rear. If, by virtue of my invention as thus far described, the second shot were to occur when the piece was in this position, the result might be disastrous.

Accordingly I have added a second handle **32**, secured to the piece by screws **33**, or by means of brazing.

And, to obtain a further function, I have made this auxiliary handle hollow for the reception of dry-cells **34**, held in place by a cap **35**.

Two contacts **36** and **37**, a button **38**, a lens **39**, and a light-bulb **40**, complete the picture. The lens and bulb are so disposed that a ray of light cast by the bulb will fall just where a bullet would land.

This enables me to sweep the dark with my beam of light, and put a burst of bullets into my objective the instant that the beam falls upon it,

Having now described and illustrated one form of my invention, I wish it to be understood that my invention is not to be limited to the specific form or arrangement of parts hereinbefore described, except insofar as such limitations are specified in the appended claims.

I claim:

1. In a machine-gun, having the conventional parts including stock, barrel, chamber, magazine, and means for ejecting exploded cartridges and for inserting new cartridges into the chamber the combination of: a slide; a hammer, so proportioned and positioned that the rearward motion of the slide, under the influence of recoil, will cock the hammer; means to lock the hammer cocked; a trigger, so proportioned and positioned that, after being pulled to fire the gun, it must move forward before it will be in condition to fire again; means, under the influence of the recoil of the slide, to thus move the trigger forward against the pressure of the trigger-finger of the operator, but leave it held in operative position against the pressure of the trigger-finger of the operator; and means, under the influence of the counter recoil of the slide, to free the trigger for firing, under the influence of continued pressure of the trigger-finger.

2. In a machine-gun, having the conventional parts including stock, barrel, chamber, magazine, and means for ejecting exploded cartridges and for inserting new cartridges into the chamber, the combination of: a slide, a hammer, so proportioned and positioned that the rearward motion of the slide, under the influence of recoil, will cock the hammer; a sear, to lock the hammer cocked; a trigger; a disconnector, so proportioned and positioned as to operatively connect the trigger to the sear when counter-recoil is completed, and to disconnect the trigger from the sear during recoil, and to maintain that disconnection until the trigger is moved forward; means, under the influence of the recoil of the slide, to thus move the trigger forward against the pressure of the trigger-finger of the operator, but leave it held in operative position against the pressure of the trigger-finger of the operator; and means, under the influence of the counter-recoil of the slide, to free the trigger for firing, under the influence of continued pressure of the trigger-finger.

3. In a machine-gun, the combination of: a hammer; a sear; a trigger; a disconnector, so proportioned and positioned as to operatively connect the trigger to the sear when counter-recoil is completed, and to disconnect the trigger from the sear during recoil, and to maintain that disconnection until the trigger is moved forward; a recoiling part to actuate the disconnector; and means, under the influence of the recoiling part, to move the trigger forward against the pressure of the trigger-finger of the operator, during recoil and hold it released until the completion of counter-recoil.

4. The combination, with a conventional semi-automatic fire-arm, of means, consisting of an adapter operatively connecting a recoiling part with the trigger, whereby the movement of the recoiling part will be transmitted to shift the trigger in the release direction against the pressure of the trigger-finger of the operator during recoil, and hold it thus shifted until the completion of counter-recoil.

5. In an attachment for converting a conventional semi-automatic pistol into a machine-gun, the combination of: a plate; a pivot therefor; a

projection from the upper portion of the plate, to engage the under edge of the slide of the pistol during recoil and counter-recoil, thereby forcing and holding the upper portion of the plate to the rear and its lower portion forward, and releasing and permitting the upper portion of the plate to move forward and its lower portion to move rearwardly upon the completion of counter-recoil; and a projection from the lower portion of the plate, engaging the rear of the trigger of the pistol, thereby forcing and holding the trigger forward against the pressure of the trigger-finger of the person firing the pistol during recoil and counter-recoil, and releasing the trigger for firing under continued pressure of the trigger-finger upon the completion of counter-recoil.

6. In an attachment for converting a conventional semi-automatic pistol into a machine-gun, the combination of: a pivoted element; a projection therefrom, for engaging a recoiling element of the pistol; and a second projection from the pivoted element, for forcing the trigger of the pistol forward against the trigger-finger of the operator; whereby the trigger is moved into prefiring position against the pressure of the trigger-finger of the operator and is held inoperative during recoil and counter-recoil, and is instantly released for firing under continued pressure of the trigger-finger of the operator, upon the completion of counter-recoil.

7. In an attachment for converting a conventional semi-automatic pistol into a machine-gun, the combination of: a pivoted element; a projection therefrom, for engaging the slide of the pistol; and a second projection from the pivoted element, for engaging the trigger of the pistol, whereby the trigger is moved into prefiring position against the pressure of the trigger-finger of the operator and is held inoperative during recoil and counter-recoil, and is instantly released for firing under continued pressure of the trigger-finger of the operator, upon the completion of counter-recoil.

8. In an attachment for converting a conventional semi-automatic pistol into a machine-gun, the combination of: an actuated element, actuated by a recoiling element of the pistol; an actuating element, engaging the trigger of the pistol, to shift the trigger in the release direction against the pressure of the trigger-finger of the operator during recoil, and hold it thus shifted until the completion of counter-recoil, and thereupon to free the trigger for action under the pressure of the trigger-finger of the operator; and an operative connection between the actuated element and the actuating element.

9. The combination with a semi-automatic fire-arm, in which the trigger must be released between successive shots; of means, actuated by the recoil of a recoiling part, said means consisting of a converter operatively connecting said recoiling part with the trigger, whereby to force the release of the trigger against the tension in the trigger-finger of the operator, and to permit this tension to pull the trigger upon the completion of counter-recoil; whereby the fire-arm is rendered fully automatic.

CHARLES J. MICHAL, JR.

Exhibit 4

Jan. 16, 1945. G. J. HYDE 2,367,280

CONTROL MEANS

Filed Nov. 17, 1941

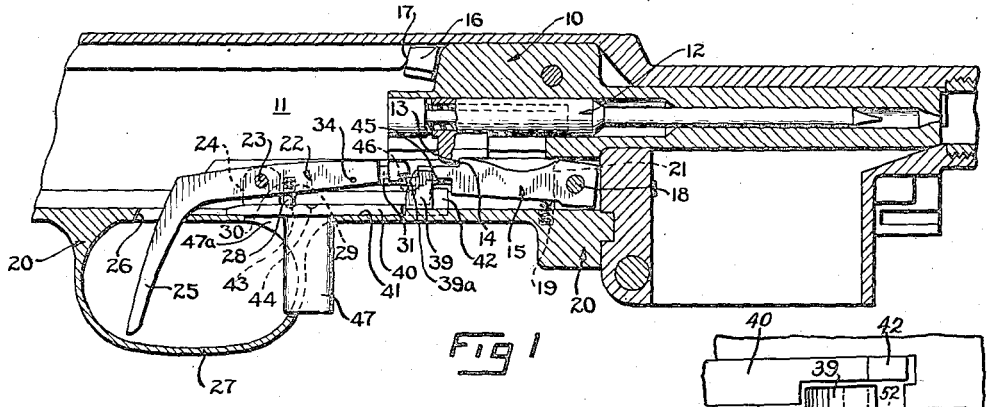

Fig 1

Fig 7

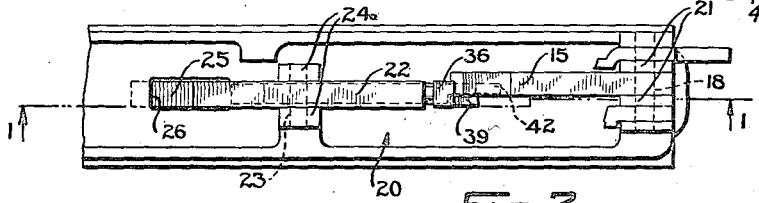

Fig 2

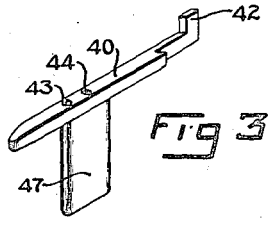

Fig 3

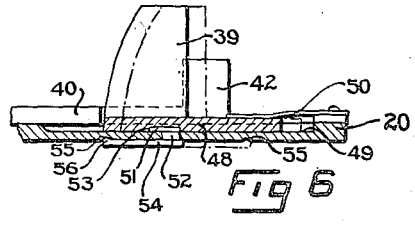

Fig 6

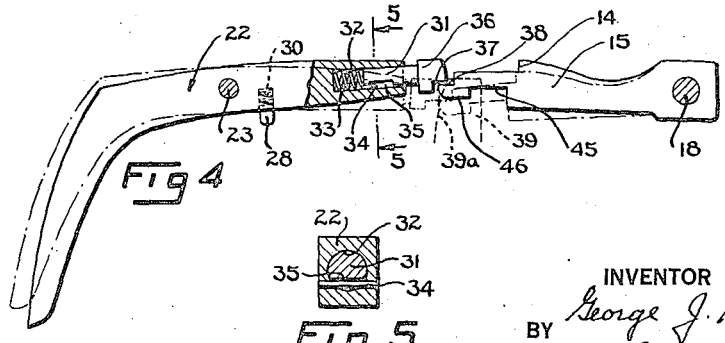

Fig 4

Fig 5

INVENTOR
George J. Hyde
BY F. Bascom Smith
ATTORNEY

Patented Jan. 16, 1945 2,367,280

UNITED STATES PATENT OFFICE

2,367,280

CONTROL MEANS

George J. Hyde, Brooklyn, N. Y., assignor to Firearms Research Corporation, New York, N. Y., a corporation of New York

Application November 17, 1941, Serial No. 419,443

2 Claims. (Cl. 42—69)

This invention relates to control means and more particularly to a trigger actuated mechanism for controlling the operation of a cocking member, such as the sear of a firearm.

It is an object of the present invention to provide novel means for controlling the operation of a semi-automatic rifle for single shot fire.

Another object is to provide novel safety means cooperating with the trigger actuated control mechanism of a firearm for holding the cocking member of said mechanism against release, said means being accessible for ready manual actuation and being positive in operation.

A further object is to provide a novel trigger mechanism adapted for adjustment to either of two positions to control the firing mechanism of an automatic rifle so as to render the latter capable of either single shot or continuous firing.

A still further object is to provide a novel trigger mechanism for controlling the sear of a rifle whereby the sear is automatically returned to operative position after each shot is fired regardless of the position of the trigger.

Still another object is to provide a novel trigger actuated mechanism for controlling the operation of a detent, such as the sear of a firearm, said mechanism being light, compact, durable and reliable and comprising a minimum number of movable parts.

The above and further objects and novel features of the invention will more fully appear from the following detailed description when the same is read in connection with the accompanying drawing. It is to be expressly understood, however, that the drawing is for the purpose of illustration only and is not intended as a definition of the limits of the invention, reference for this latter purpose being had primarily to the appended claims.

In the drawing, wherein like reference characters refer to like parts throughout the several views,

Fig. 1 is a vertical, longitudinal sectional view, with parts broken away, of a receiver of a firearm, showing a form of the trigger actuated control mechanism of the present invention operatively associated with the firing mechanism in said receiver, the section being taken substantially along line 1—1 of Fig. 2;

Fig. 2 is a top plan view, with parts broken away, of the above control mechanism mounted on the housing therefor, the latter being removed from the receiver of the firearm;

Fig. 3 is a perspective view of the movable member of the safety means of said control mechanism;

Fig. 4 is an enlarged view, with parts broken away, of the trigger mechanism and the sear controlled thereby, showing in broken lines the position of said mechanism and the sear at the point of disengagement;

Fig. 5 is a sectional view taken substantially along line 5—5 of Fig. 4;

Fig. 6 is a vertical, longitudinal sectional view, with parts broken away, of an alternate embodiment of the cam means provided for controlling the engagement between the sear and the trigger mechanism of the present invention; and

Fig. 7 is a fragmentary top plan view on a slightly reduced scale of the embodiment shown in Fig. 6.

The novel control means of the present invention are illustrated, by way of example, as controlling the operation of the sear of the firing mechanism of a semi-automatic rifle, such as shown in my copending application Serial No. 398,034, filed June 14, 1941, and entitled "Firearm." It is to be understood, however, that the novel trigger actuated control mechanism and the safety means cooperatively associated therewith, which comprise the novel means of the present invention, are not limited for utility only with a firing mechanism of the type shown, but are adapted for controlling the operation of the cocking members or detents of various other devices.

The firing mechanism is of the type comprising a bolt 10 slidably mounted in a receiver 11 for reciprocating movement, said movement being imparted thereto by actuating means (not shown) and being adapted to effect the ejection of the fired cartridge and the injection of a fresh cartridge into firing position. A spring-pressed firing pin 12 is carried by said bolt and is movable relative thereto, said pin being provided with a depending shoulder 13 adapted for engagement with an upwardly extending shoulder 14 on a sear 15 during the forward movement of said bolt whereby said firing pin is cocked. Bolt 10 is fixed in firing position (Fig. 1) by the engagement of a lever 16, pivotably mounted thereon, with an abutment 17 formed in said receiver. Sear 15 is pivotally mounted on a pin 18 and is normally urged upwardly into operative engagement with firing pin 12 by suitable resilient means, such as a compressed spring 19 guided in a recess in a housing 20, pin 18 being supported by bearing members 21 (Fig. 2) formed with or otherwise rigidly secured to said housing.

In order to operate sear 15 so as to release cocked firing pin 12, novel trigger actuated control means are provided. As shown, said means comprise a trigger lever 22 mounted intermediate the ends thereof for pivotal movement relative to housing 20, for example, on a pin 23 supported between suitable bearing members, such as lugs 24 (Fig. 2), formed with or otherwise rigidly secured to said housing. A trigger 25 depends (Fig. 1) from the rear end of said lever, being integrally formed with the latter to extend through a recess 26 in housing 20, and a trigger guard 27 preferably forms a part of said housing to prevent inadvertent actuation of said trigger. Lever 22 is normally held inoperative by resilient means adapted to apply a counter-clockwise torque thereto (Figs. 1 and 4), said means preferably comprising a pin 28 slidably mounted in a recess 29 in said lever and a spring 30 contained in said recess to apply a downward force to said pin. Spring actuated mechanism 28, 30 serves a second function to be more fully described hereafter in connection with the safety means.

To depress the rear or free end of sear 15 when trigger 25 is pulled and release said sear from firing pin 12, a rod 31 is slidably mounted in a bore 32 (Fig. 4) in the forward end of lever 22 and is pressed outwardly in the direction of sear 15 by a spring 33 disposed in said bore. A pin 34 (Fig. 5) extends transversely through lever 22 and is in operative engagement with a slot or groove 35 provided in rod 31 (Figs. 4 and 5), said pin and groove cooperating to fix the outermost position of said rod relative to lever 22 while permitting inward axial movement of said rod against the pressure of spring 33. An enlarged head portion 36 is formed with or otherwise rigidly secured to the end of rod 31 and is provided with a shoulder 37 adapted to engage and apply a downward force to a shoulder or surface 38 provided at the rear end of sear 15. Pivotal movement of lever 22 in a clockwise direction is thus transmitted to sear 15 by said head portion, producing a counter-clockwise rotation of said sear.

To control the firing mechanism of a rifle, particularly of the automatic type, for single shot fire, the sear is automatically returned to operative position after each shot is fired regardless of the position of the trigger. To accomplish this result, novel means are provided for disengaging head 36 from sear 15 when the latter has been sufficiently depressed to release firing pin 12. As shown in Figs. 1 to 5, said means comprise a cam member 39 mounted on housing 20 to the side of and adjacent the rear end of sear 15, lever 22 being located relative to sear 15 (Fig. 2) so that head 36 projects beyond one side of said sear for engagement with said cam member. Cam surface 39a of said member engages said head and moves the latter axially as lever 22 is pivoted clockwise, the axial movement causing disengagement between said head and sear 15 when firing pin 12 is released. Thus, sear 15 is returned to operative position by spring 19 as soon as the cartridge is fired, regardless of the position of lever 22 and of trigger 25.

Novel safety means are provided for holding the trigger mechanism inoperative so as to prevent release of the firing mechanism and, as shown, said means comprise a rod or bar 40 slidably mounted in a longitudinal groove 41 in housing 20 (Fig. 1). The forward end of said bar adjoins cam member 39 and has an upwardly extending lug 42 formed thereon, said lug being located below sear 15 and being movable longitudinally in the same vertical plane as said sear. Rod 40 is resiliently held in groove 41 by spring-pressed pin 28 and is provided with a pair of recesses 43 and 44, which are adapted to receive said pin, to fix said bar in the two alternate positions thereof. In one position of said bar, i. e., when the rear recess 43 engages pin 28 (Fig. 1), lug 42 is disposed opposite a recess 45 in the under side of sear 15 and the latter is free to be actuated by lever 22 to release the firing mechanism. In the other position of bar 40, i. e., when recess 44 receives pin 28, lug 42 is positioned below surface 46 of said sear and is adapted to engage said surface to prevent pivotal movement of said sear, rendering the trigger mechanism inoperative. In order to actuate bar 40, a flat depending arm 47 (Fig. 3) is rigidly attached to said bar intermediate the ends thereof, preferably by being formed therewith, and extends through a longitudinal recess 47a which connects with groove 41. Arm 47 is adapted for ready manual actuation, being located to project on both sides of the forward wall of trigger guard 27.

In operation, when trigger 25 is pulled, clockwise motion is imparted to lever 22 and sear engaging member 31, 36 is caused to depress sear 15. Cam member 39 engages said sear engaging member during the pivotal movement of said lever and imparts axial movement thereto, whereby said member is disengaged from the sear when the latter has been depressed sufficiently to effect the release of cocked firing pin 12. Trigger 25 is adapted to pivot lever 22 beyond this point of release, assuring the return of said sear to operative position whenever the trigger is pressed sufficiently to release the firing mechanism. When trigger 25 is released, lever 22 is pivoted in a counterclockwise direction by spring actuated pin 28, and sear engaging member 31, 36 is returned to its normal operative position above sear 15. To render the trigger mechanism inoperative, arm 47 of the safety means is pulled rearward to locate lug 42 beneath surface 46 of sear 15.

Novel alternate means for mounting cam member 39 are provided in order to adapt the above-described trigger mechanism for utility in automatic rifles which are capable of continuous as well as single shot fire. As shown in Figs. 6 and 7, said means comprise a plate 48 to which cam member 39 is rigidly secured, said plate being slidably mounted in a groove 49 in housing 20 and held in said groove by suitable means, such as a flat spring 50. A disc 51 is provided in groove 49 and is eccentrically mounted on a shaft 52 carried by housing 20 so as to be in cooperative engagement with the walls of a transverse slot 53 in plate 48. To rotate shaft 52, a resilient lever 54 is mounted thereon to be accessible from the exterior of housing 20, said lever having two positions thereof determined by recesses 55 in said housing which are adapted to receive the enlarged end 56 of said lever. Rotation of the latter from one of said positions to the other causes cam member 39 to be displaced longitudinally relative to housing 20.

In operation, when the rifle firing mechanism is to be controlled for single shot fire, cam member 39 is disposed as shown in full lines in Fig. 6, being located relative to the sear and the sear engaging member in the same manner as in Fig. 1. However, for continuous firing it is desirable that the sear engaging member remain in continuous engagement with the sear and, accordingly, for this type of firing, cam member 39 is moved longitudinally forward to the position

shown in broken lines in Fig. 6. The longitudinal displacement of said cam member to this second position is sufficient to move the latter out of the path of the sear engaging member so that the latter remains in engagement with the sear.

There is thus provided a novel trigger actuated mechanism adapted to control the operation of the sear of an automatic rifle for single shot or repeated firing. The mechanism comprises novel means for effecting disengagement between the sear and the sear actuating member to cause the sear to automatically return to operative position after each cartridge is fired. There is also provided a novel safety means adapted, when operative, to hold the trigger mechanism inoperable, said means being mounted in a novel manner and comprising a minimum number of parts. The trigger mechanism and safety means are compact, positive in operation, and comprise relatively simple, rugged parts which can be readily fabricated.

Although only two embodiments of the present invention have been illustrated and described, it is to be expressly understood that the same is not limited thereto. Various changes may be made in the design and arrangement of parts, as will now be apparent to those skilled in the art, without departing from the spirit and scope of the invention. For a definition of the limits of the invention, reference will be had primarily to the appended claims.

What is claimed is:

1. In an automatic rifle adapted for single shot or repeated firing, a pivoted sear, means resiliently urging said sear into operative position, a pivoted lever, a trigger for operating said lever, the pivotal axes of said sear and said lever being disposed in a single plane substantially parallel to the longitudinal axis of the barrel of the rifle, a member carried by said lever and movable bodily relative thereto, said member having an end portion arranged to engage and move said sear to inoperative position when actuated by the movement of said trigger, and cam means disposed adjacent said sear and selectively movable bodily to two positions for controlling the engagement between said sear and said member, said last-named means in one position being arranged in response to movement of said trigger to be engaged by said end portion to disengage said member from said sear when the latter reaches inoperative position and in the other position thereof being arranged to permit continuous engagement between said sear and said member.

2. In an automatic rifle adapted for single shot or continuous firing, a pivoted sear, means resiliently urging said sear into operative position, a pivotal lever, the pivotal axes of said sear and said lever being in a single plane substantially parallel to the longitudinal axis of the bore of the rifle, a trigger for imparting pivotal movement to said lever, a member slidably mounted in said lever, said member having an end portion arranged to engage and move said sear to inoperative position when said lever is pivoted, cam means disposed adjacent said sear and operative to engage said end portion and impart movement to said member relative to said lever in response to movement of the latter to cause said member to become disengaged from said sear when the latter reaches inoperative position, and means for moving said cam means bodily to inoperative position whereby said member and sear are maintained in continuous engagement, said last-named means comprising an eccentrically mounted disc and a transverse slot in said cam means and engaged by said disc.

GEORGE J. HYDE.

Exhibit 5

No. 659,507. Patented Oct. 9, 1900.

J. M. BROWNING.

RECOIL OPERATED FIREARM.

(Application filed Feb. 8, 1900.)

(No Model.) 5 Sheets—Sheet 1.

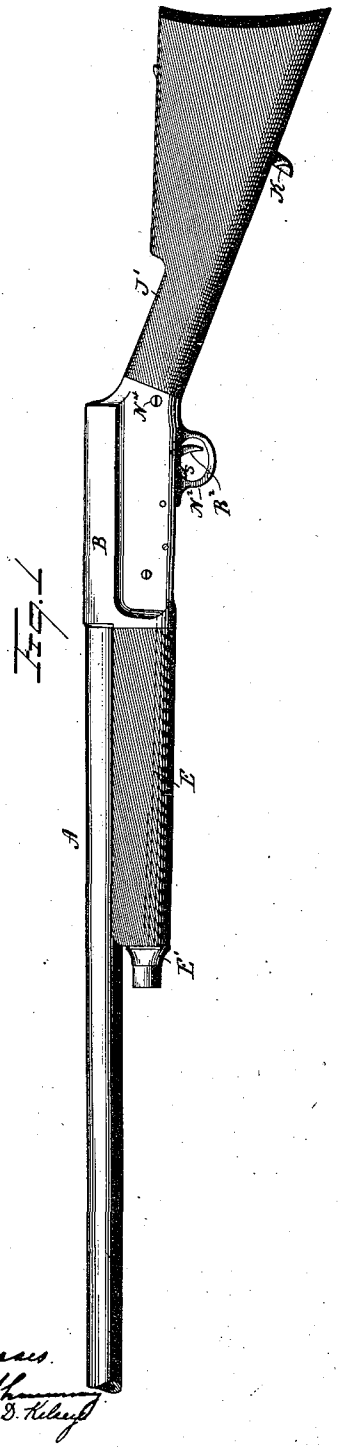

Fig. 1

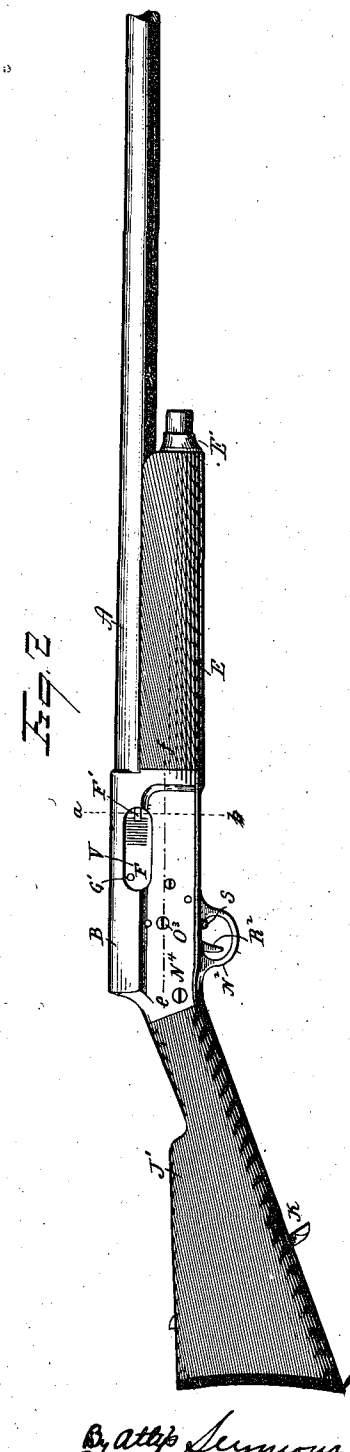

Fig. 2

Witnesses.
J. H. Shumway
Lillian D. Kelley

John M. Browning
Inventor
By attys Seymour & Earle

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J. M. BROWNING.

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(No Model.) 5 Sheets—Sheet 2.

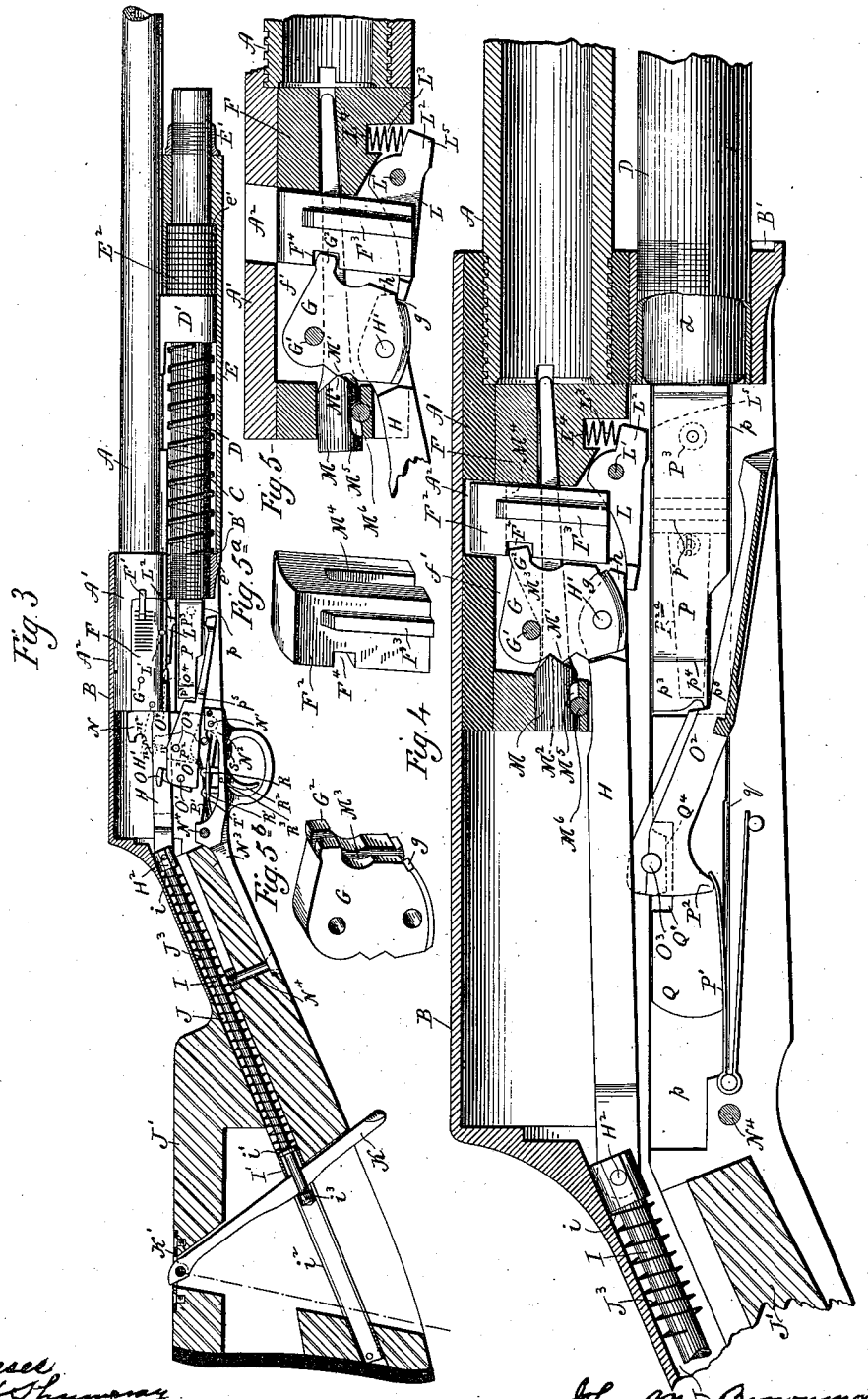

Fig 3

Fig 5

Fig 5a

Fig 5b

Fig 4

Witnesses
Jos. H. Shumway
Lillian D. Kelley.

John M. Browning
Inventor
By Attys Seymour & Earle

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(No Model.) 5 Sheets—Sheet 3.

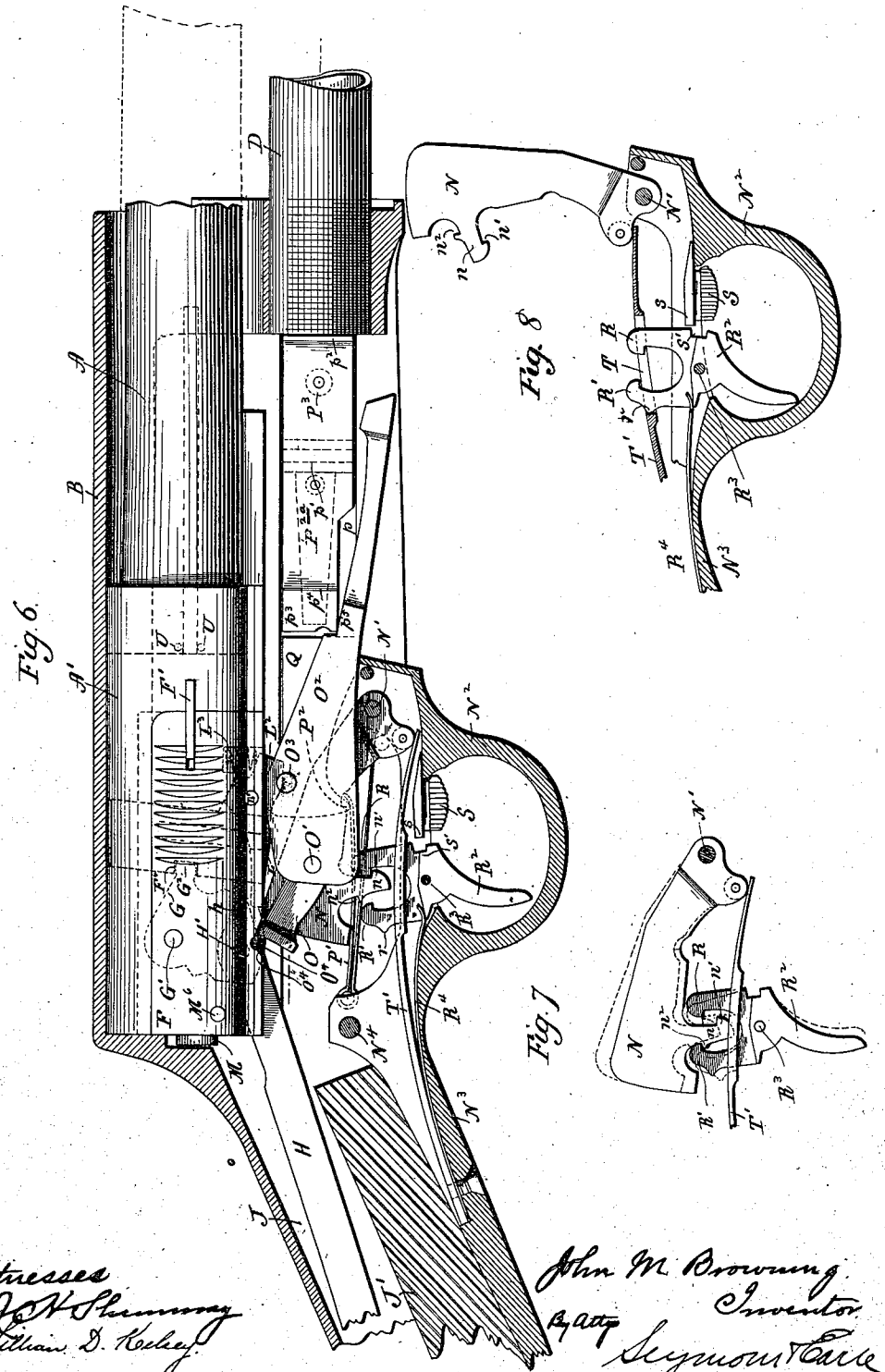

Fig. 6.

Fig. 8

Fig. 7

Witnesses
J. K. Shumway
Lillian D. Kelley

John M. Browning,
Inventor.
By Atty
Seymour Earle

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J. M. BROWNING.

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(No Model.) 5 Sheets—Sheet 4.

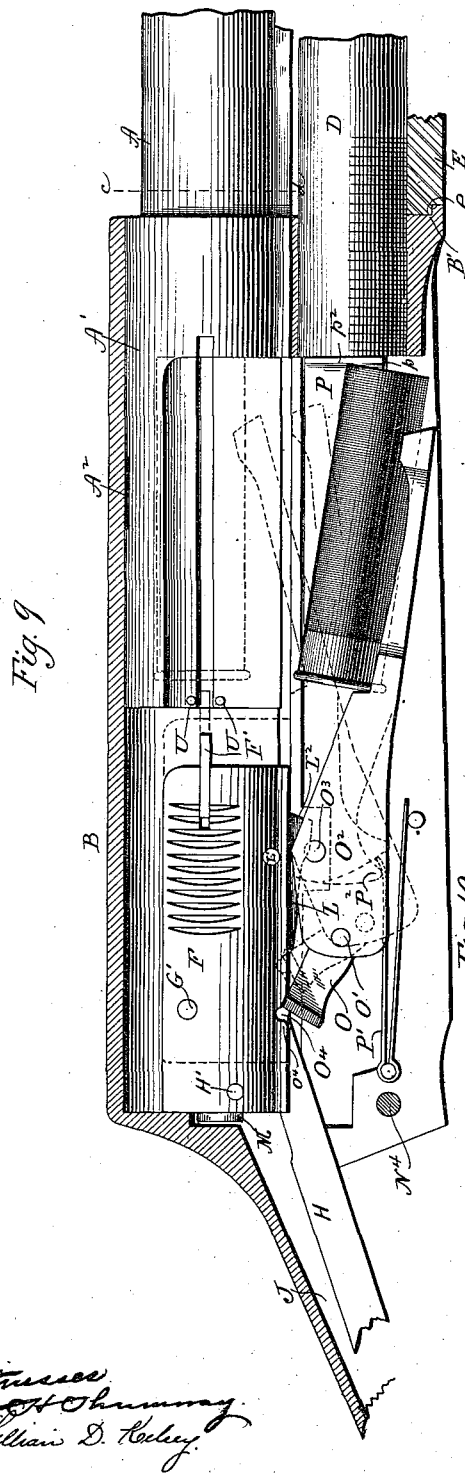

Fig. 9

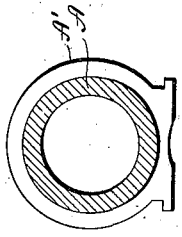

Fig. 11

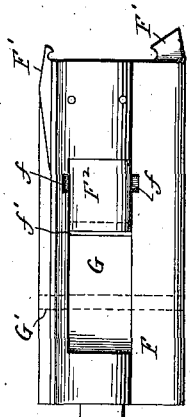

Fig. 12

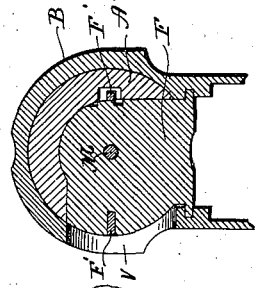

Fig. 10

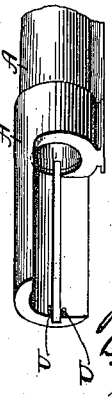

Fig. 22

Witnesses
Jos. F. Shumway.
Lillian D. Kelley.

John M. Browning.
Inventor
By Attys
Seymour Earle

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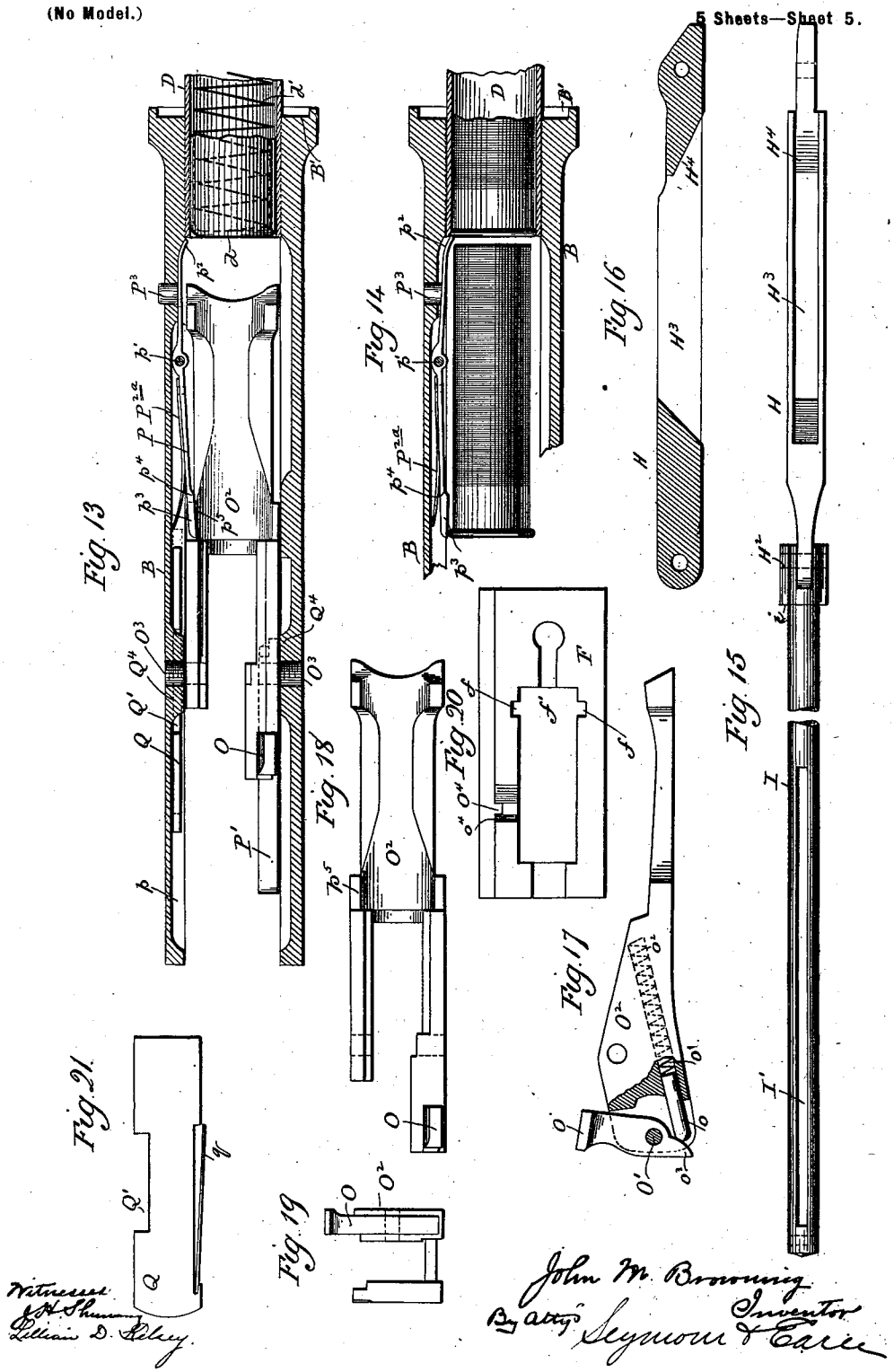
J. M. BROWNING.

RECOIL OPERATED FIREARM.

(Application filed Feb. 8, 1900.)

(No Model.) 5 Sheets—Sheet 5.



Witnesses
J. H. Shumway
Lillian D. Kelley.

John M. Browning
Inventor
By Atty's Seymour & Earle

UNITED STATES PATENT OFFICE.

JOHN M. BROWNING, OF OGDEN, UTAH.

RECOIL-OPERATED FIREARM.

SPECIFICATION forming part of Letters Patent No. 659,507, dated October 9, 1900.

Application filed February 8, 1900. Serial No. 4,557. (No model.)

To all whom it may concern:

Be it known that I, JOHN M. BROWNING, of Ogden, in the county of Weber and State of Utah, have invented a new Improvement in Firearms; and I do hereby declare the following, when taken in connection with the accompanying drawings and the letters of reference marked thereon, to be full, clear, and exact description of the same, and which said drawings constitute part of this specification, and represent, in—

Figure 1, a view in side elevation of the left-hand side of an automatic firearm constructed in accordance with my invention; Fig. 2, a similar view of the right-hand side thereof, showing the ejection-opening formed in its receiver or gun-frame; Fig. 3, a broken view, in vertical longitudinal section, showing the gun in the closed positions of its parts; Fig. 4, a less comprehensive broken view of the gun in vertical section drawn to full size and with the parts in their closed positions and with the trigger-plate and all of its connected parts removed for the sake of clearness; Fig. 5, a detail section showing the breech-bolt in its closed position, but with the locking-block thereof in the unlocked position into which it is moved by the rocking tumbler; Fig. 5^a, a detached perspective view of the locking-block; Fig. 5^b, a corresponding view of the operating-tumbler thereof; Fig. 6, a broken view of the gun in vertical section, showing its parts in their open positions; Fig. 7, a detail view showing the coaction of the hammer with the two hooks constituting the double sear of the trigger; Fig. 8, a corresponding but more comprehensive view showing the hammer, the trigger with its two hooks, and a safety-catch which is here represented in its blocked or inoperative position; Fig. 9, a broken view of the gun in vertical section, showing the parts of the gun in the positions due to them when the gun has been opened manually instead of automatically. In this view the trigger-plate, with its connected parts has been removed for the sake of clearness; Fig. 10, a broken view, in vertical section, of the receiver on the line *a b* of Fig. 2; Fig. 11, a view in vertical section on the line *c d* of Fig. 9, looking rearward and taken through the gun-barrel at a point close to the extension thereof; Fig. 12, a detached plan view of the breech-bolt, showing the locking-block and rocking tumbler mounted therein; Fig. 13, a broken view, in horizontal section, on the line *e f* of Fig. 2 and designed to show the carrier, the combined cartridge-stop and carrier-catch, and the sliding inertia-piece or carrier-catch lock; Fig. 14, a similar but less comprehensive view showing the carrier-catch in the position which it has after it has been operated by a cartridge for releasing the carrier and is acting as a cartridge-stop; Fig. 15, a detached plan view of the operating-link and operating-rod of the gun; Fig. 16, a detached view in longitudinal section of the link; Fig. 17, a detached broken view, in side elevation, of the carrier; Fig. 18, a detached plan view of the carrier; Fig. 19, a view of the rear end of the carrier; Fig. 20, a detached reverse plan view of the breech-bolt; Fig. 21, a detached view, in side elevation, of the sliding carrier-catch lock or inertia-piece; Fig. 22, a detached perspective view of the barrel extension.

My invention relates to an improvement in automatic portable firearms of the class in which the recoil following the explosion of a cartridge in the gun-barrel is utilized to operate the breech mechanism of the gun, the object of my present invention being to produce an improved arm of this class in which the recoiling parts are housed for their protection, as well as the protection of the user of the arm, and in which the parts are constructed with particular reference to simplicity of construction, strength, durability, and reliability of operation.

With these ends in view my invention consists in certain details of construction and combinations of parts, as will be hereinafter described, and pointed out in the claims.

In carrying out my invention as herein shown I provide a gun-barrel A with a tube-like extension A′, into the forward end of which the barrel is screwed. This extension is located within and housed by the upper portion of the gun-frame or receiver B, in which the extension reciprocates back and forth, together with the barrel, the rear end of which enters the receiver during the recoil following the explosion of a cartridge in the barrel. The barrel and extension are returned to their normal or closed positions af-

ter the recoil by means of a spiral action-spring C, mounted upon the rear end of the magazine D, the open rear end of which is screwed into the lower portion of the forward end of the receiver, while its forward end extends forward through a heavy sleeve or collar D′ depending from the barrel, to which it is secured in any desired manner. The said magazine and action-spring are inclosed by means of a fore stock E, the rear end of which is formed with a segmental flange *e* to adapt it to be inserted into a recess B′, formed in the forward end of the receiver. At its forward end the fore stock is held in place by the impingement against it of a nut E′, screwed upon the projecting forward end of the magazine, which is threaded for the purpose, as shown in Fig. 3. To take the shock of the return of the barrel and its extension under the action of the action-spring, I employ a buffer, which, as herein shown, consists of a series of vulcanized fiber rings E^2, located in the front stock at a point in front of the collar or sleeve D′, with which the rearmost ring engages, while the outermost ring engages with a shoulder *e′*, formed within the said front stock. If desired, the rings E^2 might be dispensed with and the fore stock itself adapted to act as the buffer.

Within the extension A′, I locate the breech-closure F, which is of the bolt type and which is confined to movement back and forth. This breech-closure is provided at its forward end with two yielding extractors F′ F′, of any approved construction, which project slightly beyond its forward end.

For locking the breech-bolt F in its closed position I employ a vertically-movable locking-block F^2, which is mounted in it and which is provided upon its opposite edges with vertical ribs F^3 F^3, which enter grooves *f f*, cut in the opposite side walls of the vertical chamber *f′*, formed in the bolt, as shown in Fig. 20, for the reception of the locking-block, the upper end of which is adapted to enter a substantially-rectangular locking-opening A^2, formed to receive it in the upper portion of the barrel extension, as seen in Figs. 3 and 4. The locking-block is reciprocated for the purpose of being thrown into its locked and unlocked positions by means of a tumbler G, located in the chamber *f′* aforesaid and swinging on a horizontal pin G′, the ends of which enter the side walls of the breech-bolt. This tumbler is provided at its upper forward corner with an arm G^2, entering a transverse slot F^4, formed in the rear face of the locking-block, the upper and lower faces of these arms being rounded, as seen in Figs. 5 and 5^b. The said tumbler is swung on its pivot G′, as required for raising and lowering the block, by means of an operating-link H, the forward end of which is pivotally connected with the tumbler by means of a pin H′. At its rear end this link is connected by a pin H^2 with the forward end of an operating-rod I, which extends rearward in an inclined position into a long chamber J, formed for its reception in the butt-stock J′. This rod, as shown in Fig. 15, is formed with a very long narrow slot I′, receiving an operating-lever K, which is located in a narrow vertically-arranged slot J^2, formed in the butt-stock J′. The said lever K is pivotally mounted in a small plate K′, set into the upper edge of the butt-stock, while its lower end projects just enough below the lower edge of the butt-stock to permit it to be readily engaged and operated by hand. The forward end of a coiled operating-spring J^3, encircling said rod, impinges against a shoulder *i*, formed at the forward end of the operating-rod I, while its rear end abuts against a washer *i′*, through which the rod is free to play and which is supported upon the forward end of a tube I′, located in the butt-stock and formed with a vertical longitudinal slot i^2 for the downward passage through it of the lever K and receiving a small head i^3, which is secured to the extreme rear end of the rod I. In the automatic operation of the gun the spring J^2 is compressed by the rearward excursion of the breech-bolt, at which time the rod I moves freely rearward without disturbing the lever K, which, as aforesaid, passes downwardly through the long slot J^2. On the other hand, when the gun is opened manually the projecting lower end of the lever is seized by the user with his hand and drawn back, whereby through the head i^3 the rod I is retracted and the operating-spring J^3 placed under tension for returning the breech-bolt to its closed position and for performing the other functions of the said spring.

The forward end of the operating-link II is formed with a nose *h*, coacting with the thin rear end of a locking-lever L, mounted in the lower face of the breech-bolt F and hung upon a horizontal pivot L′, located just in front of the lower end of the locking-block F^2. At its extreme forward end the lever is formed with a lug L^2, impinged upon by a small coiled spring L^3, located within a socket I′, formed within the breech-bolt. The said spring exerts a constant effort to depress the forward end of the lever, and hence lift its rear end into engagement with a transversely-arranged locking-notch *g*, formed in the lower forward corner of the rocking tumbler. When the rear end of the lever L is entered into the said notch *g*, the bolt F^2 is held down in its unlocked position through the medium of the tumbler, as shown in Fig. 5, which represents the breech-bolt in its closed position, with the locking-block in its unlocked position.

A shoulder L^5, formed upon the lug L^2 of the locking-lever L, acts as a secondary cartridge-stop, as will appear later on.

When the gun is ready to be fired, the breech-bolt F is locked to the barrel A through the medium of the locking-block F^2, the upper end of which is entered into the opening A^2 of the barrel extension A′, the locking-

block being held in its locked position through the medium of the rocking tumbler G, the link H, the operating-rod I, and the operating-spring J^3, which exerts a constant effort to push the said rod and link forward, and hence to push the lower end of the rocking tumbler G forward, with the effect of lifting its upper end, and hence lifting the locking-block. At this time the extreme rear end of the locking-lever L is located under the nose *h*, formed at the extreme forward end of the link H. Now when the gun is fired the barrel, barrel extension, and breech-bolt will recoil together, and at the limit of their recoiling movement the rear ends of the breech-bolt and barrel extension will strike the rear wall of the receiver-chamber B'. The rearward excursion of the breech-bolt will thus be arrested, but the momentum of the recoil will carry the rod I and link H still farther rearward, with the effect of rocking the rocking tumbler G downward and rearward, so as to retract the upper end of the locking-block from the opening A^2 in the barrel extension, whereby the breech-bolt will be unlocked from the said extension and barrel, which is now immediately returned to its closed position under the power of the action-spring C. Just as soon as the rocking tumbler G is swung downward, as described, it is caught and locked in such position by the snapping of the rear end of the locking-lever L into its notch *g*, whereby the locking-block F^2 is locked in its unlocked position, in which it is maintained until in the closing movement of the breech-bolt the locking-block F^2 has passed the rear end of the barrel extension A', whereby the locking-block is prevented from being prematurely moved into its locked position and so as to engage with the rear edge of the barrel extension. Soon after the locking-block passes the rear edge of the barrel extension in the forward excursion of the breech-bolt the rear end of the locking-lever L is pushed downward out of the locking-notch *g* in the rocking tumbler by the nose *h* of the link H, which gradually assumes a horizontal position as the breech-bolt moves forward. Just as soon as the rocking tumbler F^2 is unlocked by having the locking-lever thrown out of engagement with it the operating-spring J acts, through the operating-rod I and link H, to swing the said tumbler upward, with the effect of lifting the locking-block F^2, the upper end of which will then ride over the inner face of the extension until it is "snapped," so to speak, into the locking-opening A^2, formed in the said barrel extension, as shown in Fig. 4.

The firing-pin M is operated in being retracted by the rocking tumbler, which is provided for that purpose with a horizontally-arranged tooth-like projection M', which coacts with a doubly-beveled nose M^2, formed at the rear end of the pin, which is longitudinally movable in the breech-bolt and extends forward through a slot M^3 in the rocking tumbler and through a slot M^4 in the locking-block. A short groove M^5, formed in the rear end of the firing-pin, receives a stop-pin M^6, which limits the reciprocation of the pin. When the rocking tumbler is swung downward, as shown in Fig. 5, for the unlocking movement of the locking-block, the projection M' of the rocking tumbler coacts with the nose M^2 of the firing-pin for the retraction of the pin, as shown in the said figure. Then when the rocking tumbler is swung upward the pin is left in its retracted position, in which it is struck by the hammer N.

As has been already explained, the barrel, barrel extension, and breech-bolt recoil together, with the breech-bolt locked to the barrel extension the same as in firing. When the breech-bolt reaches the limit of its rearward excursion, the momentum of the operating rod and link operates the rocking tumbler and locking-block to unlock the breech-bolt from the barrel extension, so as to permit the immediate return of the barrel and barrel extension to their normal positions under the influence of the action-spring C. The breech-bolt does not, however, return with them, as just as soon as it reaches the limit of its rearward excursion it is locked in that position by means of a locking-dog O, mounted in a vertical position upon a pin O' in the extreme rear end of the carrier O^2, which is pivotally hung upon pins O^3, located in the lower portion of the gun frame or receiver B at a point forward of the pin O', upon which the said locking-dog is mounted. The said dog is normally maintained in position to be engaged by the rear end of the breech-bolt by means of a plunger *o*, operated by a spiral spring *o'*, located within a spring-socket o^2, formed in the rear end of the carrier, as clearly shown in Fig. 17, the rear end of the plunger *o* engaging with a finger o^3, formed at the lower end of the dog. For coaction with this dog the breech-bolt is formed upon the right-hand side of its lower edge with a locking-notch O^4, Fig. 20, the rear wall o^4 of which, Fig. 6, constitutes an abutment-face. In the rearward movement of the breech-bolt its lower edge strikes the upper forward corner of the dog O and cants the same rearward against the tension of its spring o^2, as shown in Figs. 6 and 9. The lower edge of the rear end of the bolt then slides over the dog until the locking-notch O^4 in the bolt is brought into registration with the upper corner of the dog, which is then snapped into it by the action of the spring o^2. In this rearward movement of the bolt the abutment-face o^4 of the notch is carried rearward beyond the upper end of the dog, with which the said abutment-face is, however, almost immediately reëngaged for locking the bolt in its rearward position by a slight forward recoil movement of the bolt. The locking-dog when thus engaged with the bolt operates to hold the same in its open position

against the tension of the operating-spring J^3, which exerts a constant effort to move the breech-bolt forward against the locking-dog, which is held up in its locking position by the carrier, which is in turn held in its depressed position by the carrier-catch P, Fig. 13, which is released by the cartridges as they are fed rearward from the tubular magazine, as will be hereinafter described. When the carrier-catch is disengaged from the carrier, the forward pressure of the spring J^3 will be transmitted, through the rod I, link H, and bolt F, to the locking-dog, which will be pushed downward and forward and acts to swing the carrier upon its pivot O^3, whereby the forward end of the carrier is elevated, as shown by broken lines in Fig. 9, for the purpose of lifting a cartridge up in front of the forward end of the breech-bolt, in which position the carrier is temporarily held by the engagement of the free end of the carrier-spring P′ with the rear beveled face of an operating-nose P^2, formed at the rear end of the carrier. As the bolt moves forward the dog takes a position which permits the bolt to ride over it, whereby the dog is released from the notch in the bolt. The dog is shown by broken lines in Fig. 9 in the position which it has when it has been operated, as described, to lift the carrier. When the breech-bolt moves into its closed position, its lower face engages with the elevated forward end of the carrier and depresses the same sufficiently to cause the point of the nose P^2 of the carrier to be snapped rearward of the free end of the carrier-spring P′, which then acts to throw the carrier into its depressed position, as shown by full lines in Fig. 9. The construction of the nose P^2 and spring P′ is such, as I may here remark, that the elevation of the carrier into its intermediate position, as shown by broken lines in Fig. 9, for loading the magazine is not sufficient to cause the said nose to be snapped over the spring, which will therefore operate to return the carrier to its depressed position between the feeding of each cartridge into the magazine D. The carrier-catch P is located in a shallow recess p, formed in the inner face of the left-hand wall of the gun frame or receiver and hung upon a vertically-arranged pivot p'. The forward end of the catch is bent inward, as at p^2, to constitute a cartridge-stop, while its rear end is enlarged to form a locking-finger p^3, formed at its base with a bevel p^4, which is engaged by the rims of the cartridges just before they reach their final positions upon the carrier, for pushing the said locking-finger p^3 of the catch outward and away from the locking-surface p^5 of the carrier, with which the said finger normally engages to hold the carrier in its depressed position. A spring P^{2a}, coacting with the rear end of the catch, exerts a constant effort to throw its locking-finger inward over the locking-surface p^5 of the carrier. It will be understood, of course, that when the locking-finger p^3 is pushed outward by a cartridge the stop-finger p^2 at the forward end of the catch will be thrown inward in position to act as a cartridge-stop. At its forward end the carrier-catch is provided with a push-button P^3, which projects through the left-hand wall of the frame and provides means for manually operating the carrier-catch to unlock the carrier when there are no cartridges in the magazine D, which, as I may here state, is provided with the usual plunger d and plunger-spring d'.

In order to prevent the carrier from being unlocked before the barrel and barrel extension have completed their forward movement, (either by the premature operation of the catch P by a cartridge before the said barrel and barrel extension have completed their said forward movement or by the jolting of the catch out of engagement with the carrier under the shock of stopping the recoiling parts at the limit of their forward and rearward movements,) I employ a sliding lock, or, as I prefer to term it, an "inertia-piece" Q, which is constructed, arranged, and operated to temporarily lock the said catch P. This inertia-piece Q is located in the rear portion of the long shallow recess p before mentioned and is formed with a central longitudinal opening Q′, receiving the hub Q^4, which provides a bearing for the screw O^3, upon which the carrier swings. The opening Q′ is made long enough to allow the inertia-piece a limited movement forward and backward. A spring q, mounted in the inertia-piece so as to ride upon the bottom wall of the recess p, is employed to hold the inertia-piece in either its forward or rearward position. In its normal position its forward end is just back of the rear end of the catch P.

The operation of the inertia-piece is as follows: When the gun is fired, the recoiling parts recoil until the rear end of the barrel extension and the rear end of the breech-bolt strikes the rear end of the receiver. This blow drives the receiver rearward, together with its contained parts, including the carrier-catch, the rear end of which is thus driven rearward back of the forward end of the inertia-piece, which, not being positively connected with any portion of the carrier, stands practically still, while the receiver and its contained parts are driven rearward, as described. The recoiling parts are immediately started forward by the forward pull of the action-spring, and if a cartridge feeding rearward from the magazine should complete its rearward movement before the barrel reaches the end of its forward excursion it will strike the catch, which will be prevented from operating to release the carrier by the inertia-piece; but when the barrel completes its forward movement the shock of stopping it and its connected parts drives the receiver and the parts connected therewith forward, whereby the rear end of the catch is pulled away, so to speak, from the forward end of the inertia-piece, which stands practically

still when the receiver is being driven forward, as described. In this way the catch is disengaged from the inertia-piece and left free to be forced outward by the cartridge, so as to release the carrier. It will also be seen that the inertia-piece prevents the rear end of the catch from being jolted away from the carrier, so as to unlock the same, by the shock of stopping the recoiling parts at the limit of their rear of their forward movement.

The hammer N is hung by a pivot N′ in the forward end of the trigger-plate N^2, the rear end of which is extended to form the lower tang N^3, which is secured in place by a bolt N^4.

In order to prevent the entire charge of cartridges in the magazine from being fired by one pulling of the trigger and to require a separate action of the trigger for the explosion of each cartridge, I provide the hammer with a finger *n*, formed with a cocking-notch *n′* and a safety-notch n^2, the former being located nearer the lower end of the finger than the latter. These notches respectively coact with a cocking-hook R and a safety-hook R′, arranged in opposition to each other, with sufficient space between them for the reception of the finger *n* of the hammer, these two hooks being virtually sear-hooks and formed integral with the trigger R^2, which is hung on a pin R^3 and provided with a trigger-spring R^4. The hammer, as it will be understood, passes upward through a long slot H^3, formed in the link H, and is automatically cocked during the recoil of the gun by the beveled forward end wall H^4 of the slot H^3 in the said link H, whereby the safety-notch n^2 of the finger *n* of the hammer is engaged with the safety-hook R′, which holds it cocked when a rearward draft is maintained upon the trigger by the finger of the user of the gun. On the other hand, if this draft upon the trigger is removed the spring R^4 will swing the trigger so as to disengage the hook R′ from the notch n^2; but this swinging movement of the trigger only brings the cocking-hook R into position to strike into the cocking-notch *n′* of the hammer before the hammer has time to escape, so that thereafter the hammer will be held by the trigger until the same is again pulled. In this way automatic action of the gun is limited to the reloading of a single cartridge by the recoil following the explosion of a previously-fed cartridge. If desired, the construction just described may be reversed by locating the finger *n* upon the trigger and the hooks R R′ upon the hammer.

For the purpose of locking the trigger so that it cannot be moved in either direction I employ a sliding safety-catch S, formed at its rear end with a nose *s*, adapted to enter the notch *s′*, formed in the forward side of the trigger in such position with reference to the nose that the latter can only be entered into the former when the hammer is in its cocked position. In order to prevent the safety device from being accidentally brought into use, I provide the safety-hook R′ of the trigger with a nose *r*, which coacts with the rear wall of an opening T, formed in the main or hammer spring T′ for the forward passage through it of the arms R and R′. When the hammer is cocked, the spring is depressed and the rear end wall of the said opening is cleared from registration with the projection *r*, whereby the trigger may be swung rearward into position to bring its notch *s′* into registration with the nose *s* of the safety-catch S. When, however, the hammer is released for firing, the spring is lifted, so that the rear end wall of the opening T engages with the projection *r* and tilts the trigger forward, so as to remove its notch *s′* from registration with the notch S. It will thus be seen that the safety-catch can only be utilized for locking the trigger when the hammer is cocked. This is necessary, because if it were possible to lock the trigger against movement in either direction with the hammer in its uncocked position then should the hammer be thrown back breakage would result, because the trigger must move freely to permit the engagement of the hammer with it.

For the purpose of ejecting the spent cartridges I provide the barrel extension at its rear end and along its left-hand side with two ejecting-pins U U, which when the extension and barrel are near the limit of their return movement under the power of the action-spring C engage with the rim of the spent cartridge, which is at this time held by the extractors, and swing the cartridge from left to right, causing its ejection through the ejection-opening V, formed in the right-hand side of the receiver. On the other hand, if the gun should be opened by hand through the instrumentality of the operating-lever K the rim of the cartridge will be drawn against the pins U U with sufficient force to cause the cartridge to be ejected through the said opening V.

Having fully described my improved firearm, I will now describe the operation thereof. I shall, however, do this only briefly, for the reason that the operation of the gun has been so largely explained in connection with the description of the mechanism thereof.

Let it be assumed, in the first place, that the magazine has been charged with cartridges and that the last cartridge introduced thereinto has been moved back by the magazine-spring to engagement with the shoulder L^5 upon the under face of the locking-lever L, mounted in the breech-bolt. The gun must now be manually opened by drawing back upon the projecting lower end of the operating-lever K, whereby the breech-bolt is unlocked from the barrel extension and withdrawn to the limit of its rearward excursion without disturbing the barrel or barrel extension, but at the same time cocking the hammer and placing the operating-spring J^3 under tension. The said cartridge will now be pushed rearwardly by the magazine-

spring and coact with the rear end of the combined carrier-catch and cartridge-stop, so as to unlock the carrier. The operating-spring J will now assert itself and push the breech-bolt forward, with the effect of lifting the unlocked carrier, the cartridge upon which will then be forced into the gun-barrel. Then after the breech-bolt has reached its closed position it will be locked therein by the locking-block F^2, which will be moved into its locked position by the locking-tumbler acting under the power of the said spring F. During this forward movement of the bolt the carrier will be forced downward into its depressed position against the tension of the carrier-spring. As soon as the carrier reaches its depressed position the combined cartridge-stop and carrier-catch will snap over it and lock it in that position. This movement of the said combined parts clears its forward end from its cartridge-stopping position in front of the rear end of the magazine, from which another cartridge will now immediately emerge and engage with the shoulder L^5 on the under face of the locking-lever L. The trigger is now pulled for firing the cartridge, the explosion following which will carry the barrel, barrel extension, and breech-bolt back, together with the bolt and barrel extension, and hence the barrel, locked together by means of the locking-block, which will be retracted, so as to unlock the barrel extension and barrel from the bolt after the bolt has reached the limit of its rearward excursion by the momentum of the parts connected with the rocking tumbler. As soon as the bolt reaches the limit of its rearward excursion it will be locked in that position by means of the locking-dog carried by the carrier. Just as soon as the breech-bolt has been unlocked from the barrel extension the barrel and barrel extension will be returned to their closed positions by means of the action-spring C. In the meantime the cartridge, which was resting against the shoulder L^5 upon the locking-lever L, travels back to its final position upon the carrier and pushes aside the carrier-catch and unlocks the carrier, which is now free to be lifted to lift the cartridge in front of the breech-bolt, which is pushed forward into its closed position by means of the operating-spring J^3, which also locks the bolt in its closed position. The gun is now ready for being fired by pulling the trigger, the operation of reloading it having been effected entirely automatically by the recoil following the explosion of the preceding cartridge, and so on. When the last cartridge is fired, the bolt will remain open.

I may explain that preparatory to loading the magazine the push-button P^3 must be pushed inward, so as to operate the carrier-catch in releasing the carrier and permit it to be raised sufficiently to allow the cartridges to be fed under it. This movement of the carrier-catch will bring the cartridge-stop into play. This action of the catch as a cartridge-stop does not, however, prevent the cartridges from being fed into the magazine, as the stop is yielding and is readily pushed aside under the pressure placed upon the cartridges in pushing them into the rear end of the magazine.

The arm herein shown and described is what is known as a "take-down" arm, or, in other words, an arm constructed with reference to the detachment without the use of tools of the barrel and magazine from the receiver, so as to permit the barrel and magazine to be packed in a case side by side with the butt-stock and receiver.

To take down my improved gun, the nut E' is removed from the forward end of the magazine and the operating-lever K drawn back until the breech-bolt is caught and locked at the limit of its rearward excursion by the locking-dog mounted in the rear end of the carrier. The barrel and barrel extension and the front stock may now be drawn forward and separated from the receiver and magazine. For convenience the front stock is then restored to the magazine, upon which it is held by the restoration of the nut E'. The parts may now be conveniently packed in a case no longer than the length of the barrel and barrel extension.

To reassemble the gun, the barrel extension is entered into the open mouth of the receiver, the magazine again passed through the collar D', depending from the gun-barrel, the front stock is again placed over the magazine and reëngaged at its rear end with the forward end of the receiver, and the nut E is screwed home, the action-spring C, encircling the magazine, being placed under tension at the time the front stock is restored to position thereupon.

I would have it understood that I do not limit myself to the exact construction herein shown and described, but hold myself at liberty to make such changes and alterations therein as fairly fall within the spirit and scope of my invention.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a magazine-firearm, the combination with a recoiling barrel and barrel extension, of a breech-bolt, a vertically-movable locking-block mounted in the said bolt, and adapted to be entered into a locking-opening formed in the barrel extension, and means mounted in the said bolt for operating the said block in locking and unlocking the bolt to and from the barrel extension.

2. In a magazine-firearm, the combination with a recoiling barrel and barrel extension, of a breech-bolt, a vertically-movable locking-block mounted in the breech-bolt for locking the same to and unlocking it from the barrel extension, and for locking the breech-bolt at the limit of its rearward excursion while the barrel and its extension are returned to their closed positions, and a gun

frame or receiver constructed to house the said parts, and containing a laterally-arranged ejection-opening.

3. In a magazine-firearm, the combination with a recoiling barrel and barrel extension, of a breech-bolt, a vertically-movable locking-lock mounted in the said bolt and movable therein for engagement with the locking extension, whereby the bolt is locked to the said extension, and means connected with the said locking-block and operated by the momentum of recoil, to move the locking-block into its unlocked position after the breech-bolt has reached the limit of its rearward excursion.

4. In a magazine-firearm, the combination with a recoiling barrel and barrel extension, of a breech-bolt, a vertically-movable locking-block mounted in the breech-bolt and adapted to be entered into a locking-opening formed for its reception in the barrel extension, and means connected with the said block and operated by the momentum of recoil for moving the block into its unlocked position after the breech-bolt has reached the limit of its rearward excursion.

5. In a magazine-firearm, the combination with a recoiling barrel and barrel extension, of a breech-bolt, a locking-block mounted in the breech-bolt and coacting with the extension for locking the bolt thereto, a rocking tumbler also mounted in the said bolt and coacting with the said block for moving it into its locked and unlocked positions, and means connected with the said tumbler and operated by the momentum of the recoil for rocking the tumbler and moving the block into its unlocked position after the bolt has reached the limit of its rearward excursion.

6. In a magazine-firearm, the combination with a recoiling barrel and barrel extension, of a breech-bolt, a vertically-movable locking-block mounted in the breech-bolt, a rocking tumbler also mounted in the said bolt, and coacting with the block for moving the same into its locked and unlocked positions, an operating-rod extending rearwardly into the butt-stock of the gun, and a link connecting the forward end of the said rod with the said tumbler, which is rocked by the momentum acquired by the link and rod, which continue to move rearward after the bolt has reached the limit of its rearward excursion.

7. In a magazine-firearm, the combination with a recoiling barrel and barrel extension, of a breech-bolt, a vertically-movable locking-block mounted in the breech-bolt and adapted at its upper end to be entered into a locking-opening formed in the extension, a rocking tumbler also mounted in the said bolt and engaging with the said block for operating the same, and means connected with the said rocking tumbler and operated by the momentum of the recoil, for unlocking the locking-block after the breech-bolt has reached the limit of its rearward excursion.

8. In a magazine-firearm, the combination with a recoiling barrel and barrel extension, of a breech-bolt, a vertically-movable locking-block coacting with the extension to lock the bolt in its closed position, a rocking tumbler for operating the block, means coacting with the tumbler for rocking the same, and a locking-lever coacting with the tumbler for holding the same in its depressed position in which the tumbler holds the block in its unlocked position, the said block, tumbler and lever being mounted in the said bolt.

9. In a firearm, the combination with a recoiling barrel, of a breech-bolt, a vertically-movable locking-block mounted in the breech-bolt for locking the breech-bolt to the barrel, a locking-lever mounted in the breech-bolt for locking the said block in its unlocked position, and means coacting with the said locking-lever to operate the same in releasing the said block.

10. In a firearm, the combination with a recoiling barrel and barrel extension, of a breech-bolt, a vertically-movable locking-block for locking the bolt to the said extension, a rocking tumbler coacting with the said block for operating the same, a locking-lever coacting with the said tumbler for holding the same in its depressed position, and means coacting with the said lever to operate the same in releasing the said tumbler and hence the locking-block, the said block, tumbler and lever being mounted in the breech-bolt.

11. In a magazine-firearm, the combination with a recoiling barrel and barrel extension, of a breech-bolt, a vertically-movable locking-block for locking the bolt to the barrel extension, a rocking tumbler for operating the block, a locking-lever coacting with the tumbler for holding the same in its depressed position in which the tumbler holds the block in its unlocked position, a link connected with the rocking tumbler, and coacting with the locking-lever for disengaging the same from the rocking tumbler, and an operating-rod extending rearwardly into the gun-stock, and connected with the link which coacts with the rod in moving the bolt into its unlocked position by the momentum they acquire by the recoil of the gun, the said locking-block, rocking tumbler and locking-lever being mounted in the breech-bolt.

12. In a magazine-firearm, the combination with a recoiling barrel and barrel extension, of a breech-bolt, a locking-block, a rocking tumbler coacting with the said block for the operation thereof, and a firing-pin mounted in the bolt, and coacting with the rocking tumbler which retracts it.

13. In a firearm, the combination with a recoiling barrel and barrel extension, of a breech-bolt, a vertically-movable locking-block mounted in the said bolt, a spring-actuated operating-rod extending into the butt-stock of the gun, and means connecting the said rod with the said block which is operated by the rod for manually unlocking the bolt and opening the gun.

14. In a magazine-firearm, the combination with a reciprocating barrel and barrel extension, of a breech-bolt, a vertically-movable locking-block mounted in the bolt for locking the same to the extension, an operating-rod extending into the butt-stock of the gun, a spring encircling the said rod, a transversely-arranged operating part mounted in the stock of the gun, connected with the rear end of the said rod, and adapted to be manually operated for retracting the rod and placing the said spring under tension, and means connecting the forward end of the said rod with the said locking-block.

15. In a magazine-gun, the combination with a reciprocating barrel and barrel extension, of a breech-bolt, a vertically-movable locking-block mounted therein, a rocking tumbler mounted in the said bolt for operating the block, an operating-rod extending into the butt-stock of the gun, a link connecting the said rocking tumbler with the forward end of the said rod, a transversely-arranged operating-spring encircling the rod, and an operating-lever mounted in the butt-stock, connected with the rear end of the rod for retracting the same, and adapted to be manually operated.

16. In a magazine-gun, the combination with a reciprocating barrel and barrel extension, of a breech-bolt, a vertically-movable locking-block mounted in the breech-bolt, an operating-rod extending into the butt-stock of the gun, connection between the said rod and block, an operating-spring encircling the said rod, a tube located in the butt-stock and receiving the rear end of the rod, a washer mounted upon the forward end of the tube, forming a bearing for the rear end of the spring, and having the rear end of the rod extended rearwardly through it, and a transversely-arranged operating-lever pivoted in the upper portion of the butt-stock, extending downward through the rear end of the rod, projecting below the lower edge of the butt-stock for manual operation, and passing through the said tube which is slotted for the purpose.

17. In a magazine-firearm, the combination with a recoiling barrel and barrel extension, of a breech-bolt, a pivotal carrier, and means mounted in the carrier itself for locking the bolt at the limit of its rearward excursion.

18. In a magazine-firearm, the combination with a recoiling barrel and barrel extension, of a breech-bolt, a pivotal carrier, and a locking-dog mounted in the rear end of the carrier itself for engaging with the breech-bolt and locking the same at the limit of its rearward excursion.

19. In a magazine-firearm, the combination with a recoiling barrel and barrel extension, of a breech-bolt, a pivotal carrier, a locking-dog mounted in the carrier itself and engaging with the breech-bolt to lock the same in its open position while the barrel and barrel extension are returned to their closed positions, and an operating-spring placed under tension by the recoil of the gun, and acting through the said bolt and the said locking-dog to lift the carrier into its elevated position when the bolt moves forward.

20. In a magazine-firearm, the combination with a recoiling barrel and barrel extension, of a breech-bolt, a locking-block mounted therein for locking it to the said extension, a rocking tumbler mounted in the breech-bolt for operating the said block, an operating-rod extending into the butt-stock of the gun, a link connecting the said rod and the said rocking tumbler, a pivotal carrier, a locking-dog pivotally mounted in the rear end of the carrier at a point to the rear of the pivot thereof, and adapted to coact with the bolt to lock the same in its open position, and an operating-spring, whereby the locking-dog acts to lock the bolt in its open position, and to lift the carrier, under the power of the said spring, into its elevated position.

21. In a magazine-firearm, the combination with a recoiling barrel, of a tube-like barrel extension laterally cut away for the ejection of the spent cartridges, a breech-bolt adapted to enter the said extension, a vertically-movable locking-block mounted in the said bolt for locking the same to the said extension, a rocking tumbler also mounted in the said bolt for coacting with the rocking tumbler, means extending rearward from the said tumbler for operating the same and a gun frame or housing inclosing the said parts and formed with a lateral ejection-opening.

22. In a magazine-gun, the combination with a pivotal carrier, of a combined carrier-catch and cartridge-stop which in one position locks the carrier in its depressed position and in another position acts as a cartridge-stop, these two functions being performed alternately.

23. In a magazine-firearm, the combination with a pivotal carrier, of a combined cartridge-stop and carrier-catch for locking the carrier in its depressed position, pivotally mounted upon a vertical pivot located in a recess formed in the inner face of one of the side walls of the gun-frame.

24. In a magazine-gun, the combination with a pivotal carrier, of a combined cartridge-stop and carrier-catch for locking the carrier in its depressed position, and adapted to be operated to release the carrier by the head of a cartridge.

25. In a magazine-gun, the combination with a pivotal carrier, of a combined cartridge-stop and carrier-catch for locking the carrier in its depressed position, and a part brought into operation by the recoil of the gun for preventing the premature operation of the said combined part in unlocking the carrier.

26. In a magazine-gun, the combination with a pivotal carrier, of a combined cartridge-stop and carrier-catch for locking the carrier in its depressed position, and a sliding inertia-piece coacting with the carrier-catch end

of the said combined part and brought into operation by the recoil of the gun, for preventing the premature operation of the said combined part in unlocking the carrier.

27. In a magazine-firearm, the combination with a pivotal carrier, of a combined cartridge-stop and carrier-catch for locking the carrier in its depressed position, and an inertia-piece brought into operation by the recoil of the gun, and coacting with the carrier-catch for preventing the premature operation thereof in unlocking the carrier, the said combined part and inertia-piece being located in a recess formed in the inner face of one of the side walls of the gun.

28. In a magazine-firearm, the combination with a recoiling barrel and barrel extension, of a breech-bolt, a locking-block, a rocking tumbler for operating the block, an operating-link connected with the said tumbler, an operating-rod connected with the said link, and a hammer passing upward through the said link which engages with it to automatically cock it.

29. An automatic firearm, having a hammer and a trigger, one of the said parts having a locking-notch and a safety-notch, and the other part having a locking-hook and a safety-hook, the said notches and hooks coacting to prevent the hammer from being released by the trigger except as the rearward draft upon the trigger is first relieved to permit the hold of the hammer to be transferred from the safety-notch and safety-hook to the cocking-notch and cocking-hook.

30. In a magazine-firearm, the combination with a hammer provided with a finger containing a locking-notch and a safety-notch, of a trigger provided with a locking-hook and a safety-hook arranged in opposition to each other and sufficiently separated from each other to permit the finger containing the said notches to pass down between them, and respectively coacting with the said notches to prevent the hammer from being released by the trigger except as the rearward draft upon the trigger is first relieved to permit the hold of the hammer to be transferred from the safety-notch and safety-hook to the cocking-notch and cocking-hook.

31. In a firearm, the combination with a hammer and a trigger, of a safety-catch for locking the trigger, and a mainspring constructed and arranged to prevent the catch from being engaged with the trigger to lock the same except when the hammer is in its cocked position.

32. In a magazine-firearm, the combination with a pivotal carrier formed at the extreme lower corner of its rear end with a nose, of a carrier-spring bent at its free end to conform to the curvature of the said nose with which it coacts to hold the carrier in its elevated and in its depressed positions, and to return it to its depressed position after it has been pushed upward for feeding a cartridge into the magazine.

33. In a firearm, the combination with the receiver and tubular magazine thereof, of a recoiling barrel and barrel extension, a front stock through which the forward end of the magazine projects, an action-spring placed under tension by the front stock, and means applied to the projecting forward end of the magazine for detachably connecting the front stock with the magazine, whereby when the front stock is removed from the magazine, the recoiling barrel and barrel extension may be withdrawn from their connection with the receiver.

34. In a firearm, the combination with the receiver and tubular magazine thereof, of a recoiling barrel and barrel extension, an action-spring located within the said front stock for restoring the barrel and barrel extension to their closed positions, a front stock within which the action-spring is located and through the forward end of which the magazine extends, and a buffer for taking the shock of the forward excursion of the barrel and its extension, and engaging with the said front stock to which the shock is transmitted.

35. In a firearm, the combination with the receiver and tubular magazine thereof, of a recoiling barrel and barrel extension, a front stock applied to the magazine and receiver, an action-spring located within the front stock, and a nut applied to the forward end of the magazine and engaging with the front stock to hold it in place.

36. In a firearm, the combination with a recoiling barrel, of a barrel extension formed at or near its rear end with one or more ejecting pins or projections located in position to engage directly with a rim of a spent cartridge, a breech-bolt adapted to enter the said extension, one or more extractors carried by the said bolt, a gun frame or housing inclosing the said parts and formed with a lateral ejection-opening, and an action-spring for restoring the barrel and barrel extension to their closed positions, during which act of restoration the said ejecting means effect the expulsion of the spent cartridge.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

JOHN M. BROWNING.

Witnesses:
JOHN E. RAMSDEN,
N. GAIL NORTON.

Exhibit 6

US009829263B2

(12) **United States Patent**
Bonner

(10) **Patent No.: US 9,829,263 B2**
(45) **Date of Patent: Nov. 28, 2017**

(54) **RAPID RESET FIRE CONTROL**

(71) Applicant: **James Dillon Bonner**, Smyrna, TN (US)

(72) Inventor: **James Dillon Bonner**, Smyrna, TN (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.: **14/601,209**

(22) Filed: **Jan. 20, 2015**

(65) **Prior Publication Data**

US 2016/0010933 A1 Jan. 14, 2016

Related U.S. Application Data

(60) Provisional application No. 61/965,045, filed on Jan. 18, 2014.

(51) **Int. Cl.**
F41A 19/10 (2006.01)
F41A 19/14 (2006.01)

(52) **U.S. Cl.**
CPC ***F41A 19/10*** (2013.01); ***F41A 19/14*** (2013.01)

(58) **Field of Classification Search**
CPC F41A 19/10; F41A 19/14
USPC 89/136, 129.01, 129.02, 131, 141, 147, 89/151; 42/69.02, 69.03
See application file for complete search history.

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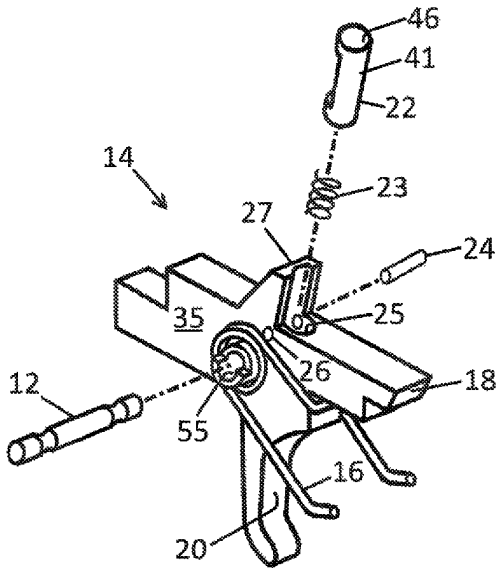
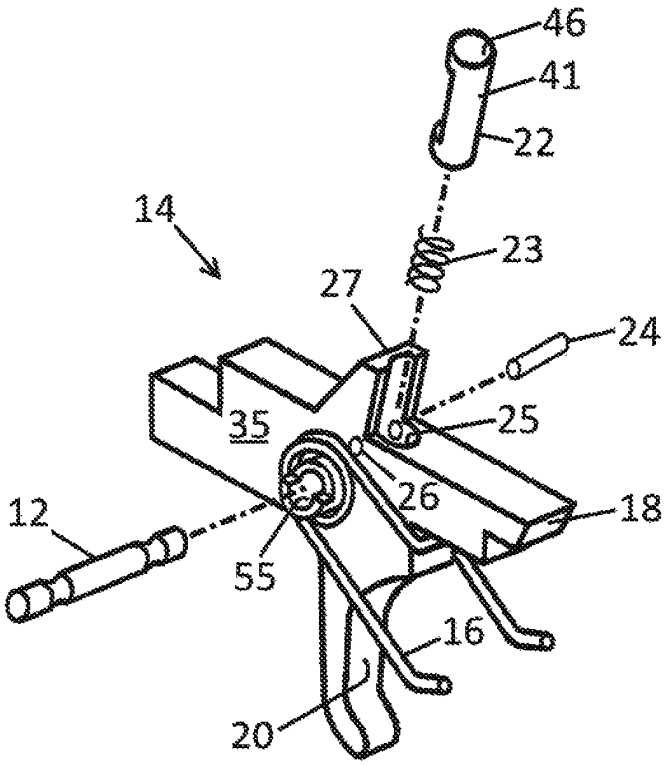
Primary Examiner — Reginald Tillman, Jr.

(57) **ABSTRACT**

The present invention is an instrument for the rapid firing of a self-loading firearm in a manner which was not previously possible. Some exemplary embodiments of the present invention comprise a fire control group for firearms essentially conforming to semi-automatic fire control groups as known to the art with the addition of novel features, as described herein, which temporarily transfer hammer spring force to the trigger after the firearm has fired live ammunition, resulting in the urging of the trigger to its reset position by hammer spring force. This temporary use of hammer spring force to urge the trigger to its reset position enables more controllable rapid firing of the firearm and other attributes.

4 Claims, 17 Drawing Sheets





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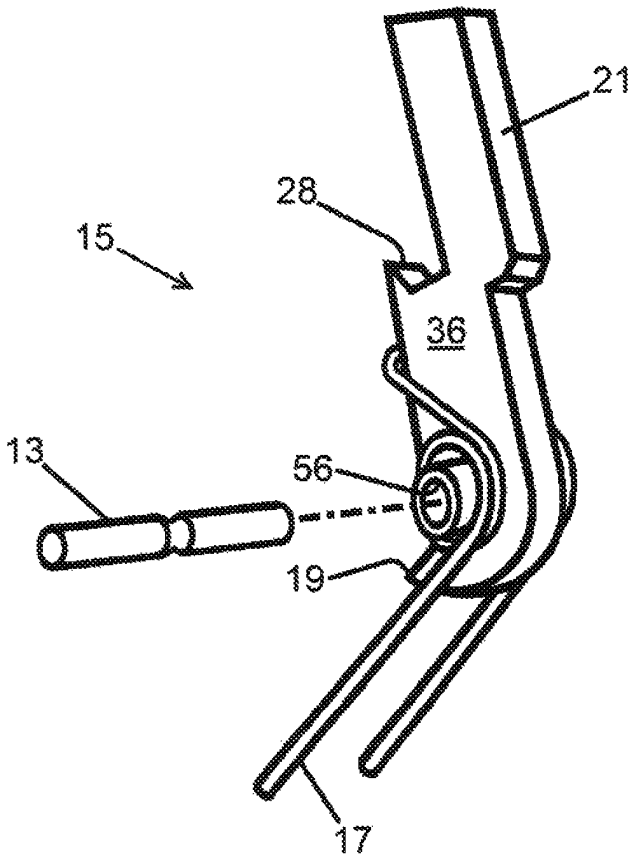
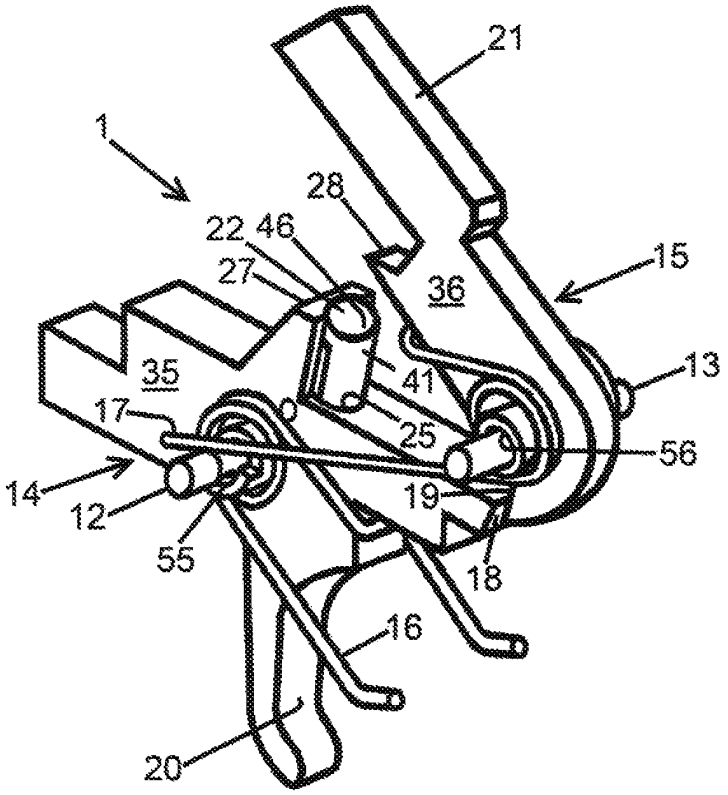


Fig. 2



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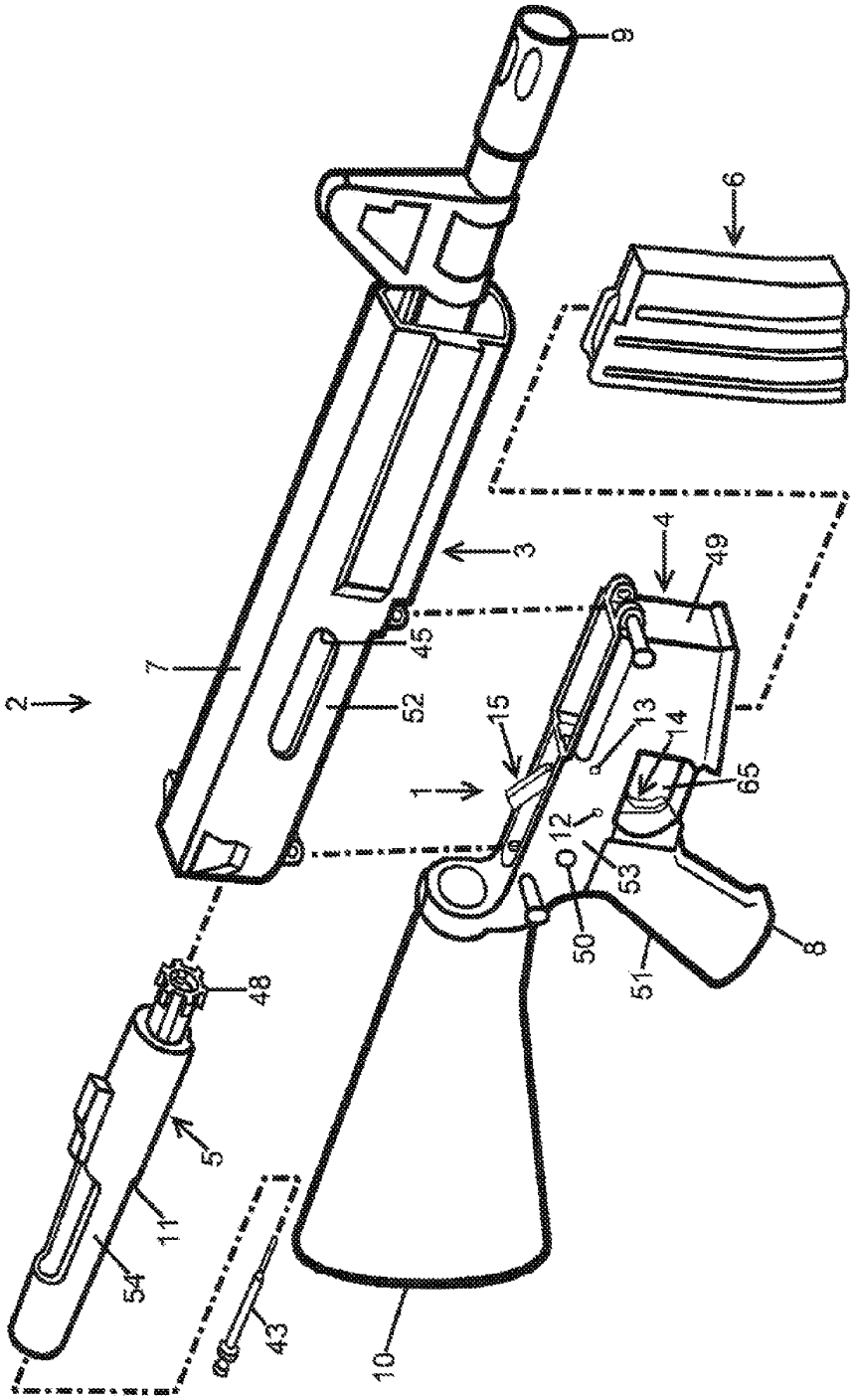

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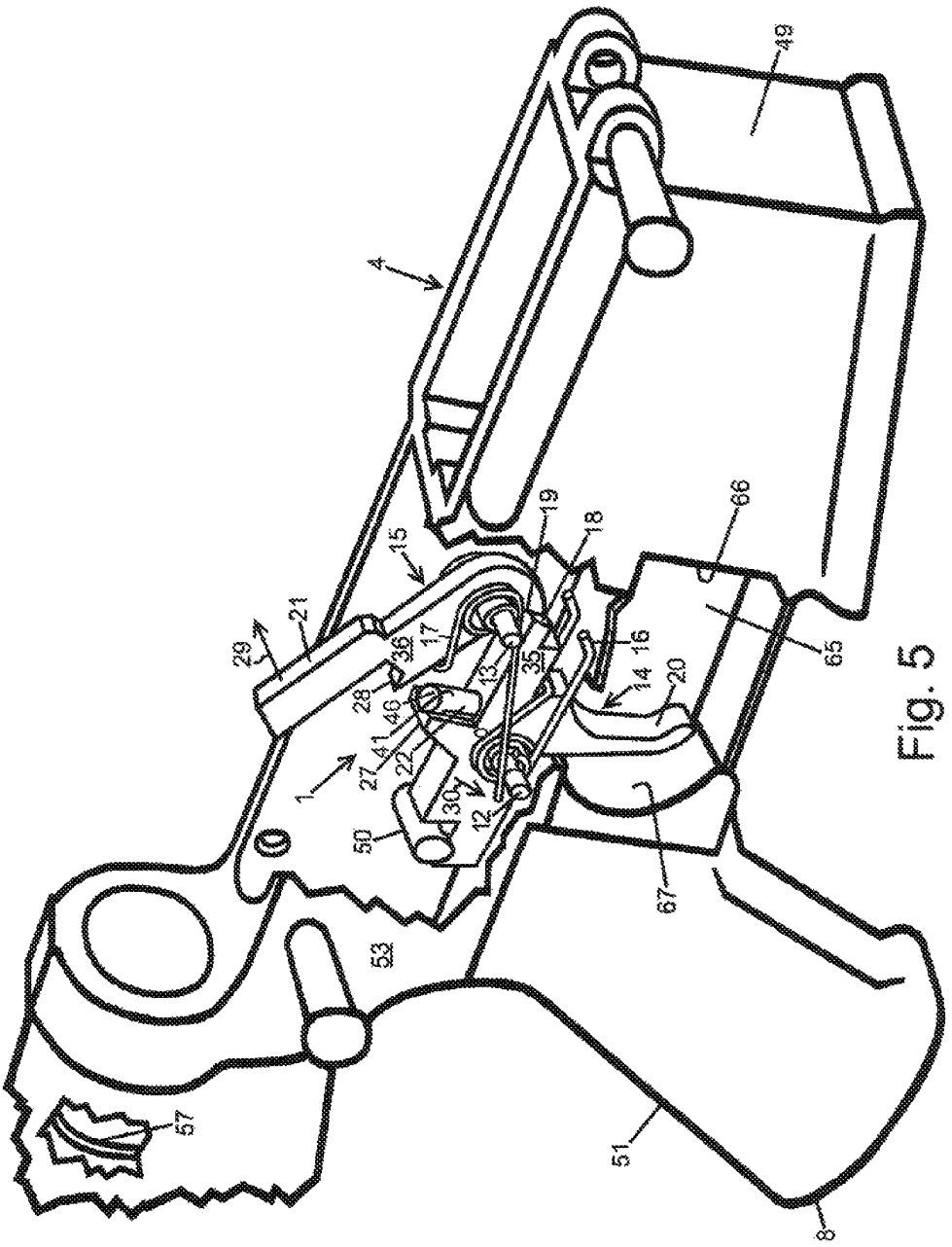
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Fig. 5

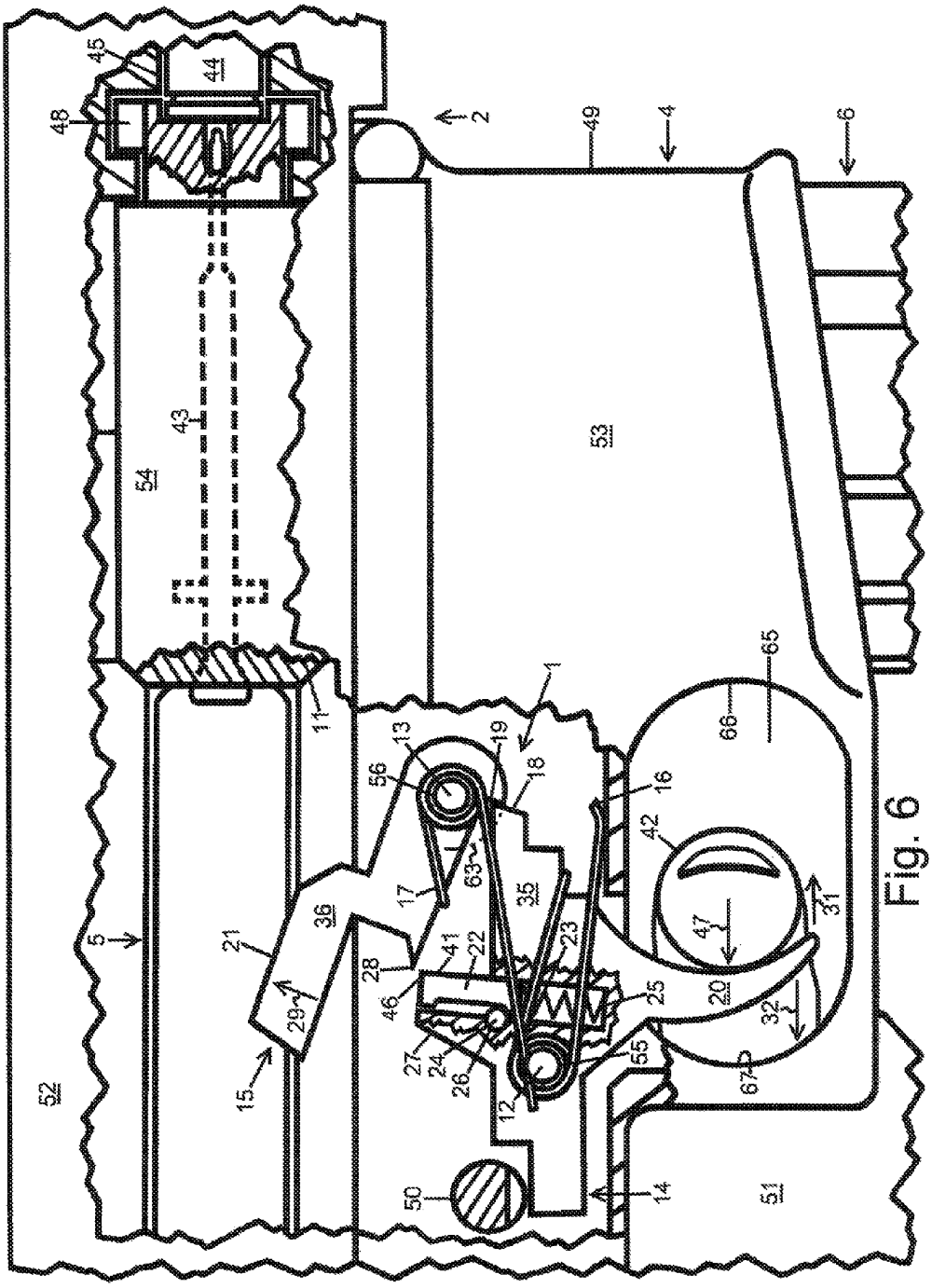
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Fig. 6

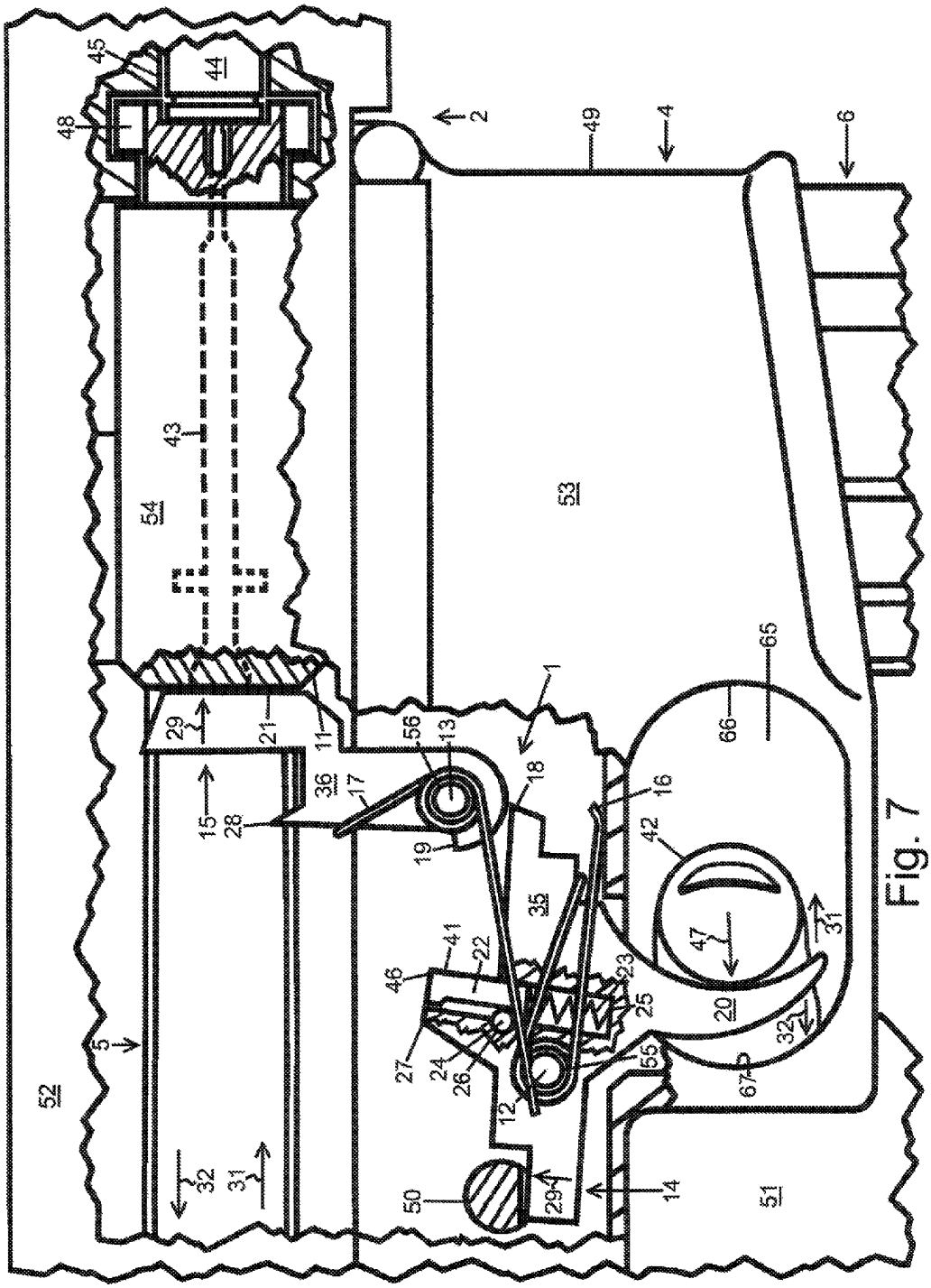
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Fig. 7

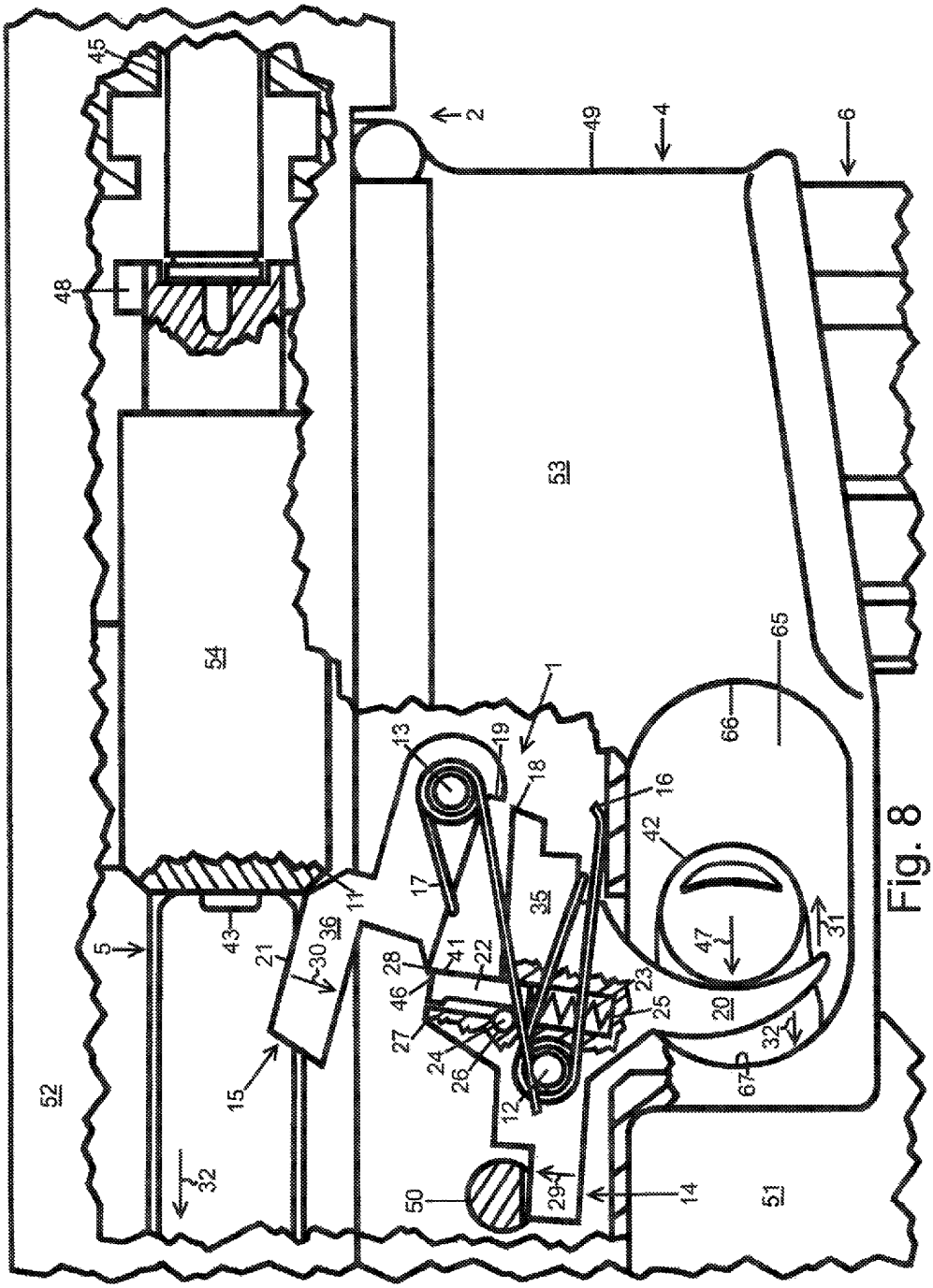
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Fig. 8

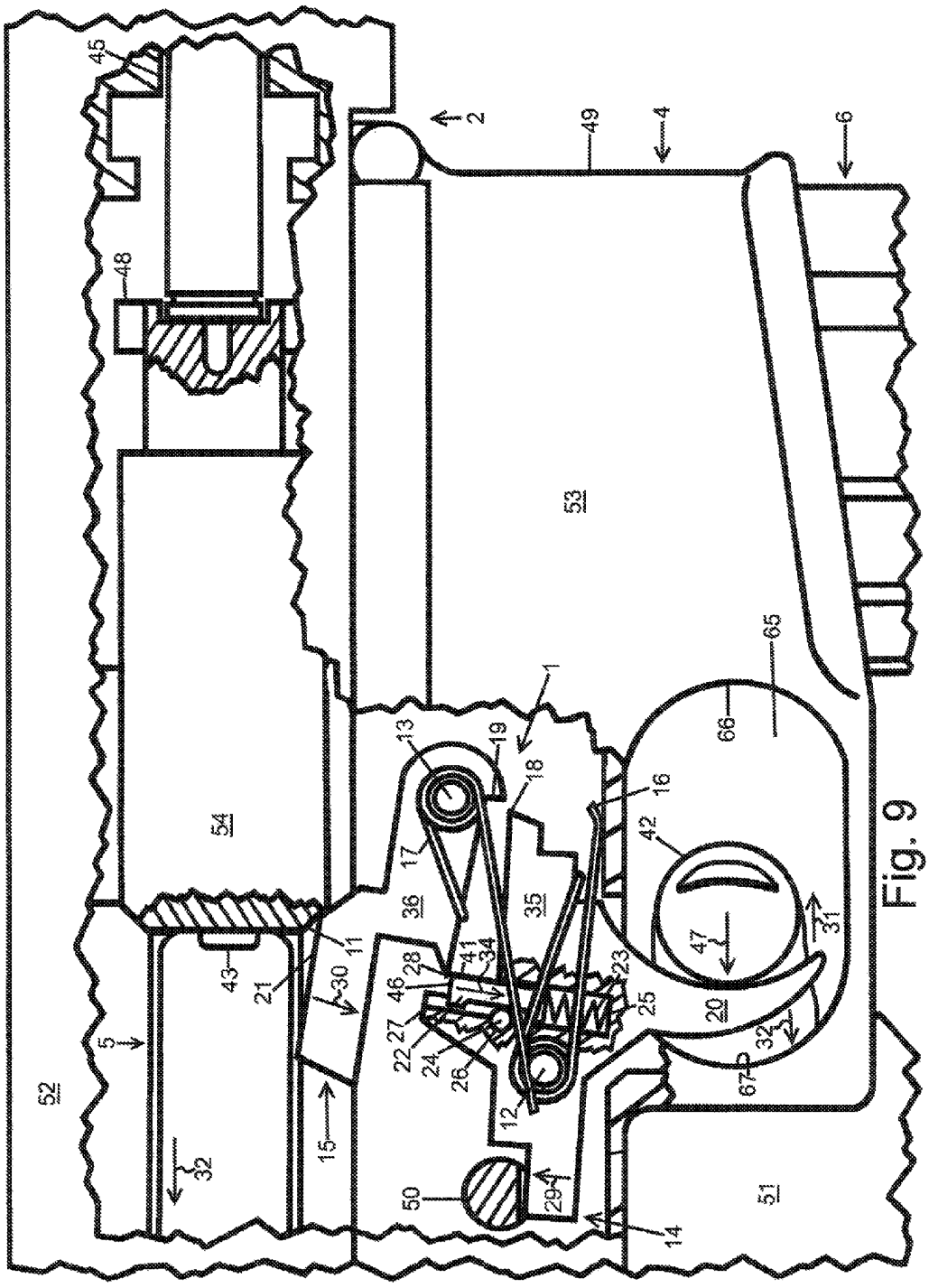
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Fig. 9

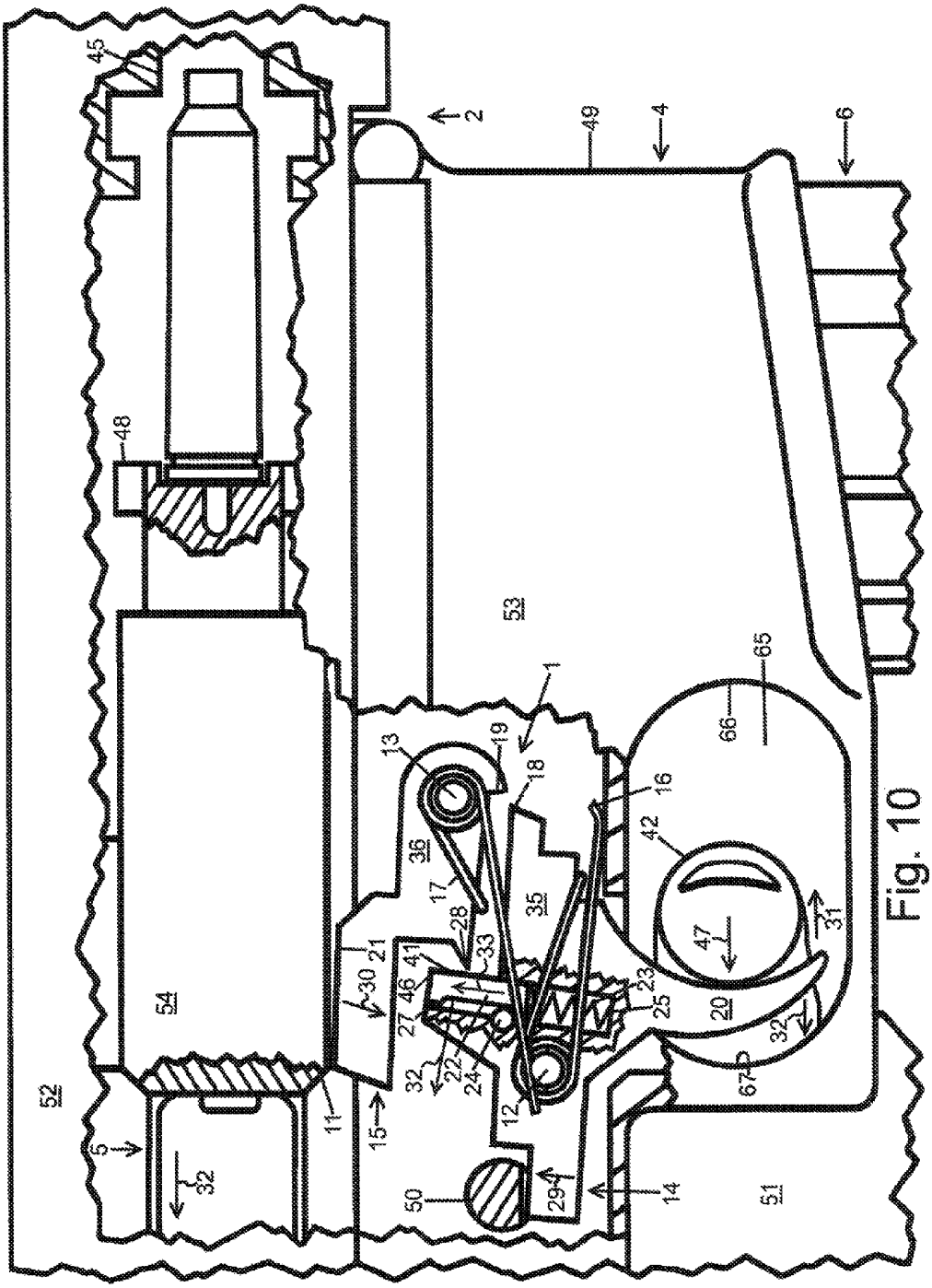
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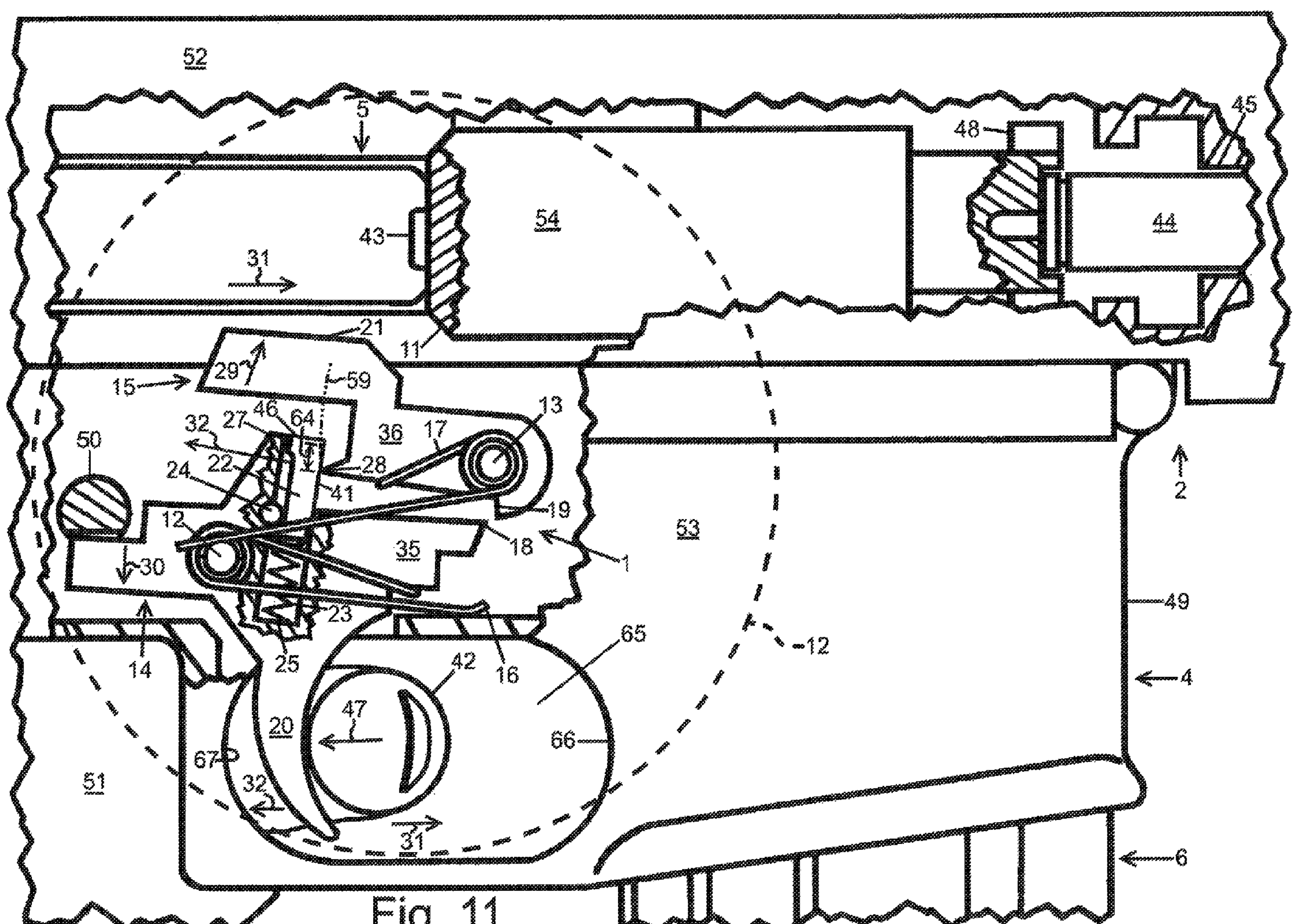
Fig. 10



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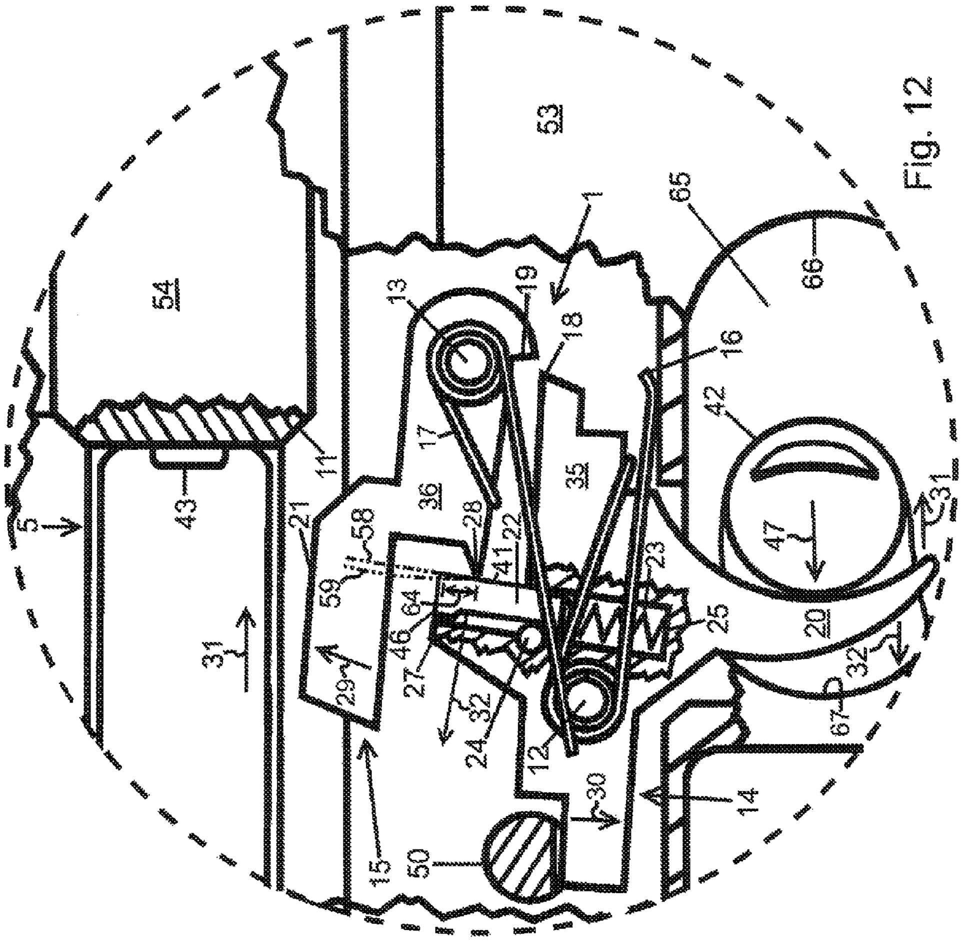
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Fig. 12

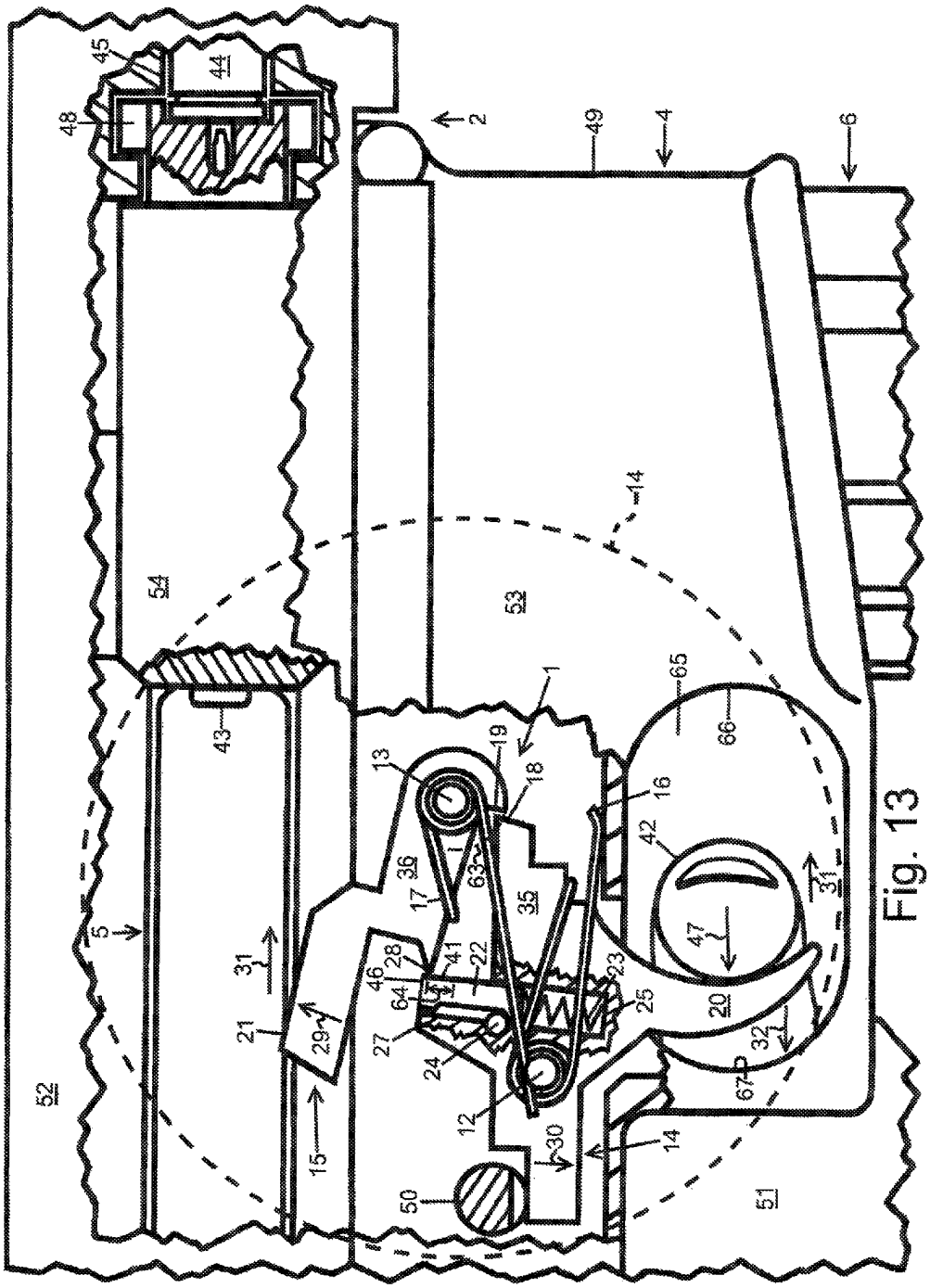
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Fig. 13

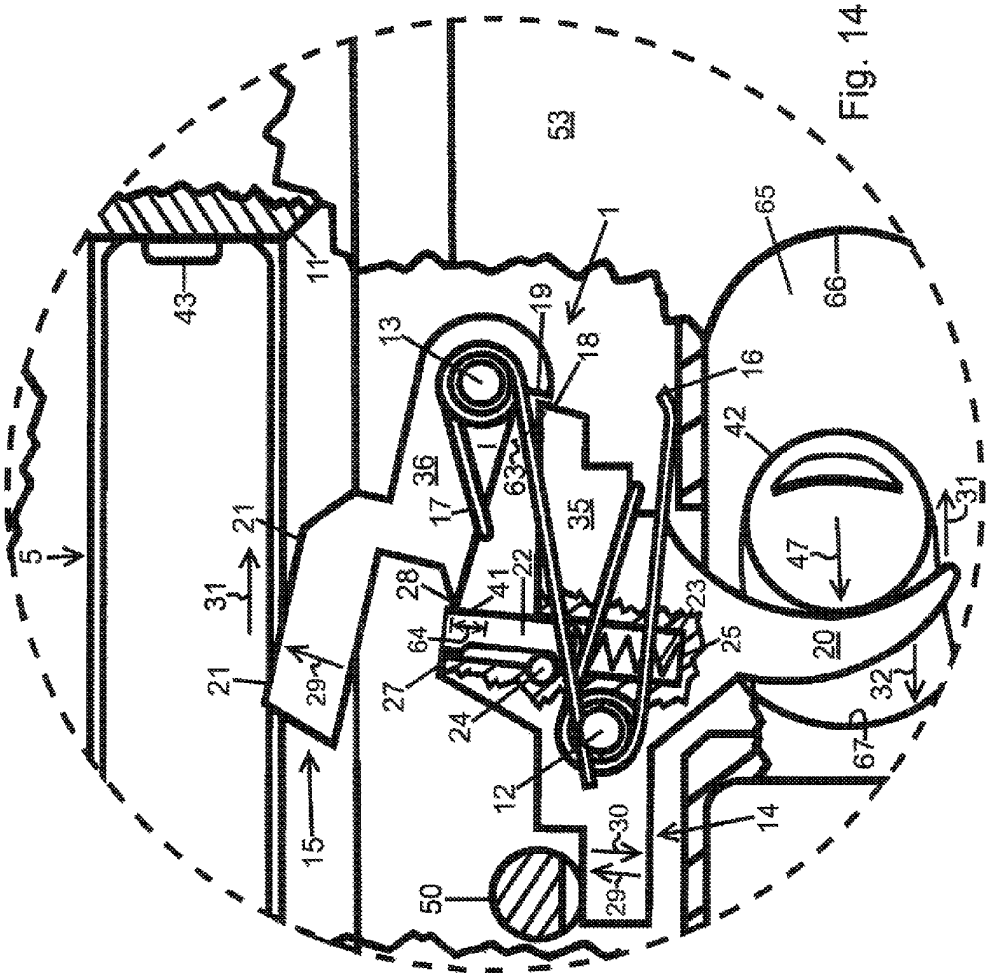
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Fig. 14

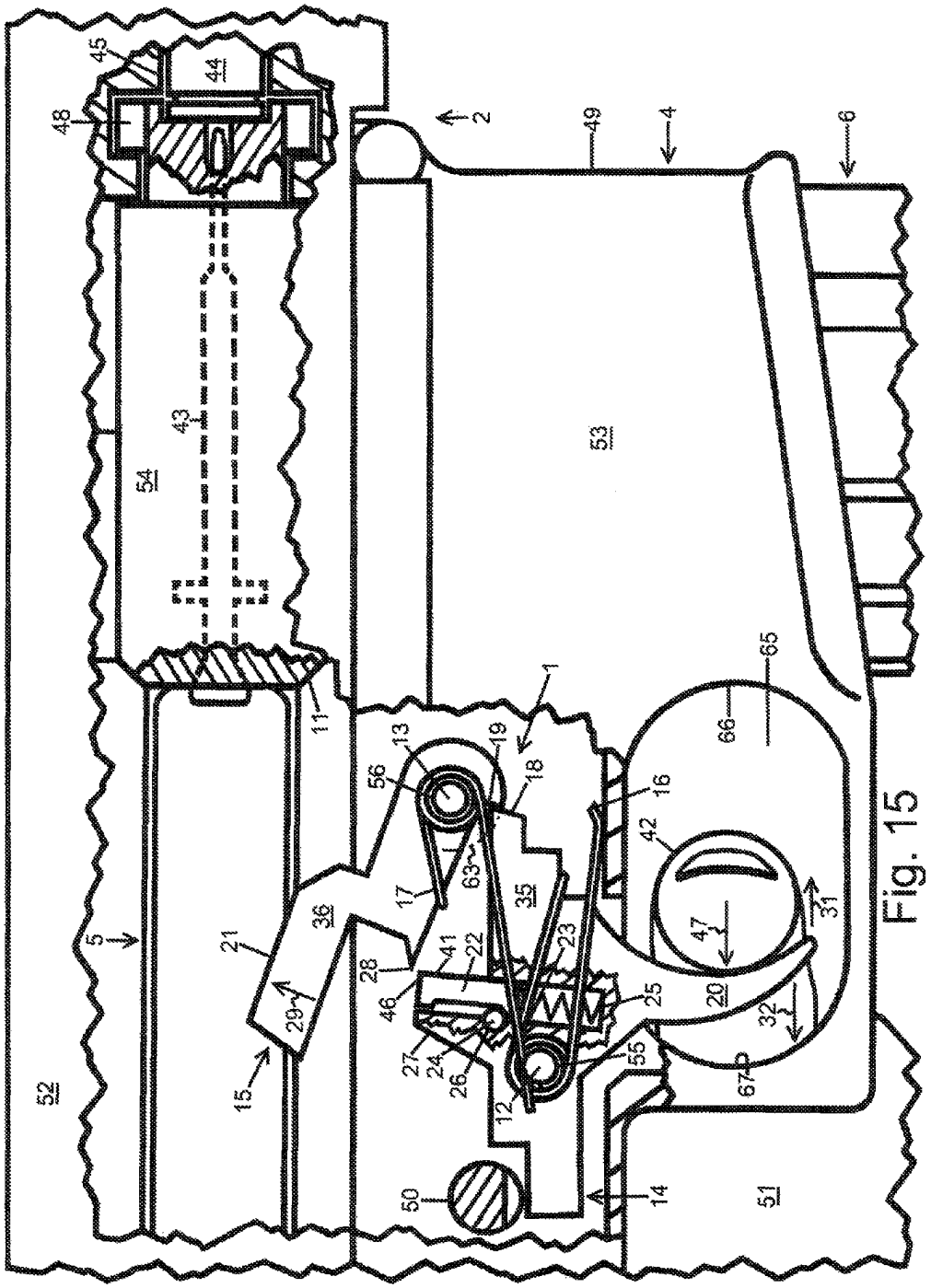
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Fig. 15

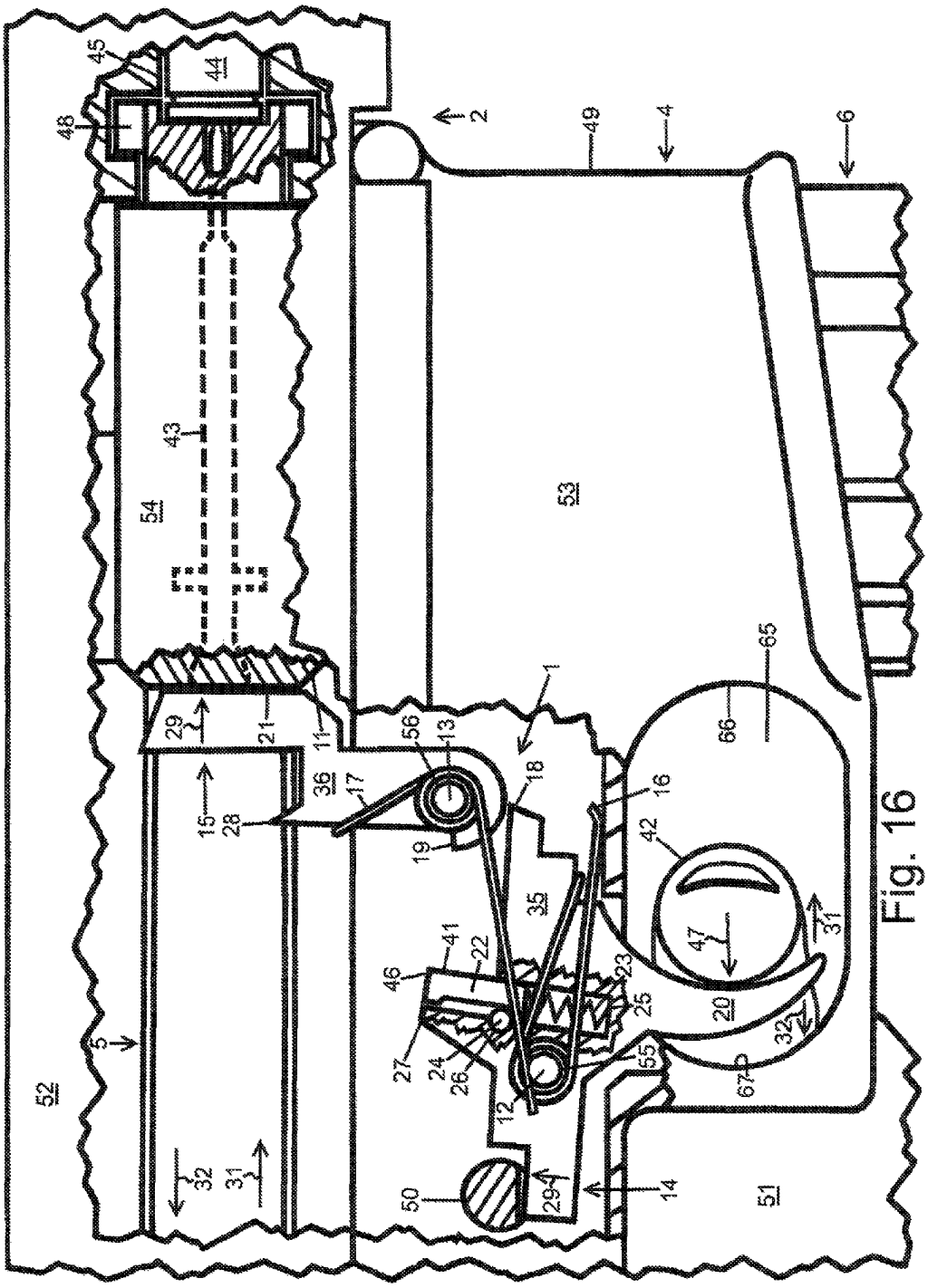
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Fig. 16

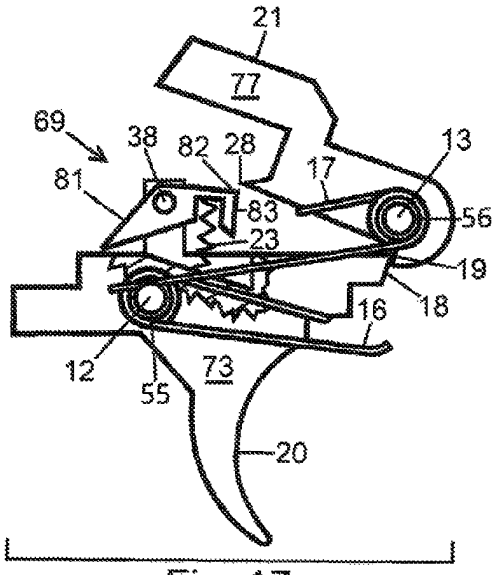

Fig. 17

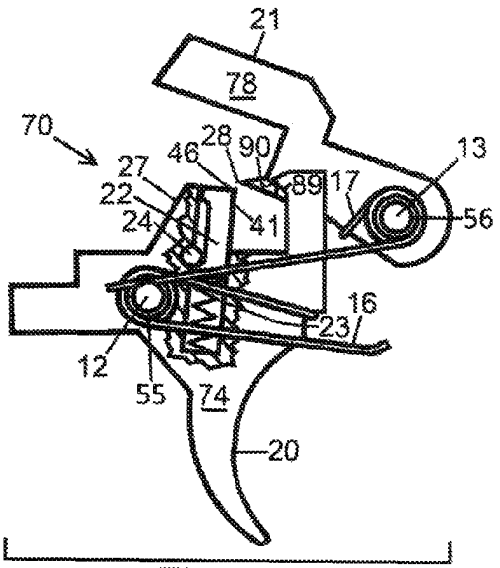

Fig. 18

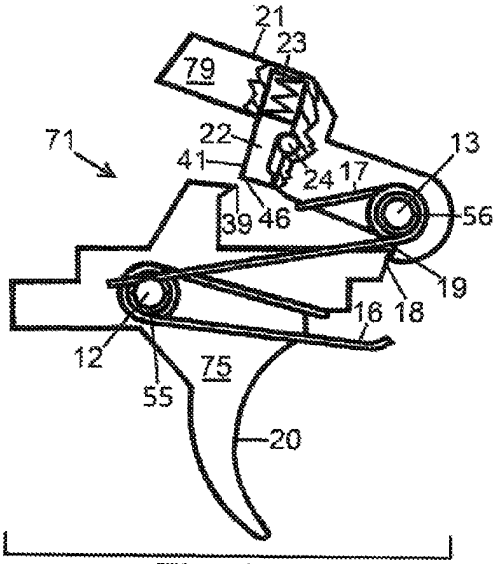

Fig. 19

RAPID RESET FIRE CONTROL

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority of U.S. Provisional Application No. 61/965,045 filed Jan. 18, 2014 by the present inventor, titled: Rapid Reset Fire Control.

FEDERALLY SPONSORED RESEARCH

NONE

SEQUENCE LISTING

NONE

FIELD OF THE INVENTION

The present invention relates to firearms. More specifically, the present invention relates to firearm fire control groups comprising a pivotal hammer.

BACKGROUND OF THE INVENTION

Self-loading firearms are presently in use throughout the world and have become the dominate firearm type in modern manufacture. Chief among the advantages which have lead to the domination of self-loading firearms is the utility of various rapid fire capabilities which self-loading firearms known to the art are capable of.

Self-loading firearms are those wherein the next live ammunition cartridge loads after a live ammunition cartridge has been fired. Once the firearm is made ready to fire, the user need only interact with the fire control group of the firearm in order to fire a live ammunition cartridge and load the next available live ammunition cartridge from a magazine, belt or other ammunition feeding device, such that the firearm is made ready to fire again without additional user interaction.

The fire control groups for self-loading firearms known to the art frequently share many characteristics of how they are operated by the user. For most such fire control groups a semi-automatic firing mode is provided. Said semi-automatic firing mode is such that the user fires the firearm by using a finger to apply force to the trigger of the fire control group until the trigger is moved from its reset position to its firing position, at which point a live ammunition cartridge is fired. Once the firearm has been fired in said manner, in order for the user to fire an additional live ammunition cartridge, the user reduces the force being applied to the trigger with his or her finger, thus allowing the trigger to return to its reset position. After this, the user again applies increasing force with his or her finger to the trigger until the trigger is again moved to its firing position, causing the firearm to fire an additional live ammunition cartridge. This process may be further repeated to continue firing additional live ammunition cartridges until live ammunition cartridges are no longer available to the firearm.

This semi-automatic firing mode as found in semi-automatic fire control groups known to the art is disadvantageous for multiple reasons, including but not limited to:

a) Firing multiple live ammunition cartridges requires the user to both increase and decrease the force applied to the trigger with his or her finger. This requirement is time consuming and significantly limits the potential rate of fire.

b) The repeated alternation between contraction and relaxation of the muscles in the users finger is physically taxing, and thus, may induce cramps and even exhaust the ability of the users finger to pull the trigger at the desired rate of fire.

c) The time consumed by the requirement for the user to reduce force applied to the trigger in order for the next live ammunition cartridge to be fired may be in excess of the time required for the user to aim the firearm, resulting in an unnecessary delay between the firings of live ammunition cartridges.

d) A trigger spring with significant strength is required to bias the trigger towards its reset position. This results in a heavier trigger pull weight.

These and other disadvantages in the state of the art have led to the incorporation into many fire control group designs both a semi-automatic mode as previously described, and an additional fully-automatic mode of fire. Said fully-automatic mode of fire is such that the firearm will continue firing live ammunition cartridges as long as the trigger is held in the firing position and the firearm has available live ammunition cartridges. This fire control group with both semi-automatic and fully-automatic firing modes alleviates some of the above disadvantages found in firearms which are only capable of semi-automatic fire.

However, fire control groups with both semi-automatic and fully-automatic firing modes, as known to the art, suffer from a number of disadvantages, including but not limited to:

a) Many firearms known to the art which incorporate fire control groups with both a semi-automatic and a fully-automatic firing mode also incorporate a selector switch which the user must manipulate in order to change between the low rate of fire semi-automatic firing mode and the high rate of fire fully-automatic firing mode. Manipulating such a selector switch is time consuming and burdensome for the user of the firearm.

b) Firearms known to the art which incorporate fire control groups with both a semi-automatic and a fully-automatic firing mode require additional parts and complexity when compared to firearms which only incorporate a semi-automatic firing mode. This is a burden on manufacturing and can be a source of reliability problems and increased cost.

c) The fully-automatic firing mode of many firearms known to the art typically does not provide the capability for the user to adjust the rate of fire of the firearm during the process of firing the firearm.

d) Firearms known to the art which incorporate a fully-automatic firing mode often have an excessively high rate of fire, this excessively high rate of fire produces a recoil force beyond that which is easily controlled by the user. This excessively high rate of fire may result in the firearm dangerously and uncontrollably drifting off of the desired target. Such an excessively high rate of fire may also consume ammunition at an undesirably high rate.

e) Under stress the firearm user may unintentionally clinch his or her firing hand, depressing the trigger with his or her finger. This can result in the firearm entering a very dangerous runaway firing condition at a high rate of fire until the user regains control of the firearm or the firearm runs out of ammunition.

The above disadvantages present in fire control groups known to the art which incorporate a fully-automatic firing mode have led to many firearm designs which incorporate a feature called arate-reducer. This feature typically comprises a mechanical device installed within the firearm which slows the firing rate of the firearm during firing in fully-automatic

mode in order to alleviate some of the above disadvantages found in firearms with fully-automatic firing modes.

However, firearms operating in fully-automatic mode while equipped with a rate-reducer still suffer from disadvantages, including but not limited to:

a) Firearms known to the art which incorporate a rate-reducer for reducing the fully-automatic firing rate require additional parts and complexity. This is a burden on manufacturing and can be a cause of reliability problems and increased cost.

An example of an attempt to resolve the aforementioned disadvantages of semi-automatic fire control groups can be found in U.S. Pat. No. 8,371,208 to Cottle, wherein a sliding articulation is added to the firearm stock such that when the firearm fires live ammunition the resultant recoil force moves the receiver of the firearm away from the users finger. This movement of the firearm away from the users finger allows the trigger to return to its reset position. Said movement of the trigger to the reset position as a result of recoil force allows for a faster rate of fire. However, this concept adds considerable complexity to the firearm, does not lend itself to practical use and has proven to be unreliable for many users. Thus, this concept does not resolve the existing disadvantages in the state of the art.

Another example of an attempt to resolve the disadvantages of semi-automatic fire control groups is U.S. Pat. No. 8,667,881 to Hawbaker, wherein a fire control group is described which fires live ammunition both when the trigger is moved to the firing position, and also when the trigger is returned to the reset position. This concept essentially doubles the potential rate of fire compared to a typical semi-automatic fire control group. However this concept does not approach the high rate of fire of many fully-automatic fire control groups. Additionally, it adds considerable complexity to the fire control group when compared to typical semi-automatic fire control groups as known to the art. As such, this concept does not resolve the existing disadvantages in the state of the art.

A further example of an attempt to resolve the disadvantages of semi-automatic fire control groups is U.S. Pat. No. 5,074,190 to Troncoso, wherein an apparatus which provides spring bias to the trigger in the direction of the reset position is described. This concept, however, applies said spring bias to the trigger throughout the process of firing the firearm. As a result the users finger must apply additional force to the trigger in order to move the trigger from the reset position to the firing position. This additional force which the user must apply is equal to the added spring bias towards the reset position applied to the trigger. Thus, once the trigger is moved to the firing position, the user is still required to reduce the force applied to the trigger with his or her finger in order to fire the firearm again. As a result this concept does not resolve the disadvantages of semi-automatic fire control groups known to the art.

With these facts identified it is clear that fire control groups known to the art have many disadvantages. In order that self-loading firearms be equipped with a fire control group which eliminates these disadvantages, a new type of fire control group is needed. Despite this need, the state of the art does not allow for a fire control group which resolves these disadvantages, and therefore is greatly lacking.

BRIEF SUMMARY OF THE INVENTION

The present invention was developed in response to the present state of the art, and in particular, in response to the problems and needs in the state the art that have not yet been fully solved by fire control group instruments and methods currently available. In accordance with the present invention as embodied and broadly described herein in the embodiments, a new type of firearm fire control group is provided. The present invention is the long awaited solution to many of the inherent problems and difficulties in the rapid firing of self-loading firearms.

In its exemplary embodiments, the present invention may be described as a fire control group for firearms essentially conforming to semi-automatic fire control groups known to the art with the addition of novel features, as described herein, which temporarily transfer hammer spring force to the trigger after the firearm has fired live ammunition. This temporary transfer of hammer spring force to the trigger is such that the trigger is urged towards its reset position by force from the hammer spring. This temporary surge in the urging of the trigger towards its reset position may return the trigger to its reset position without requiring the user to reduce the force which was applied to the trigger by the users finger in order to fire the firearm. This return of the trigger to its reset position without the user reducing force applied to the trigger can enable easier, faster and more controllable rapid firing of the firearm when compared to fire control groups known to the art.

In its exemplary embodiments, the present invention has a number of advantages when compared to fire control groups with semi-automatic firing modes in the state of the art. These advantages include but are not limited to:

a) The present invention allows for firing multiple live ammunition cartridges without requiring the user to both increase and also decrease the force applied to the trigger with the users finger. This decreases the time required for the user to prepare the firearm for subsequent firings as well as significantly increases the maximum potential rate of fire.

b) The present invention does not require repeated alternation between contraction and relaxation of the muscles in the users finger for multiple firings to occur. This avoids the associated problems found in the state of the art, including physical taxation, potential of cramping, and the risk of exhausting the ability of the users finger to pull the trigger at the desired rate of fire.

c) The present invention eliminates the time consumed by the requirement in the state of the art for the user to reduce force applied to the trigger after firing a life ammunition cartridge in order for the next live ammunition cartridge to be fired. This greatly reduces the excess delay which exists in the state of the art after the user has aimed the firearm in the process of firing an additional live ammunition cartridge.

d) The present invention allows for reduction in the trigger spring strength required to bias the trigger towards its reset position. This allows for the desirable trait of a lighter trigger pull.

Further, in its exemplary embodiments, the present invention has a number of advantages when compared to fire control groups with both semi-automatic and fully-automatic firing modes in the state of the art. These advantages include but are not limited to:

a) The present invention eliminates the requirement that a selector switch be manipulated by the user in order for the user to change between a low rate of fire and a high rate of fire. This saves time and reduces the burden on the firearm user.

b) The present invention allows for a self-loading firearm with both a low rate of fire and a high rate of fire without requiring additional parts and complexity when compared to firearms which incorporate only a semi-automatic firing mode as known to the art. Therefore the present invention

allows for a firearm with a high rate of fire without burdening manufacturing, increasing cost or reducing reliability.

c) The present invention allows for the user to adjust the rate of fire of the firearm during the process of firing the firearm by adjusting the rearward force applied to the trigger. This would allow the user to adjust the rate of fire based on the needs of the user.

d) The present invention allows for a rate of fire that is lower than the cyclic rate of the fully-automatic firearms. This reduces the problems of excessive recoil and excessive ammunition consumption which are commonly associated with the fully-automatic firing mode as known to the art.

e) The present invention allows for a fire control group which may be configured such that excessive force applied to the trigger by the users finger during stress induced clinching of the hand will not repeatedly fire the firearm at a high rate of fire.

Furthermore, the present invention also has advantages when compared to fully-automatic firearms equipped with a rate-reducer as known to the art, including but not limited to:

a) The present invention provides for a firearm which is capable of a high rate of fire which is greater than the rate of fire of typical semi-automatic firing modes as known the art, yet less than the rate of fire of typical fully-automatic firing modes as known to the art. This is seen by many in the art as ideal. The present invention is capable of providing said rate of fire without requiring the additional parts and complexity of a rate-reducer as known to the art. This provides the benefits of a state of the art rate reducer without the increased burden on manufacturing, increased cost and reliability problems which are associated with the complexity of a rate-reducer as known to the art.

BRIEF DESCRIPTION OF DRAWINGS

In order that the manner in which the above-recited and other features and advantages of the present invention are obtained will be readily understood, a greater particular description of the present invention briefly described above will be rendered by reference to specific embodiments thereof which are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the present invention and are not therefore to be considered to be limiting of its scope, the present invention will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

FIG. **1** is an exploded view of one embodiment of the trigger assembly **14**.

FIG. **2** is an exploded view of one embodiment of the hammer assembly **15**.

FIG. **3** is a perspective view of one embodiment of the rapid reset fire control **1**. The rapid reset fire control **1** of FIG. **3** is an embodiment of the present invention. The rapid reset fire control **1** of FIG. **3** comprises the trigger assembly **14** of FIG. **1** and the hammer assembly **15** of FIG. **2**.

FIG. **4** is an exploded view of a firearm **2**. FIG. **4** depicts the rapid reset fire control **1** of FIG. **3** installed within the lower receiver assembly **4** of the firearm **2**. The firearm **2** of FIG. **4** is illustrative of one type of firearm which is known to the art.

FIG. **5** is a perspective partial sectional view of the lower receiver assembly **4** of the firearm **2**. FIG. **5** depicts the rapid reset fire control **1** of FIG. **3** installed within the lower receiver assembly **4** of the firearm **2**.

FIG. **6** is a right side partial sectional view of the firearm **2** and the rapid reset fire control **1**. FIG. **6** depicts the rapid reset fire control **1** installed within the lower receiver assembly **4** of the firearm **2**. FIG. **6** depicts the firearm **2** in its ready to fire condition.

FIG. **7** is a right side partial sectional view of the firearm **2** and the rapid reset fire control **1**. FIG. **7** depicts the rapid reset fire control **1** installed within the lower receiver assembly **4** of the firearm **2**. FIG. **7** depicts the first firing of the firearm **2** utilizing the rapid reset fire control **1**.

FIG. **8** is a right side partial sectional view of the firearm **2** and the rapid reset fire control **1**. FIG. **8** depicts the rapid reset fire control **1** installed within the lower receiver assembly **4** of the firearm **2**. FIG. **8** depicts the cycling of the firearm **2** action by the operating system of the firearm **2**.

FIG. **9** is a right side partial sectional view of the firearm **2** and the rapid reset fire control **1**. FIG. **9** depicts the rapid reset fire control **1** installed within the lower receiver assembly **4** of the firearm **2**. FIG. **9** depicts the cycling of the firearm **2** action by the operating system of the firearm **2**.

FIG. **10** is a right side partial sectional view of the firearm **2** and the rapid reset fire control **1**. FIG. **10** depicts the rapid reset fire control **1** installed within the lower receiver assembly **4** of the firearm **2**. FIG. **10** depicts the cycling of the firearm **2** action by the operating system of the firearm **2**.

FIG. **11** is a right side partial sectional view of the firearm **2** and the rapid reset fire control **1**. FIG. **11** depicts the rapid reset fire control **1** installed within the lower receiver assembly **4** of the firearm **2**. FIG. **11** depicts the cycling of the firearm **2** action by the operating system of the firearm **2**.

FIG. **12** is an enlarged view depicting a portion of FIG. **11**.

FIG. **13** is a right side partial sectional view of the firearm **2** and the rapid reset fire control **1**. FIG. **13** depicts the rapid reset fire control **1** installed within the lower receiver assembly **4** of the firearm **2**. FIG. **13** depicts the cycling of the firearm **2** action by the operating system of the firearm **2**.

FIG. **14** is an enlarged view depicting a portion of FIG. **13**.

FIG. **15** is a right side partial sectional view of the firearm **2** and the rapid reset fire control **1**. FIG. **15** depicts the rapid reset fire control **1** installed within the lower receiver assembly **4** of the firearm **2**. FIG. **15** depicts the return of firearm **2** to its ready to fire condition.

FIG. **16** is a right side partial sectional view of the firearm **2** and the rapid reset fire control **1**. FIG. **16** depicts the rapid reset fire control **1** installed within the lower receiver assembly **4** of the firearm **2**. FIG. **16** depicts the second firing of the firearm **2** utilizing the rapid reset fire control **1**.

FIG. **17** is a right side partial sectional view of a second embodiment of the present invention **69**.

FIG. **18** is a right side partial sectional view of a third embodiment of the present invention **70**.

FIG. **19** is a right side partial sectional view of a fourth embodiment of the present invention **71**.

REFERENCE NUMERALS

1 Rapid reset fire control.
2 Firearm.
3 Upper receiver assembly.
4 Lower receiver assembly.
5 Bolt carrier assembly.
6 Magazine assembly.
7 Upper portion of firearm.
8 Lower portion of firearm.
9 Forward portion of firearm.

10 Rearward portion of firearm.
11 Bolt carrier surface.
12 Trigger pin.
13 Hammer pin.
14 Trigger assembly.
15 Hammer assembly.
16 Trigger spring.
17 Hammer spring.
18 Trigger sear.
19 Hammer sear.
20 Trigger interface.
21 Striking surface.
22 cam member.
23 cam member spring.
24 cam member pin.
25 cam member hole.
26 cam member pin hole.
27 cam member support.
28 Hammer surface.
29 Clockwise direction.
30 Counter-clockwise direction.
31 Forward direction.
32 Rearward direction.
33 Upward direction.
34 Downward direction.
35 Trigger body.
36 Hammer body.
37 Counteracting force.
38 Pivot pin.
39 Trigger surface.
41 Second surface.
42 Finger.
43 Firing pin.
44 Live ammunition cartridge.
45 Firing chamber.
46 First surface.
47 Rearward force.
48 Bolt assembly.
49 Forward portion of magazine well.
50 Safety selector.
51 Hand grip.
52 Right side of the upper receiver assembly.
53 Right side of the lower receiver assembly.
54 Right side of the bolt carrier assembly.
55 Trigger pin hole.
56 Hammer pin hole.
57 Action spring.
58 Angle of the second surface.
59 Path of travel of the hammer surface.
63 Path of travel of the hammer sear.
64 Certain length.
65 Trigger well.
66 Forward portion of trigger well.
67 Rearward portion of trigger well.
69 Second embodiment of the present invention.
70 Third embodiment of the present invention.
71 Fourth embodiment of the present invention.
73 Second embodiment of the trigger body.
74 Third embodiment of the trigger body.
75 Fourth embodiment of the trigger body.
77 Second embodiment of the hammer body.
78 Third embodiment of the hammer body.
79 Fourth embodiment of the hammer body.
81 Second embodiment of the cam member.
82 Second embodiment of the first surface.
83 Second embodiment of the second surface.
89 Second embodiment of the trigger sear.
90 Second embodiment of the hammer sear.

DETAILED DESCRIPTION OF DRAWINGS

The presently exemplary embodiments of the present invention will be best understood by reference to the drawings, wherein like parts are designated by like numerals throughout. It will be readily understood that the components of the present invention, as generally described and illustrated in the figures herein, could be arranged and designed in a wide variety of different configurations. Thus, the following greater detailed description of the embodiments of the apparatus, system, and method of the present invention, as represented in FIG. **1** through FIG. **19**, is not intended to limit the scope of the present invention, as claimed, but is merely representative of presently exemplary embodiments of the present invention.

FIG. **1** is an exploded view of one embodiment of the trigger assembly **14**. The trigger assembly **14** of FIG. **1** comprises a trigger body **35**, a user interface **20**, a cam member **22**, a first surface **46**, a second surface **41**, a cam member spring **23**, a cam member pin **24**, a cam member hole **25**, a cam member pin hole **26**, a trigger spring **16**, a trigger sear **18**, a cam member support **27**, a trigger pin hole **55** and a trigger pin **12**. The trigger spring **16** is depicted as attached to the trigger body **35** so that it may be illustrated with greater clarity. In this embodiment of the trigger assembly **14** the user interface **20**, the trigger spring **16**, the trigger sear **18**, the trigger pin hole **55** and the trigger pin **12** are essentially of the type found on the AR-15 type firearm and its derivatives.

The trigger pin **12** may be placed through the trigger pin hole **55** such that the trigger body **35** may pivot about the axis of the trigger pin **12**. In this configuration the user interface **20**, the cam member **22**, the first surface **46**, the second surface **41**, the cam member spring **23**, the cam member pin **24**, the cam member hole **25**, the cam member pin hole **26**, the trigger sear **18** and the cam member support **27** pivot together with the trigger body **35** about the axis of the trigger pin **12**. The incorporation of the cam member **22**, the cam member spring **23**, the cam member pin **24**, the cam member hole **25**, the cam member pin hole **26** and the cam member support **27** unto the trigger body **35** allow the trigger assembly **14** to properly engage with the hammer assembly **15** of FIG. **2**.

Additional embodiments of the trigger assembly **14** are possible which essentially conform to alternative trigger configurations as known to the art which differ in arrangement, geometry, dimensions and operation.

FIG. **2** is an exploded view of one embodiment of the hammer assembly **15**. The hammer assembly **15** of FIG. **2** comprises a hammer body **36**, a striking surface **21**, a hammer surface **28**, a hammer pin **13**, a hammer pin hole **56**, a hammer sear **19** and a hammer spring **17**. The hammer spring **17** is depicted attached to the hammer body **36** so that it may be illustrated with greater clarity. In this embodiment of the hammer assembly **15** the hammer body **36**, the striking surface **21**, the hammer surface **28**, the hammer pin **13**, the hammer pin hole **56**, the hammer sear **19** and the hammer spring **17** are essentially of the type found on the AR-15 type firearm and its derivatives.

The hammer pin **13** may be placed through the hammer pin hole **56** such that the hammer body **36** may pivot about the axis of the hammer pin **13**. In this configuration the

striking surface **21**, the hammer surface **28** and the hammer sear **19** pivot together with the hammer body **36** about the axis of the hammer pin **13**.

Additional embodiments of the hammer assembly **15** are possible which essentially conform to alternative hammer configurations as known to the art which differ in arrangement, geometry, dimensions and operation.

FIG. **3** is a perspective view of one embodiment of the rapid reset fire control **1**. The rapid reset fire control **1** of FIG. **3** is an embodiment of the present invention. The rapid reset fire control **1** of FIG. **3** comprises the trigger assembly **14** of FIG. **1** and the hammer assembly **15** of FIG. **2**. FIG. **3** depicts the trigger assembly **14** and the hammer assembly **15** in their assembled states. FIG. **3** depicts the trigger assembly **14** and the hammer assembly **15** engaging with one another such that the rapid reset fire control **1** has achieved its reset condition. As further illustrated in the subsequent figures, this reset condition of the rapid reset fire control **1** is such that the trigger sear **18** engages the hammer sear **19**. As further illustrated in the subsequent figures, the rapid reset fire control **1** engages with the firearm **2** of FIG. **4** in a manner such that the functions of the present invention may be performed.

While the embodiment of the present invention which is depicted in FIG. **3** may bare certain similarities to state of the art fire control groups utilized on the AR-15 type firearm and its derivatives, additional embodiments of the present invention are possible which essentially conform to alternative fire control group configurations as known to the art which differ in arrangement, geometry, dimensions and operation.

FIG. **4** is an exploded view of a firearm **2**. FIG. **4** depicts the rapid reset fire control **1** of FIG. **3** installed within the lower receiver assembly **4** of the firearm **2**. The firearm **2** of FIG. **4** is illustrative of one type of firearm which is known to the art. The firearm **2** of FIG. **4** comprises a bolt carrier assembly **5**, a magazine assembly **6**, an upper receiver assembly **3** and a lower receiver assembly **4**. The firearm **2** of FIG. **4** having a forward portion **9**, a rearward portion **10**, an upper portion **7** and a lower portion **8**. As further illustrated in the subsequent figures, the rapid reset fire control **1** engages with the firearm **2** of FIG. **4** in a manner such that the functions of the present invention may be performed.

While the firearm **2** of FIG. **4** includes a firearm operating system as known to the art, the particular operating system is not depicted for the sake of simplicity. However, the firearm operating system of the firearm **2** may conform to firearm operating system principles which are well understood in the art. The firearm **2** of FIG. **4** may utilize various types of firearm operating systems which are known to the art, these firearm operating system types include but are not limited to blowback operation, recoil operation, gas operation and other firearm operating systems.

While the rapid reset fire control **1** of FIG. **3** may be utilized with the firearm **2** of FIG. **4** in a manner such that the functions of the present invention may be performed, alternative embodiments of the present invention may be utilized with various firearm types in order that the functions of the present invention may be performed. These various firearm types include but are not limited to handguns, sub-machine guns, shotguns, carbines, rifles, machine guns and many other firearm types which are known to the art.

FIG. **5** is a perspective partial sectional view of the lower receiver assembly **4** of the firearm **2**. FIG. **5** depicts the rapid reset fire control **1** of FIG. **3** installed within the lower receiver assembly **4** of the firearm **2**. As known to the art, the trigger assembly **14** of FIG. **1** is installed within the lower receiver assembly **4** upon the trigger pin **12** and the hammer assembly **15** of FIG. **2** is installed within the lower receiver assembly **4** upon the hammer pin **13**.

The trigger body **35**, as well as its associated features, may pivot about the axis of the trigger pin **12**. The associated features of the trigger body **35** comprise the cam member **22**, the cam member spring **23**, the cam member pin **24**, the cam member support **27**, the cam member hole **25**, the cam member pin hole **26**, the trigger sear **18** and the trigger interface **20**.

The hammer body **36**, as well as its associated features, may pivot about the axis of the hammer pin **13**. The associated features of the hammer body **36** comprise the striking surface **21**, the hammer surface **28** and the hammer sear **19**.

As is known to the art the trigger spring **16** engages with the lower receiver assembly **4** such that the trigger body **35**, as well as its associated features, are urged in the counter-clockwise direction **30** about the axis of the trigger pin **12**. Similarly, the hammer spring **17** engages with the trigger pin **12** such that the hammer body **36**, as well as its associated features, are urged in the clockwise direction **29** about the axis of the hammer pin **13**.

As illustrated in FIG. **5**, the trigger body **35** may engage with the safety selector **50** in a manner such that safety selector functions, as known to the art, may be performed.

FIG. **6** is a right side partial sectional view of the firearm **2** and the rapid reset fire control **1**. FIG. **6** depicts the rapid reset fire control **1** installed within the lower receiver assembly **4** of the firearm **2**. Portions of the right side of the upper receiver assembly **52**, right side of the lower receiver assembly **53** and right side of the bolt carrier assembly **54** are not depicted so that conditions within the firearm **2** may be illustrated with greater clarity. FIG. **6** through FIG. **16** depict, in sequence, the conditions within the firearm **2** as the firearm **2** is operated by the user using the rapid reset fire control **1**. This sequence includes the first firing of the firearm which is depicted in FIG. **7**, the second firing of the firearm which is depicted in FIG. **16** as well as the cycling of the firearm **2** action by the operating system of the firearm **2** which is depicted in FIG. **7** through FIG. **13**.

FIG. **6** depicts the rapid reset fire control **1** in its reset condition. As depicted in FIG. **6**, this reset condition of the rapid reset fire control **1** is such that the trigger sear **18** engages the hammer sear **19**. As known to the art, this engagement between the trigger sear **18** and the hammer sear **19** prevents the hammer body **36** from pivoting about the axis of the hammer pin **13** in the clockwise direction **29**. Because engagement between the trigger sear **18** and the hammer sear **19** prevents the hammer body **36** from pivoting about the axis of the hammer pin **13** in the clockwise direction **29**, the firearm **2** is prevented from firing the live ammunition cartridge **44** which is present in the firing chamber **45** while the rapid reset fire control **1** is in its reset condition.

FIG. **6** depicts the trigger interface **20** in its reset position. As depicted in FIG. **6**, this reset position of the trigger interface **20** is such that the trigger interface **20** is positioned distant from the rearward portion of the trigger well **67** in comparison to the firing position of the trigger interface **20** which is subsequently depicted in FIG. **7**. As depicted in FIG. **6**, when the rapid reset fire control **1** achieves its reset condition, the trigger interface **20** assumes its reset position.

FIG. **6** depicts the bolt carrier assembly **5** in its in-battery condition. As depicted in FIG. **6**, this in-battery condition of the bolt carrier assembly **5** is such that the bolt carrier assembly **5** is proximate to the firing chamber **45**. As known

to the art, the firearm **2** may function properly if the live ammunition cartridge **44** which is present in the firing chamber **45** is fired by the firearm **2** while the bolt carrier assembly **5** is in its in-battery condition. As known to the art, when the firearm **2** achieves the conditions which are depicted in FIG. **6** the live ammunition cartridge **44** which is present in the firing chamber **45** may be fired by the firearm **2** in a manner such that proper function of the firearm **2** is achieved. Therefore, the firearm **2** of FIG. **6** is in its ready to fire condition.

FIG. **6** depicts the firearm **2** in its ready to fire condition. In order for the user to cause the firearm **2** of FIG. **6** to fire the live ammunition cartridge **44** which is present in the firing chamber **45**, the user engages the trigger interface **20** with his or her finger **42** in a manner such that a rearward force **47** is applied unto the trigger interface **20**. As subsequently described in FIG. **7**, this rearward force **47** which is applied unto the trigger interface **20** causes the trigger interface **20** to be displaced essentially in the rearward direction **32** from its reset position which is currently depicted in FIG. **6** to its firing position which is subsequently depicted in FIG. **7**. As described in the figures, this displacement of the trigger interface **20** essentially in the rearward direction **32** causes the trigger sear **18** to be disengaged from the hammer sear **19** in a manner such that the firearm **2** will fire the live ammunition cartridge **44** which is present in the firing chamber **45** as known to the art.

FIG. **7** is a right side partial sectional view of the firearm **2** and the rapid reset fire control **1**. FIG. **7** depicts the rapid reset fire control **1** installed within the lower receiver assembly **4** of the firearm **2**. Portions of the right side of the upper receiver assembly **52**, right side of the lower receiver assembly **53** and right side of the bolt carrier assembly **54** are not depicted so that conditions within the firearm **2** may be illustrated with greater clarity. FIG. **6** through FIG. **16** depict, in sequence, the conditions within the firearm **2** as the firearm **2** is operated by the user using the rapid reset fire control **1**. This sequence includes the first firing of the firearm which is depicted in FIG. **7**, the second firing of the firearm which is depicted in FIG. **16** as well as the cycling of the firearm **2** action by the operating system of the firearm **2** which is depicted in FIG. **7** through FIG. **13**. The conditions which are depicted in FIG. **7** take place in sequence immediately after the conditions which are depicted in FIG. **6**.

FIG. **7** depicts the conditions of the firearm **2** and the rapid reset fire control **1** during the first firing of the firearm **2**. In order for the user to cause the firearm **2** of FIG. **6** to fire the live ammunition cartridge **44** which is present in the firing chamber **45**, the user has engaged the trigger interface **20** with his or her finger **42** in a manner such that a rearward force **47** is applied unto the trigger interface **20**.

As depicted in FIG. **7**, this rearward force **47** which is applied unto the trigger interface **20** has caused the trigger interface **20** to be displaced essentially in the rearward direction **32** from its reset position which is previously depicted in FIG. **6** to its firing position which is currently depicted in FIG. **7**.

Because the trigger interface **20** is an associated feature of the trigger body **35** and therefore moves with the trigger body **35**, the aforementioned displacement of the trigger interface **20** in the rearward direction **32** from its previous position which is depicted in FIG. **6** to its current position which is depicted in FIG. **7** has caused the trigger body **35** to pivot about the axis of the trigger pin **12** in the clockwise direction **29** from its previous position which is depicted in FIG. **6** to its current position which is depicted in FIG. **7**.

Because the trigger sear **18** is an associated feature of the trigger body **35** and therefore moves with the trigger body **35**, the aforementioned pivotal displacement of the trigger body **35** about the axis of the trigger pin **12** in the clockwise direction **29** from its previous position which is depicted in FIG. **6** to its current position which is depicted in FIG. **7** has caused the trigger sear **18** to be pivotally displaced about the axis of the trigger pin **12** in a manner such that the trigger sear **18** disengages from the hammer sear **19**.

As described in the figures, this disengagement of the trigger sear **18** from the hammer sear **19** has permitted force from the hammer spring **17** to cause the hammer body **36** to pivot about the axis of the hammer pin **13** in the clockwise direction **29** from its previous position which is depicted in FIG. **6** to its current position which is depicted in FIG. **7**.

As described in the figures, this displacement of the hammer body **36** from its previous position which is depicted in FIG. **6** to its current position which is depicted in FIG. **7** has caused the striking surface **21** to engage the firing pin **43**. As known to the art, this engagement between the striking surface **21** and the firing pin **43** has caused the firing pin **43** to engage the live ammunition cartridge **44** which is present in the firing chamber **45**.

As known to the art, the firing pin **43** has engaged the live ammunition cartridge **44** which is present in the firing chamber **45** in a manner such that the live ammunition cartridge **44** is fired by the firearm **2**. This first firing of the firearm **2**, which is depicted in FIG. **7**, provides impetus to the operating system of the firearm **2** as known to the art. As known to the art, this impetus from the first firing of the firearm **2** causes the bolt carrier assembly **5** to be displaced within the firearm **2** in both the rearward direction **32**, as depicted in FIG. **8** through FIG. **10**, and then in the forward direction **31**, as depicted in FIG. **11** through FIG. **13**.

FIG. **7** depicts the trigger interface **20** in its firing position. As depicted in FIG. **7**, this firing position of the trigger interface **20** is such that the trigger interface **20** is positioned proximate to the rearward portion of the trigger well **67** in comparison to the reset position of the trigger interface **20** which is depicted in FIG. **6**. As depicted in FIG. **7**, during the firing of the firearm **2** the trigger interface **20** assumes its firing position.

FIG. **7** depicts the user as continuing to engage the trigger interface **20** with his or her finger **42** in such a manner that essentially the same rearward force **47** is applied unto the trigger interface **20** as was needed to cause the first firing of the firearm **2** to occur.

The user of the firearm **2** with the rapid reset fire control **1** installed may increase or decrease the speed at which, after this first firing of the firearm **2**, the rapid reset fire control **1** reattains its reset position, by simply varying the amount of rearward force **47** by which he or she engages the trigger interface. The aforementioned increase or decrease in the speed that the rapid reset fire control **1** reattains its reset position has the effect of allowing the user of the firearm **2** with rapid reset fire control **1** installed to manipulate the rate of fire during firing of the firearm **2**.

FIG. **8** is a right side partial sectional view of the firearm **2** and the rapid reset fire control **1**. FIG. **8** depicts the rapid reset fire control **1** installed within the lower receiver assembly **4** of the firearm **2**. Portions of the right side of the upper receiver assembly **52**, right side of the lower receiver assembly **53** and right side of the bolt carrier assembly **54** are not depicted so that conditions within the firearm **2** may be illustrated with greater clarity. FIG. **6** through FIG. **16** depict, in sequence, the conditions within the firearm **2** as the firearm **2** is operated by the user using the rapid reset fire

control **1**. This sequence includes the first firing of the firearm which is depicted in FIG. **7**, the second firing of the firearm which is depicted in FIG. **16** as well as the cycling of the firearm **2** action by the operating system of the firearm **2** which is depicted in FIG. **7** through FIG. **13**. The conditions which are depicted in FIG. **8** take place in sequence immediately after the conditions which are depicted in FIG. **7**.

FIG. **8** depicts the conditions of the firearm **2** and the rapid reset fire control **1** after the first firing of the firearm **2**. This first firing of the firearm **2**, which is depicted in FIG. **7**, has provided impetus to the operating system of the firearm **2** as known to the art. This impetus from the first firing of the firearm **2** has caused the bolt carrier assembly **5** to be displaced in the rearward direction **32** within the firearm **2** from its previous position which is depicted in FIG. **7** to its current position which is depicted in FIG. **8**.

This displacement of the bolt carrier assembly **5** in the rearward direction **32** within the firearm **2** from its previous position which is depicted in FIG. **7** to its current position which is depicted in FIG. **8** has caused the bolt carrier surface **11** to engage the striking surface **21**.

Due to the aforementioned engagement between the bolt carrier surface **11** and the striking surface **21**, the hammer body **36** has been caused to pivot about the axis of the hammer pin **13** in the counter-clockwise direction **3** from its previous position which is depicted in FIG. **7** to its current position which is depicted in FIG. **8** as the bolt carrier assembly **5** was displaced within the firearm **2** in the rearward direction **32** from its previous position which is depicted in FIG. **7** to its current position which is depicted in FIG. **8**.

The aforementioned pivotal displacement of the hammer body **36** in the counter-clockwise direction **30** about the axis of the hammer pin **13** from its previous position which is depicted in FIG. **7** to its current position which is depicted in FIG. **8** has caused the hammer surface **28** to begin engaging the first surface **46** of the cam member **22**.

FIG. **8** depicts the user as continuing to engage the trigger interface **20** with his or her finger **42** in such a manner that essentially the same rearward force **47** is applied unto the trigger interface **20** as was needed to cause the first firing of the firearm **2** to occur.

FIG. **9** is a right side partial sectional view of the firearm **2** and the rapid reset fire control **1**. FIG. **9** depicts the rapid reset fire control **1** installed within the lower receiver assembly **4** of the firearm **2**. Portions of the right side of the upper receiver assembly **52**, right side of the lower receiver assembly **53** and right side of the bolt carrier assembly **54** are not depicted so that conditions within the firearm **2** may be illustrated with greater clarity. FIG. **6** through FIG. **16** depict, in sequence, the conditions within the firearm **2** as the firearm **2** is operated by the user using the rapid reset fire control **1**. This sequence includes the first firing of the firearm which is depicted in FIG. **7**, the second firing of the firearm which is depicted in FIG. **16** as well as the cycling of the firearm **2** action by the operating system of the firearm **2** which is depicted in FIG. **7** through FIG. **13**. The conditions which are depicted in FIG. **9** take place in sequence immediately after the conditions which are depicted in FIG. **8**.

FIG. **9** depicts the conditions of the firearm **2** and the rapid reset fire control **1** after the first firing of the firearm **2**. This first firing of the firearm **2**, which is depicted in FIG. **7**, has provided impetus to the operating system of the firearm **2** as known to the art. This impetus from the first firing of the firearm **2** has caused the bolt carrier assembly **5** to be displaced in the rearward direction **32** within the firearm **2** from its previous position which is depicted in FIG. **8** to its current position which is depicted in FIG. **9**.

This displacement of the bolt carrier assembly **5** in the rearward direction **32** within the firearm **2** from its previous position which is depicted in FIG. **8** to its current position which is depicted in FIG. **9** has caused the bolt carrier surface **11** to further engage the striking surface **21**.

Due to the aforementioned engagement between the bolt carrier surface **11** and the striking surface **21**, the hammer body **36** has been caused to pivot in the counter-clockwise direction **30** about the axis of the hammer pin **13** from its previous position which is depicted in FIG. **8** to its current position which is depicted in FIG. **9** as the bolt carrier assembly **5** was displaced within the firearm **2** in the rearward direction **32** from its previous position which is depicted in FIG. **8** to its current position which is depicted in FIG. **9**.

The aforementioned pivotal displacement of the hammer body **36** in the counter-clockwise direction **30** about the axis of the hammer pin **13** from its previous position which is depicted in FIG. **8** to its current position which is depicted in FIG. **9** has caused the hammer surface **28** to further engage the first surface **46** of the cam member **22**. As depicted in FIG. **9**, this further engagement between the hammer surface **28** and the first surface **46** of the cam member **22** has caused the cam member **22** to be displaced in the downward direction **34** from its previous position which is depicted in FIG. **8** to its current position which is depicted in FIG. **9**. The aforementioned downward displacement of the cam member **22** from its previous position which is depicted in FIG. **8** to its current position which is depicted in FIG. **9** has caused the cam member **22** to be depressed into the cam member hole **25** against the urging of the cam member spring **23**.

Due to the aforementioned manner in which the hammer surface **28**, first surface **46**, cam member **22**, cam member spring **23** and trigger body **35** interact, as the cam member **22** is displaced in the downward direction **34** from its previous position which is depicted in FIG. **8** to its current position which is depicted in FIG. **9**, the trigger body **35** may be caused to pivot about the axis of the trigger pin **12** in the clockwise direction **29**. This pivotal displacement of the trigger body **35** about the axis of the trigger pin **12** in the clockwise direction **29** may have the added benefit of urging the trigger interface **20** to assume its aforementioned firing position immediately after the firing of the firearm regardless of the users manipulation of the trigger interface **20** immediately after firing. Forcing the trigger interface **20** into its firing position immediately after firing may provide the added benefit consistency and ease of use.

FIG. **9** depicts the user as continuing to engage the trigger interface **20** with his or her finger **42** in such a manner that essentially the same rearward force **47** is applied unto the trigger interface **20** as was needed to cause the first firing of the firearm **2** to occur.

FIG. **10** is a right side partial sectional view of the firearm **2** and the rapid reset fire control **1**. FIG. **10** depicts the rapid reset fire control **1** installed within the lower receiver assembly **4** of the firearm **2**. Portions of the right side of the upper receiver assembly **52**, right side of the lower receiver assembly **53** and right side of the bolt carrier assembly **54** are not depicted so that conditions within the firearm **2** may be illustrated with greater clarity. FIG. **6** through FIG. **16** depict, in sequence, the conditions within the firearm **2** as the firearm **2** is operated by the user using the rapid reset fire control **1**. This sequence includes the first firing of the

firearm which is depicted in FIG. **7**, the second firing of the firearm which is depicted in FIG. **16** as well as the cycling of the firearm **2** action by the operating system of the firearm **2** which is depicted in FIG. **7** through FIG. **13**. The conditions which are depicted in FIG. **10** take place in sequence immediately after the conditions which are depicted in FIG. **9**.

FIG. **10** depicts the conditions of the firearm **2** and the rapid reset fire control **1** after the first firing of the firearm **2**. This first firing of the firearm **2**, which is depicted in FIG. **7**, has provided impetus to the operating system of the firearm **2** as known to the art. This impetus from the first firing of the firearm **2** has caused the bolt carrier assembly **5** to be displaced in the rearward direction **32** within the firearm **2** from its previous position which is depicted in FIG. **9** to its current position which is depicted in FIG. **10**.

This displacement of the bolt carrier assembly **5** in the rearward direction **32** within the firearm **2** from its previous position which is depicted in FIG. **9** to its current position which is depicted in FIG. **10** has caused the bolt carrier surface **11** to further engage the striking surface **21**.

Due to the aforementioned engagement between the bolt carrier surface **11** and the striking surface **21**, the hammer body **36** has been caused to pivot in the counter-clockwise direction **30** about the axis of hammer pin **13** from its previous position which is depicted in FIG. **9** to its current position which is depicted in FIG. **10** as the bolt carrier assembly **5** was displaced within the firearm **2** in the rearward direction **32** from its previous position which is depicted in FIG. **9** to its current position which is depicted in FIG. **10**. The aforementioned pivotal displacement of the hammer body **36** in the counter-clockwise direction **30** about the axis of the hammer pin **13** from its previous position which is depicted in FIG. **9** to its current position which is depicted in FIG. **10** has caused the hammer surface **28** to disengage from the first surface **46** of the cam member **22**.

As depicted in FIG. **10**, this disengagement of the hammer surface **28** from the first surface **46** of the cam member **22** has permitted force from the cam member spring **23** to cause the cam member **22** to be displaced in the upward direction **33** from its previous position which is depicted in FIG. **9** to its current position which is depicted in FIG. **10**. As depicted in FIG. **10**, the current position of the cam member **22** is such that the cam member **22** engages the cam member pin **24**. This engagement between the cam member **22** and the cam member pin **24** is such that further displacement of the cam member **22** in the upward direction **33** is prevented. As depicted in FIG. **10**, the current position of the cam member **22** is such that the cam member **22** engages the cam member support **27**. This engagement between the cam member **22** and cam member support **27** is such that the cam member **22** is prevented from being displaced essentially in the rearward direction **32** in relation to the position of the cam member support **27**.

FIG. **10** depicts the user as continuing to engage the trigger interface **20** with his or her finger **42** in such a manner that essentially the same rearward force **47** is applied unto the trigger interface **20** as was needed to cause the first firing of the firearm **2** to occur.

FIG. **11** is a right side partial sectional view of the firearm **2** and the rapid reset fire control **1**. FIG. **11** depicts the rapid reset fire control **1** installed within the lower receiver assembly **4** of the firearm **2**. Portions of the right side of the upper receiver assembly **52**, right side of the lower receiver assembly **53** and right side of the bolt carrier assembly **54** are not depicted so that conditions within the firearm **2** may be illustrated with greater clarity. FIG. **6** through FIG. **16** depict, in sequence, the conditions within the firearm **2** as the firearm **2** is operated by the user using the rapid reset fire control **1**. This sequence includes the first firing of the firearm which is depicted in FIG. **7**, the second firing of the firearm which is depicted in FIG. **16** as well as the cycling of the firearm **2** action by the operating system of the firearm **2** which is depicted in FIG. **7** through FIG. **13**. The conditions which are depicted in FIG. **11** take place in sequence immediately after the conditions which are depicted in FIG. **10**.

FIG. **11** depicts the conditions of the firearm **2** and the rapid reset fire control **1** after the first firing of the firearm **2**. This first firing of the firearm **2**, which is depicted in FIG. **7**, has provided impetus to the operating system of the firearm **2** as known to the art. This impetus from the first firing of the firearm **2** has caused the bolt carrier assembly **5** to be displaced in the forward direction **31** within the firearm **2** from its previous position which is depicted in FIG. **10** to its current position which is depicted in FIG. **11**.

This displacement of the bolt carrier assembly **5** in the forward direction **31** within the firearm **2** from its previous position which is depicted in FIG. **10** to its current position which is depicted in FIG. **11** has permitted the hammer body **36** to pivot about the axis of the hammer pin **13** in the clockwise direction **29** from its previous position which is depicted in FIG. **10** to its current position which is depicted in FIG. **11** by the urging of force from the hammer spring **17**.

The path of travel of the hammer surface **59** illustrates the path taken by the hammer surface **28** as the hammer body **36** pivots about the axis of the hammer pin **13**. As depicted in FIG. **11**, the second surface **41** of the cam member **22** occupies a portion of the path of travel of the hammer surface **59**. As depicted in FIG. **1**, because the second surface **41** occupies the path of travel of the hammer surface **59**, the aforementioned pivoting of the hammer body **36** in the clockwise direction **29** has caused the hammer surface **28** to begin engaging the second surface **41** of the cam member **22**.

After the hammer surface **28** has begun engaging the second surface **41** of the cam member **22**, force from the hammer spring **17** continues to urge the hammer body **36** to pivot further about the axis of the hammer pin **17** in the clockwise direction **29**. Because the second surface **41** occupies a portion of the path of travel of the hammer surface **59**, in order for the hammer body **36** to further pivot about the axis of the hammer pin **13** in the clockwise direction **29** from its current position which is depicted in FIG. **11** to its subsequent positions which are depicted in FIG. **13** and FIG. **15**, the cam member **22** must be be displaced essentially in the rearward direction **32** in relation to its current position which is depicted in FIG. **11**. This displacement of the cam member **22** essentially in the rearward direction **32** is accomplished by a camming engagement between the hammer surface **28** and the second surface **41** as the hammer surface **28** slides across the second surface **41** of the cam member **22**.

As depicted in FIG. **11**, the cam member **22** engages the cam member support **27**. Because the cam member **22** engages the cam member support **27**, the cam member **22** is prevented from being displaced essentially in the rearward direction **32** in relation to the cam member support **27**.

As described in the figures, because the cam member **22** is prevented from being displaced essentially in the rearward direction **32** in relation to the cam member support **27**, as the hammer surface **28** is displaced a certain length **64** across the second surface **41** of the cam member **22**, force from the hammer spring **17** causes the trigger body **35** to pivot about

the axis of the trigger pin **12** in the counter-clockwise direction **30** from its current position which is depicted in FIG. **11** to its subsequent position which is depicted in FIG. **13** through the aforementioned camming engagement between the hammer surface **28** and the second surface **41**.

Due to the aforementioned manner in which the hammer surface **28**, second surface **41**, cam member **22** and cam member support **27** interact, as force from the hammer spring **17** causes the hammer body **36** to pivot about the axis of the hammer pin **13** in the clockwise direction **29** from its current position which is depicted in FIG. **11** to its subsequent position which is depicted in FIG. **13**, force from the hammer spring **17** also causes the trigger body **36** to pivot about the axis of the trigger pin **12** in the counter-clockwise direction **30** from its current position which is depicted in FIG. **11** to its subsequent position which is depicted in FIG. **13**.

If, after the first firing of the firearm **2**, the user engages the trigger interface **20** with his or her finger **42** in such a manner that a significantly greater rearward force **47** is applied unto the trigger interface **20** than was needed to cause the first firing of the firearm **2** to occur, the conditions of the rapid reset fire control **1** within the firearm **2** will remain as depicted in FIG. **11** so long as such an engagement between the users finger **42** and the trigger interface **20** exists.

FIG. **11** depicts the user as continuing to engage the trigger interface **20** with his or her finger **42** in such a manner that essentially the same rearward force **47** is applied unto the trigger interface **20** as was needed to cause the first firing of the firearm **2** to occur.

FIG. **12** is an enlarged view depicting a portion of FIG. **11**. FIG. **12** further illustrates the conditions of FIG. **11**. Portions of the right side of the upper receiver assembly **52**, right side of the lower receiver assembly **53** and right side of the bolt carrier assembly **54** are not depicted so that conditions within the firearm **2** may be illustrated with greater clarity. FIG. **6** through FIG. **16** depict, in sequence, the conditions within the firearm **2** as the firearm **2** is operated by the user using the rapid reset fire control **1**. This sequence includes the first firing of the firearm which is depicted in FIG. **7**, the second firing of the firearm which is depicted in FIG. **16** as well as the cycling of the firearm **2** action by the operating system of the firearm **2** which is depicted in FIG. **7** through FIG. **13**. The conditions which are depicted in FIG. **12** take place in sequence immediately after the which are conditions depicted in FIG. **10**.

FIG. **12** depicts the conditions of the firearm **2** and the rapid reset fire control **1** after the first firing of the firearm **2**. This first firing of the firearm **2**, which is depicted in FIG. **7**, has provided impetus to the operating system of the firearm **2** as known to the art. This impetus from the first firing of the firearm **2** has caused the bolt carrier assembly **5** to be displaced in the forward direction **31** within the firearm **2** from its previous position which is depicted in FIG. **10** to its current position which is depicted in FIG. **12**.

This displacement of the bolt carrier assembly **5** in the forward direction **31** within the firearm **2** from its previous position which is depicted in FIG. **10** to its current position which is depicted in FIG. **12** has permitted the hammer body **36** to pivot about the axis of the hammer pin **13** in the clockwise direction **29** from its previous position which is depicted in FIG. **10** to its current position which is depicted in FIG. **12** by the urging of force from the hammer spring **17**.

The path of travel of the hammer surface **59** illustrates the path taken by the hammer surface **28** as the hammer body **36** pivots about the axis of the hammer pin **13**. As depicted in FIG. **12**, the second surface **41** of the cam member **22** occupies a portion of the path of travel of the hammer surface **59**. As depicted in FIG. **12**, because the second surface **41** occupies the path of travel of the hammer surface **59**, the aforementioned pivoting of the hammer body **36** in the clockwise direction **29** has caused the hammer surface **28** to begin engaging the second surface **41** of the cam member **22**.

After the hammer surface **28** has begun engaging the second surface **41** of the cam member **22**, force from the hammer spring **17** continues to urge the hammer body **36** to pivot further about the axis of the hammer pin **17** in the clockwise direction **29**. Because the second surface **41** occupies a portion of the path of travel of the hammer surface **59**, in order for the hammer body **36** to further pivot about the axis of the hammer pin **13** in the clockwise direction **29** from its current position which is depicted in FIG. **12** to its subsequent positions which are depicted in FIG. **13** and FIG. **15**, the cam member **22** must be displaced essentially in the rearward direction **32** in relation to its current position which is depicted in FIG. **12**. This displacement of the cam member **22** essentially in the rearward direction **32** is accomplished by a camming engagement between the hammer surface **28** and the second surface **41** as the hammer surface **28** slides across the second surface **41** of the cam member **22**.

As depicted in FIG. **12**, the cam member **22** engages the cam member support **27**. Because the cam member **22** engages the cam member support **27**, the cam member **22** is prevented from being displaced essentially in the rearward direction **32** in relation to the cam member support **27**.

As described in the figures, because the cam member **22** is prevented from being displaced essentially in the rearward direction **32** in relation to the cam member support **27**, as the hammer surface **28** is displaced a certain length **64** across the second surface **41** of the cam member **22**, force from the hammer spring **17** causes the trigger body **35** to pivot about the axis of the trigger pin **12** in the counter-clockwise direction **30** from its current position which is depicted in FIG. **12** to its subsequent position which is depicted in FIG. **13** through the aforementioned camming engagement between the hammer surface **28** and the second surface **41**.

Due to the aforementioned manner in which the hammer surface **28**, second surface **41**, cam member **22** and cam member support **27** interact, as force from the hammer spring **17** causes the
hammer body **36** to pivot about the axis of the hammer pin **13** in the clockwise direction **29** from its current position which is depicted in FIG. **12** to its subsequent position which is depicted in FIG. **13**, force from the hammer spring **17** also causes the trigger body **36** to pivot about the axis of the trigger pin **12** in the counter-clockwise direction **30** from its current position which is depicted in FIG. **12** to its subsequent position which is depicted in FIG. **13**.

If, after the first firing of the firearm **2**, the user engages the trigger interface **20** with his or her finger **42** in such a manner that a significantly greater rearward force **47** is applied unto the trigger interface **20** than was needed to cause the first firing of the firearm **2** to occur, the conditions of the rapid reset fire control **1** within the firearm **2** will remain as depicted in FIG. **12** so long as such an engagement between the users finger **42** and the trigger interface **20** exists.

FIG. **12** depicts the user as continuing to engage the trigger interface **20** with his or her finger **42** in such a manner

that essentially the same rearward force **47** is applied unto the trigger interface **20** as was needed to cause the first firing of the firearm **2** to occur.

FIG. **12** depicts the angle of the second surface **58**. This angle of the second surface is configured in conjunction with geometry of the other elements of the rapid reset fire control **1** such that the functions of the present invention as described in FIG. **6** through FIG. **16** may be performed.

FIG. **13** is a right side partial sectional view of the firearm **2** and the rapid reset fire control **1**. FIG. **13** depicts the rapid reset fire control **1** installed within the lower receiver assembly **4** of the firearm **2**. Portions of the right side of the upper receiver assembly **52**, right side of the lower receiver assembly **53** and right side of the bolt carrier assembly **54** are not depicted so that conditions within the firearm **2** may be illustrated with greater clarity. FIG. **6** through FIG. **16** depict, in sequence, the conditions within the firearm **2** as the firearm **2** is operated by the user using the rapid reset fire control **1**. This sequence includes the first firing of the firearm which is depicted in FIG. **7**, the second firing of the firearm which is depicted in FIG. **16** as well as the cycling of the firearm **2** action by the operating system of the firearm **2** which is depicted in FIG. **7** through FIG. **13**. The conditions which are depicted in FIG. **13** take place in sequence immediately after the conditions which are depicted in FIG. **11**.

FIG. **13** depicts the conditions of the firearm **2** and the rapid reset fire control **1** after the first firing of the firearm **2**. This first firing of the firearm **2**, which is depicted in FIG. **7**, has provided impetus to the operating system of the firearm **2** as known to the art. This impetus from the first firing of the firearm **2** has caused the bolt carrier assembly **5** to be displaced in the forward direction **31** within the firearm **2** from its previous position which is depicted in FIG. **11** to its current position which is depicted in FIG. **13**.

This displacement of the bolt carrier assembly **5** in the forward direction **31** within the firearm **2** from its previous position which is depicted in FIG. **11** to its current position which is depicted in FIG. **13** has caused the bolt carrier assembly **5** to achieve its in-battery condition and has also caused a live ammunition cartridge **44** to be loaded into the firing chamber **45**.

It is worthy to note that FIG. **13** depicts the bolt carrier assembly **5** as having achieved its in-battery condition while the rapid reset fire control **1** has not yet achieved its reset condition. Because the bolt carrier assembly **5** has achieved its in-battery condition before the rapid reset fire control **1** has achieved its reset condition, the firearm **2** will immediately achieve the ready to fire condition the instant the rapid reset fire control achieves its reset condition as subsequently depicted in FIG. **15**. Therefore, for the sake of reliable function of the present invention, the rapid reset fire control **1** may be designed in a manner such that the bolt carrier assembly **5** is likely to achieve its in-battery condition before the rapid reset fire control **1** has achieved its reset condition.

As described in the figures, force from the hammer spring **17** continually urges the hammer body **36** to pivot further about the axis of the hammer pin **17** in the clockwise direction **29**. FIG. **13** depicts the conditions of the firearm **2** and the rapid reset fire control **1** after force from the hammer spring **17** has caused the hammer body **36** to pivot about the axis of the hammer pin **13** in the clockwise direction **29** from its previous position which is depicted in FIG. **1** to its current position which is depicted in FIG. **13**.

Due to the aforementioned manner in which the hammer surface **28**, second surface **41**, cam member **22** and cam member support **27** interact as previously described in both FIG. **11** and FIG. **12**, as force from the hammer spring **17** has caused the hammer body **36** to pivot about the axis of the hammer pin **13** in the clockwise direction **29** from its previous position which is depicted in FIG. **11** to its current position which is depicted in FIG. **13**, force from the hammer spring **17** has also caused the trigger body **36** to pivot about the axis of the trigger pin **12** in the counter-clockwise direction **30** from its previous position which is depicted in FIG. **11** to its current position which is depicted in FIG. **13**.

Because the trigger interface **20** is an associated feature of the trigger body **35** and therefore moves with the trigger body **35**, the aforementioned pivotal displacement of the trigger body **35** about the axis of the trigger pin **12** in the counter-clockwise direction **30** has caused the trigger interface **20** to be displaced essentially in the forward direction **31** from its previous position which is depicted in FIG. **11** to its current position which is depicted in FIG. **13**.

The path of travel of the hammer sear **63** illustrates the path taken by the hammer sear **19** as the hammer body **36** pivots about the axis of the hammer pin **13**. Because the trigger sear **18** is an associated feature of the trigger body **35** and therefore moves with the trigger body **35**, the aforementioned pivotal displacement of the trigger body **35** about the axis of the trigger pin **12** in the counter-clockwise direction **30** from its previous position which is depicted in FIG. **11** to its current position which is depicted in FIG. **13** has caused the trigger sear **18** to pivot about the axis of the trigger pin **12** in the counter-clockwise direction **30** from its previous position which is depicted in FIG. **11** to its current position which is depicted in FIG. **13**. This current position of the trigger sear **18**, which is depicted in FIG. **13**, is such that the trigger sear **18** occupies a portion of the path of travel of the hammer sear **63**.

FIG. **13** depicts a cuspal engagement between the hammer surface **28** and the second surface **41** of the cam member **22**. This cuspal engagement between the hammer surface **28** and the second surface **41** of the cam member **22** is such that further pivotal displacement of the hammer body **36** about the axis of the hammer pin **13** in the clockwise direction **29** in relation to its current position which is depicted in FIG. **13** will cause the hammer surface **28** to disengage from the second surface **41** of the cam member **22**. As described in the figures, force from the hammer spring **17** continually urges the hammer body **36** to pivot further about the axis of the hammer pin **17** in the clockwise direction **29**. Therefore, as described in the figures, once the hammer surface **28** is disengaged from the second surface **41** of the cam member **22**, the hammer body **36** will be caused to pivot about the axis of the hammer pin **13** in the clockwise direction **29** from its current position which is depicted in FIG. **13** to its subsequent position which is depicted in FIG. **15** by the urging of force from the hammer spring **17**.

Because the trigger sear **18** occupies the path of travel of the hammer sear **63**, the aforementioned pivotal displacement of the hammer body **36** about the axis of the hammer pin **13** in the clockwise direction **31** from its current position which is depicted in FIG. **13** to its subsequent position which is depicted in FIG. **15** will cause the hammer sear **19** to begin engaging trigger sear **18**. As subsequently depicted in FIG. **15**, this engagement between the hammer sear **19** and the trigger sear **18** prevents further pivotal displacement of the hammer body **36** in the clockwise direction **29** and returns the rapid reset fire control **1** to its reset condition.

FIG. **13** depicts the user as continuing to engage the trigger interface **20** with his or her finger **42** in such a manner

that essentially the same rearward force **47** is applied unto the trigger interface **20** as was needed to cause the first firing of the firearm **2** to occur.

FIG. **14** is an enlarged view depicting a portion of FIG. **13**. FIG. **14** further illustrates the conditions of FIG. **13**. Portions of the right side of the upper receiver assembly **52**, right side of the lower receiver assembly **53** and right side of the bolt carrier assembly **54** are not depicted so that conditions within the firearm **2** may be illustrated with greater clarity. FIG. **6** through FIG. **16** depict, in sequence, the conditions within the firearm **2** as the firearm **2** is operated by the user using the rapid reset fire control **1**. This sequence includes the first firing of the firearm which is depicted in FIG. **7**, the second firing of the firearm which is depicted in FIG. **16** as well as the cycling of the firearm **2** action by the operating system of the firearm **2** which is depicted in FIG. **7** through FIG. **13**. The conditions which are depicted in FIG. **14** take place in sequence immediately after the conditions which are depicted in FIG. **11**.

FIG. **14** depicts the conditions of the firearm **2** and the rapid reset fire control **1** after the first firing of the firearm **2**. This first firing of the firearm **2**, which is depicted in FIG. **7**, has provided impetus to the operating system of the firearm **2** as known to the art. This impetus from the first firing of the firearm **2** has caused the bolt carrier assembly **5** to be displaced in the forward direction **31** within the firearm **2** from its previous position which is depicted in FIG. **11** to its current position which is depicted in FIG. **14**.

This displacement of the bolt carrier assembly **5** in the forward direction **31** within the firearm **2** from its previous position which is depicted in FIG. **11** to its current position which is depicted in FIG. **14** has caused the bolt carrier assembly **5** to achieve its in-battery condition and has also caused a live ammunition cartridge **44** to be loaded into the firing chamber **45**.

It is worthy to note that FIG. **14** depicts the bolt carrier assembly **5** as having achieved its in-battery condition while the rapid reset fire control **1** has not yet achieved its reset condition. Because the bolt carrier assembly **5** has achieved its in-battery condition before the rapid reset fire control **1** has achieved its reset condition, the firearm **2** will immediately achieve the ready to fire condition the instant the rapid reset fire control achieves its reset condition as subsequently depicted in FIG. **15**. Therefore, for the sake of reliable function of the present invention, the rapid reset fire control **1** may be designed in a manner such that the bolt carrier assembly **5** is likely to achieve its in-battery condition before the rapid reset fire control **1** has achieved its reset condition.

As described in the figures, force from the hammer spring **17** continually urges the hammer body **36** to pivot further about the axis of the hammer pin **17** in the clockwise direction **29**. FIG. **14** depicts the conditions of the firearm **2** and the rapid reset fire control **1** after force from the hammer spring **17** has caused the hammer body **36** to pivot about the axis of the hammer pin **13** in the clockwise direction **29** from its previous position which is depicted in FIG. **11** to its current position which is depicted in FIG. **14**.

Due to the aforementioned manner in which the hammer surface **28**, second surface **41**, cam member **22** and cam member support **27** interact as previously described in both FIG. **11** and FIG. **12**, as force from the hammer spring **17** has caused the hammer body **36** to pivot about the axis of the hammer pin **13** in the clockwise direction **29** from its previous position which is depicted in FIG. **11** to its current position which is depicted in FIG. **14**, force from the hammer spring **17** has also caused the trigger body **36** to pivot about the axis of the trigger pin **12** in the counter-clockwise direction **30** from its previous position which is depicted in FIG. **11** to its current position which is depicted in FIG. **14**.

Because the trigger interface **20** is an associated feature of the trigger body **35** and therefore moves with the trigger body **35**, the aforementioned pivotal displacement of the trigger body **35** about the axis of the trigger pin **12** in the counter-clockwise direction **30** has caused the trigger interface **20** to be displaced essentially in the forward direction **31** from its previous position which is depicted in FIG. **11** to its current position which is depicted in FIG. **14**.

The path of travel of the hammer sear **63** illustrates the path taken by the hammer sear **19** as the hammer body **36** pivots about the axis of the hammer pin **13**. Because the trigger sear **18** is an associated feature of the trigger body **35** and therefore moves with the trigger body **35**, the aforementioned pivotal displacement of the trigger body **35** about the axis of the trigger pin **12** in the counter-clockwise direction **30** from its previous position which is depicted in FIG. **11** to its current position which is depicted in FIG. **14** has caused the trigger sear **18** to pivot about the axis of the trigger pin **12** in the counter-clockwise direction **30** from its previous position which is depicted in FIG. **11** to its current position which is depicted in FIG. **14**. This current position of the trigger sear **18**, which is depicted in FIG. **14**, is such that the trigger sear **18** occupies a portion of the path of travel of the hammer sear **63**.

FIG. **14** depicts a cuspal engagement between the hammer surface **28** and the second surface **41** of the cam member **22**. This cuspal engagement between the hammer surface **28** and the second surface **41** of the cam member **22** is such that further pivotal displacement of the hammer body **36** about the axis of the hammer pin **13** in the clockwise direction **29** in relation to its current position which is depicted in FIG. **14** will cause the hammer surface **28** to disengage from the second surface **41** of the cam member **22**. As described in the figures, force from the hammer spring **17** continually urges the hammer body **36** to pivot further about the axis of the hammer pin **17** in the clockwise direction **29**. Therefore, as described in the figures, once the hammer surface **28** is disengaged from the second surface **41** of the cam member **22**, the hammer body **36** will be caused to pivot about the axis of the hammer pin **13** in the clockwise direction **29** from its current position which is depicted in FIG. **14** to its subsequent position which is depicted in FIG. **15** by the urging of force from the hammer spring **17**.

Because the trigger sear **18** occupies the path of travel of the hammer sear **63**, the aforementioned pivotal displacement of the hammer body **36** about the axis of the hammer pin **13** in the clockwise direction **31** from its current position which is depicted in FIG. **14** to its subsequent position which is depicted in FIG. **15** will cause the hammer sear **19** to begin engaging trigger sear **18**. As subsequently depicted in FIG. **15**, this engagement between the hammer sear **19** and the trigger sear **18** prevents further pivotal displacement of the hammer body **36** in the clockwise direction **29** and returns the rapid reset fire control **1** to its reset condition.

FIG. **14** depicts the user as continuing to engage the trigger interface **20** with his or her finger **42** in such a manner that essentially the same rearward force **47** is applied unto the trigger interface **20** as was needed to cause the first firing of the firearm **2** to occur.

FIG. **15** is a right side partial sectional view of the firearm **2** and the rapid reset fire control **1**. FIG. **15** depicts the rapid reset fire control **1** installed within the lower receiver assembly **4** of the firearm **2**. Portions of the right side of the upper receiver assembly **52**, right side of the lower receiver

assembly **53** and right side of the bolt carrier assembly **54** are not depicted so that conditions within the firearm **2** may be illustrated with greater clarity. FIG. **6** through FIG. **16** depict, in sequence, the conditions within the firearm **2** as the firearm **2** is operated by the user using the rapid reset fire control **1**. This sequence includes the first firing of the firearm which is depicted in FIG. **7**, the second firing of the firearm which is depicted in FIG. **16** as well as the cycling of the firearm **2** action by the operating system of the firearm **2** which is depicted in FIG. **7** through FIG. **13**. The conditions which are depicted in FIG. **15** take place in sequence immediately after the conditions which are depicted in FIG. **13**.

FIG. **15** depicts the conditions of the firearm **2** and the rapid reset fire control **1** after the first firing of the firearm **2**. This first firing of the firearm **2**, which is depicted in FIG. **7**, has provided impetus to the operating system of the firearm **2** as known to the art.

As described in the figures, this impetus from the first firing of the firearm **2** has caused the bolt carrier assembly **5** to be displaced within the firearm **2**. As depicted in FIG. **15**, this displacement has caused the bolt carrier assembly **5** to achieve its in-battery condition and has also caused a live ammunition cartridge **44** to be loaded into the firing chamber **45**. Therefore, as known to the art, the firearm **2** and the rapid reset fire control **2** of FIG. **15** have completed a full cycle of operation for a typical self-loading firearm.

As depicted in FIG. **15**, the in-battery condition of the bolt carrier assembly **5** is such that the bolt carrier assembly **5** is proximate to the firing chamber **45**. As known to the art, when the firearm **2** achieves the conditions which are depicted in FIG. **15**, the live ammunition cartridge **44** which is present in the firing chamber **45** may be fired by the firearm **2** in a manner such that proper function of the firearm **2** is achieved.

As described in the figures, force from the hammer spring **17** continually urges the hammer body **36** to pivot further about the axis of the hammer pin **17** in the clockwise direction **29**.

This force from the hammer spring **17** has caused the hammer body **36** to pivot about the axis of the hammer pin **13** in the clockwise direction **29** from its previous position as depicted in FIG. **13** to its current position as depicted in FIG. **15**. Because the hammer surface **21** is an associated feature of the hammer body **36** and moves with the hammer body **36**, this pivotal displacement of the hammer body **36** from its previous position as depicted in FIG. **13** to its current position as depicted in FIG. **15** has caused the hammer surface **28** to slide across the second surface **41** of the cam member **22** through a camming engagement. This camming engagement causes the hammer surface **28** to slip off the cusp of the second surface **41** such that the hammer surface **28** disengages from the second surface **41** of the cam member **22**.

At the instant the hammer surface **28** disengaged from the second surface **28** of the cam member **22**, the trigger body **35** is oriented in a manner such that the trigger sear **18** occupies a portion of the path of travel of the hammer sear **63**. Once the hammer surface **28** disengages from the second surface **41** by the aforementioned camming engagement, the hammer surface is caused to pivot about the axis of the hammer pin **18** in the clockwise direction **29** from its previous position which is depicted in FIG. **13** to its current position which is depicted in FIG. **15** by the urging of force from the hammer spring **17**. Because the trigger sear **18** occupied the path of travel of the hammer sear **63**, the aforementioned pivotal displacement of the hammer body **36** about the axis of the hammer pin **13** in the clockwise direction **29** from its previous position which is depicted in FIG. **13** to its current position which is depicted in FIG. **15** has caused the hammer sear **19** to engage the trigger sear **18**.

FIG. **15** depicts the rapid reset fire control **1** as having reattained its reset condition due to the functions of the present invention. As depicted in FIG. **15**, this reset condition of the rapid reset fire control **1** is such that the trigger sear **18** engages the hammer sear **19**. As known to the art, this engagement between the trigger sear **18** and the hammer sear **19** prevents the hammer body **36** from pivoting about the axis of the hammer pin **13** in the clockwise direction **29**. Because engagement between the trigger sear **18** and the hammer sear **19** prevents the hammer body **36** from pivoting about the axis of the hammer pin **13** in the clockwise direction **29**, the firearm **2** is prevented from firing the live ammunition cartridge **44** which is present in the firing chamber **45** while the rapid reset fire control **1** is in its reset condition.

As depicted in FIG. **15**, when the rapid reset fire control **1** achieves its reset condition, the trigger interface **20** assumes its reset position. As depicted in FIG. **15**, this reset position of the trigger interface **20** is such that the trigger interface **20** is positioned distant from the rearward portion of the trigger well **67** in comparison to the firing position of the trigger interface **20** which is depicted in FIG. **16**.

The sequence of events by which the present invention harnesses force from the hammer spring **17** to cause the rapid reset fire control **1** to reattain its reset condition, as described in FIG. **6** through FIG. **15**, have occurred despite the user having continued to engage the trigger interface **20** with his or her finger **42** in such a manner that essentially the same rearward force **47** has been applied unto the trigger interface **20** as was needed to cause the first firing of the firearm **2** to occur. Said force from the hammer spring **17** has overcome the force applied to the trigger interface **20** by the finger **42** of the user, such that the rapid reset fire control **1** has reattained its reset condition. However, the instant that the hammer surface **28** and the second surface **41** of the cam member **22** disengage, this force from the hammer spring **17** ceases to urge the trigger interface **20** in the forward direction **31**.

Because the force from the hammer spring **17** ceases to urge the trigger interface **20** in the forward direction **31** instantaneously when the hammer surface **28** disengages from the second surface **41** of the cam member **22**, if the user has continued to engage the trigger interface **20** with his or her finger **42** in such a manner that essentially the same rearward force **47** is applied unto the trigger interface **20** as was needed to cause the first firing of the firearm **2** to occur, the trigger interface **20** will immediately be urged essentially in the rearward direction **32** due to a nearly instantaneous change in the balance of the forces fighting for control over the direction that the trigger interface **20** is to be displaced.

As depicted in FIG. **15**, the user has continued to engage the trigger interface **20** with his or her finger **42** in such a manner that essentially the same rearward force **47** is applied unto the trigger interface **20** as was needed to cause the first firing of the firearm **2** to occur. As subsequently described in FIG. **16**, this rearward force **47** which is applied unto the trigger interface **20** causes the trigger interface **20** to be displaced essentially in the rearward direction **32** from its current position which is depicted in FIG. **15** to its subsequent position which is depicted in FIG. **16**. As described in the figures, this displacement of the trigger interface **20** essentially in the rearward direction **32** causes the trigger sear **18** to be disengaged from the hammer sear

19 in a manner such that the firearm 2 will fire the live ammunition cartridge 44 which is present in the firing chamber 45 as known to the art.

If the user does not wish to cause the firearm 2 to fire an additional live ammunition cartridge 44 after the first firing of the firearm 2, the user need only reduce the rearward force 47 being applied with his or her finger 42 to the trigger interface 20 such that said rearward force 47 is less than the rearward force 47 which was required for the first firing of the firearm 2 to occur.

FIG. 16 is a right side partial sectional view of the firearm 2 and the rapid reset fire control 1. FIG. 16 depicts the rapid reset fire control 1 installed within the lower receiver assembly 4 of the firearm 2. Portions of the right side of the upper receiver assembly 52, right side of the lower receiver assembly 53 and right side of the bolt carrier assembly 54 are not depicted so that conditions within the firearm 2 may be illustrated with greater clarity. FIG. 6 through FIG. 16 depict, in sequence, the conditions within the firearm 2 as the firearm 2 is operated by the user using the rapid reset fire control 1. This sequence includes the first firing of the firearm which is depicted in FIG. 7, the second firing of the firearm which is depicted in FIG. 16 as well as the cycling of the firearm 2 action by the operating system of the firearm 2 which is depicted in FIG. 7 through FIG. 13. The conditions which are depicted in FIG. 16 take place in sequence immediately after the conditions which are depicted in FIG. 15.

FIG. 16 depicts the conditions of the firearm 2 and the rapid reset fire control 1 during the second firing of the firearm 2. In order for the user to cause the firearm 2 of FIG. 15 to fire the live ammunition cartridge 44 which is present in the firing chamber 45, the user has engaged the trigger interface 20 with his or her finger 42 in a manner such that a rearward force 47 is applied unto the trigger interface 20.

As depicted in FIG. 16, this rearward force 47 which is applied unto the trigger interface 20 has caused the trigger interface 20 to be displaced essentially in the rearward direction 32 from its previous position which is depicted in FIG. 15 to its current position which is depicted in FIG. 16.

Because the trigger interface 20 is an associated feature of the trigger body 35 and therefore moves with the trigger body 35, the aforementioned displacement of the trigger interface 20 essentially in the rearward direction 32 from its previous position which is depicted in FIG. 15 to its current position which is depicted in FIG. 16 has caused the trigger body 35 to pivot about the axis of the trigger pin 12 in the clockwise direction 29 from its previous position which is depicted in FIG. 15 to its current position which is depicted in FIG. 16.

Because the trigger sear 18 is an associated feature of the trigger body 35 and therefore moves with the trigger body 35, the aforementioned pivotal displacement of the trigger body 35 about the axis of the trigger pin 12 in the clockwise direction 29 from its previous position which is depicted in FIG. 15 to its current position which is depicted in FIG. 16 has caused the trigger sear 18 to be pivotally displaced about the axis of the trigger pin 12 in a manner such that the trigger sear 18 disengages from the hammer sear 19.

As described in the figures, this disengagement of the trigger sear 18 from the hammer sear 19 has permitted force from the hammer spring 17 to cause the hammer body 36 to pivot about the axis of the hammer pin 13 in the clockwise direction 29 from its previous position which is depicted in FIG. 15 to its current position which is depicted in FIG. 16.

As described in the figures, this displacement of the hammer body 36 from its previous position which is depicted in FIG. 15 to its current position which is depicted in FIG. 16 has caused the striking surface 21 to engage the firing pin 43. As known to the art, this engagement between the striking surface 21 and the firing pin 43 has caused the firing pin 43 to engage the live ammunition cartridge 44 which is present in the firing chamber 45.

As known to the art, the firing pin 43 has engaged the live ammunition cartridge 44 which is present in the firing chamber 45 in a manner such that the live ammunition cartridge 44 is fired by the firearm 2. This second firing of the firearm 2, which is depicted in FIG. 16, provides impetus to the operating system of the firearm 2 as known to the art. As known to the art, this impetus from the second firing of the firearm 2 causes the bolt carrier assembly 5 to be displaced within the firearm 2 in both the rearward direction 32, in a manner such as depicted in FIG. 8 through FIG. 10, and then in the forward direction 31, in a manner such as depicted in FIG. 11 through FIG. 13.

FIG. 16 depicts the trigger interface 20 in its firing position. As depicted in FIG. 16, this firing position of the trigger interface 20 is such that the trigger interface 20 is positioned proximate to the rearward portion of the trigger well 67 in comparison to the reset position of the trigger interface 20 which is depicted in FIG. 15. As depicted in FIG. 16, during the firing of the firearm 2 the trigger interface 20 assumes its firing position.

From the first firing of the firearm 2 which is depicted in FIG. 7 to the second firing of the firearm 2 which is depicted in FIG. 16, the user has continued engaging the trigger interface 20 with his or her finger 42 in a manner such that essentially the same rearward force 47 is applied unto the trigger interface 20 as is required to cause the firearm 2 to fire. Therefore an analysis of the figures makes it readily understood that the rapid reset fire control 1 allows for consecutive firings of the firearm 2 to occur rapidly wherein the trigger is placed in its reset position, not by the urging of the user, but by interaction between the rapid reset fire control 1 and the firearm 2. Therefore it is readily understood that if, after the conditions depicted in FIG. 16, the user continues to engage the trigger interface 20 with his or her finger 42 in such a manner that essentially the same rearward force 47 is applied unto the trigger interface 20 as was required to cause the firing of the firearm 2, the firearm 2 will continue to fire rapidly until live ammunition cartridges 44 are no longer available for the action of the firearm 2 to load into the firing chamber 45.

FIG. 17 is a right side partial sectional view of a second embodiment of the present invention 69. The second embodiment of the present invention 69 may be installed within the firearm 2 of FIG. 4 and engage with the firearm 2 of FIG. 4 in a manner such that the functions of the present invention as described in FIG. 6 through FIG. 16 may be performed. Instead of utilizing the plunger-like design of the cam member 22 of FIG. 1, the second embodiment of the moving part 81 utilizes a pivotal body to perform all the functions of the cam member 22 of FIG. 1. FIG. 17 depicts the second embodiment of the present invention 69 in its reset condition. As known to the art, this reset condition is such that the trigger sear 18 engages the hammer sear 19.

The second embodiment of the present invention comprises a number of features which are similar or identical to features found on the rapid reset fire control 1 of FIG. 3, these features perform identical function as the corresponding features found on the rapid reset fire control 1 of FIG. 3. The second embodiment of the present invention 69 of FIG. 17 comprises a second embodiment of the trigger body 73, a second embodiment of the hammer body 77, a second

embodiment of the cam member **81**, a pivot pin **38**, a second embodiment of the first surface **82**, a second embodiment of the second surface **83**, a user interface **20**, a cam member spring **23**, a trigger spring **16**, a trigger sear **18**, a trigger pin hole **55** and a trigger pin **12**, a striking surface **21**, a hammer surface **28**, a hammer pin **13**, a hammer pin hole **56**, a hammer sear **19** and a hammer spring **17**.

Additional embodiments of the present invention are possible which essentially conform to alternative fire control group configurations as known to the art which differ in arrangement, geometry, dimensions and operation.

FIG. **18** is a right side partial sectional view of a third embodiment of the present invention **70**. The third embodiment of the present invention **70** may be installed within the firearm **2** of FIG. **4** and engage with the firearm **2** of FIG. **4** in a manner such that the functions of the present invention as described in FIG. **6** through FIG. **16** may be performed. Instead of utilizing the typical AR-15 style trigger sear and hammer sear arrangement like that of the trigger sear **18** and hammer sear **19** of FIG. **3**, the sears are located in an alternative location upon the trigger body and the hammer body. Alternative sear arrangements, like that depicted in FIG. **18** may have particular usefulness in embodiments of the present invention designed for precision or match shooting. Alternate sear arrangements, like that depicted in FIG. **18** may also have particular suitability for embodiments of the present invention designed for various types of firearms. The second embodiment of the trigger sear **89** and second embodiment of the hammer sear **90** perform all the functions of the trigger sear **18** and hammer sear **19** of FIG. **3**. FIG. **18** depicts the third embodiment of the present invention **69** in its reset condition. As known to the art, this reset condition is such that the second embodiment of the trigger sear **89** engages the second embodiment of the hammer sear **90**.

The third embodiment of the present invention comprises a number of features which are similar or identical to features found on the rapid reset fire control **1** of FIG. **3**, these features perform identical function as the corresponding features found on the rapid reset fire control **1** of FIG. **3**. The third embodiment of the present invention **70** of FIG. **18** comprises a third embodiment of the trigger body **74**, a third embodiment of the hammer body **78**, a cam member **22**, the first surface **46**, the second surface **41**, a user interface **20**, a cam member spring **23**, a trigger spring **16**, a trigger pin hole **55** and a trigger pin **12**, a striking surface **21**, a hammer surface **28**, a hammer pin **13**, a hammer pin hole **56**, a hammer sear **19**, the second embodiment of the trigger sear **89**, a cam member support **27**, a cam member pin **24**, a second embodiment of the hammer sear **9** and a hammer spring **17**.

Additional embodiments of the present invention are possible which essentially conform to alternative fire control group configurations as known to the art which differ in arrangement, geometry, dimensions and operation.

FIG. **19** is a right side partial sectional view of a fourth embodiment of the present invention **71**. The fourth embodiment of the present invention **71** may be installed within the firearm **2** of FIG. **4** and engage with the firearm **2** of FIG. **4** in a manner such that the functions of the present invention as described in FIG. **6** through FIG. **16** may be performed. Instead of placing the cam member **22** upon the trigger body **35** as is the arrangement of FIG. **3**, the fourth embodiment of the present invention **71** places the cam member **22** upon the fourth embodiment of the hammer body **79** as depicted in FIG. **19**. Alternate arrangements of certain features of the present invention, like that depicted in FIG. **18**, may have particular suitability for embodiments of the present invention designed for various types of firearms. The cam member **22** depicted in FIG. **19** interacts with the trigger surface **39** in order to perform all the functions of the cam member **22** of FIG. **3**.

FIG. **19** depicts the fourth embodiment of the present invention **69** in its reset condition. As known to the art, this reset condition is such that the trigger sear **18** engages the hammer sear **19**.

The fourth embodiment of the present invention **71** comprises a number of features which are similar or identical to features found on the rapid reset fire control **1** of FIG. **3**, these features perform identical function as the corresponding features found on the rapid reset fire control **1** of FIG. **3**. The fourth embodiment of the present invention **71** of FIG. **19** comprises a forth embodiment of the trigger body **75**, a forth embodiment of the hammer body **79**, a cam member **22**, the first surface **46**, the second surface **41**, a user interface **20**, a cam member spring **23**, a trigger spring **16**, a trigger pin hole **55** and a trigger pin **12**, a striking surface **21**, a hammer surface **28**, a hammer pin **13**, a hammer pin hole **56**, a hammer sear **19**, the second embodiment of the trigger sear **89**, a cam member support **27**, a cam member pin **24**, a second embodiment of the hammer sear **9** and a hammer spring **17**.

Additional embodiments of the present invention are possible which essentially conform to alternative fire control group configurations as known to the art which differ in arrangement, geometry, dimensions and operation.

DETAILED DESCRIPTION OF SELECT EXEMPLARY EMBODIMENTS

The present invention may be embodied in other specific forms without departing from its structures, methods, or other essential characteristics as broadly described herein and claimed hereinafter. The described embodiments are to be considered in all respects only as illustrative, and not restrictive. The scope of the present invention is, therefore, indicated by the appended claims, rather than by the foregoing description. All changes that come within the meaning and range of equivalency of the claims are to be embraced within their scope. The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. All of the parts discussed herein may be made of metal, plastic or composites. In addition, the parts may be machined, cast, molded, extruded, stamped or forged. The described embodiments are to be considered in all respects only as illustrative and not restrictive. All changes and alternatives that would be known to one of skill in the art are embraced within the scope of the present invention.

One exemplary embodiment of the present invention is well illustrated by the rapid reset fire control **1** of FIG. **3**. The rapid reset fire control **1** of FIG. **3** may be used with the firearm **2** of FIG. **4** in order that the functions of the present invention may be performed. The rapid reset fire control **1** of FIG. **3** may be manufactured using similar materials, techniques, arrangements, geometries and dimensions as used to manufacture similar fire control groups for firearms which are known to the art.

The rapid reset fire control **1** of FIG. **3** is well suited for being constructed primarily of steel, as steel construction provides high durability and ease of manufacture. The rapid reset fire control **1** of FIG. **3** is well suited for being manufactured using metal casting and metal machining techniques which are known to the art. In particular, the trigger body **35** and hammer body **36** are well suited for

being manufactured from steel castings. In order to manufacture the trigger body **35** and hammer body **36** using steel castings, their basic shapes are first cast of steel. After this, the steel castings of the trigger body **35** and hammer body **36** are machined to include the particular arrangements, geometries and dimensions of the features found on the trigger body **35** and hammer body **36** as illustrated in FIG. **3** as required to perform the functions of the rapid reset fire control **1** As described in the figures.

The particular methods of machining these steel castings of the trigger body **35** and hammer body **36** are known to the art. These machining processes may include milling, turning, drilling and grinding. The particular features which are machined into the steel casting of the hammer body **36** are the striking surface **21**, the hammer surface **28**, the hammer pin hole **56** and the hammer sear **19**. The particular features which are machined into the steel casting of the trigger body **35** are the user interface **20**, the cam member hole **25**, the cam member pin hole **26**, the trigger sear **18**, the cam member support **27** and the trigger pin hole **55**.

In particular, the cam member hole **25** is to be drilled into the steel casting of the trigger body **35** at the proper location, angle, width and depth to provide proper clearance for both the cam member spring **23** and the cam member **22**. The angle and location at which the cam member hole **25** is drilled is chosen such that the cam member **22** provides a particular angle of the second surface **58**, as described in FIG. **12**, such that proper function of the present invention is provided. This angle of the second surface **58** influences the amount of force from the hammer spring **17** which is transferred into the trigger body **35**. In order to ensure proper function of the present invention. As described in the figures, the angle and location at which the cam member hole **25** is drilled may be modified from that which is depicted in FIG. **12** in order to increase or decrease the force from the hammer spring **17** which is transferred into the trigger body **35**. Furthermore, the particular strength of the hammer spring **17** may be modified to ensure proper function of the present invention As described in the figures. Furthermore, the particular strength of the trigger spring **16** may be modified to adjust the specific attributes of the return bias of the trigger body **35** and ensure proper function of the present invention As described in the figures. Attention should be given to the angle, geometry and finish of the trigger sear **18** and hammer sear **19** such that a configuration which performs the functions of the rapid reset fire control **1** As described in the figures is achieved. Because the present invention may engage with its host firearm in a manner such that the trigger interface is urged into its reset position after firing, trigger springs which are incorporated into embodiments of the present invention may be significantly weakened as they no longer have to be intended for this purpose. Therefore, trigger springs may be chosen to be incorporated into embodiments of the present invention which are significantly weaker than the typical trigger spring. Therefore, the present invention has the benefit of being well suited match grade or target triggers which require a lightened trigger pull, as the selection of a weak trigger spring may help decrease trigger pull weight.

After the aforementioned features are machined into the steel castings, the trigger body **35** and hammer body **36** should be heat treated. Heat treatment of the trigger body **35** and hammer body **36** is beneficial to impart high strength and wear resistance to the parts. In particular the trigger body **35** and hammer body **36** are well suited for the heat treatment process known to the art as case hardening.

Once the aforementioned features are machined into the steel castings and the parts have been heat treated and finished, the trigger body **35** and hammer body **36** are then ready to accept all of their associated features. The associated features which are added unto the hammer body **36** include the hammer pin **13** and the hammer spring **17**. The associated features which are added unto the trigger body **35** include the cam member **22**, the first surface **46**, the second surface **41**, the cam member spring **23**, the cam member pin **24**, the trigger spring **16** and the trigger pin **12**.

The cam member **22** of the embodiment of the present invention illustrated in FIG. **1** takes the form of a plunger. This plunger-like form of the cam member **22** as depicted in FIG. **1** has many benefits, including ease of manufacture, low cost, inherent durability and ease of accurate positioning of the first surface **46** and second surface **41** with precision. Additionally, due to the cylindrical shape of the plunger-like form of the cam member **22**, the area of contact between the second surface **41** and the hammer surface **59** during operation of the rapid reset fire control **1** is minimized, reducing the inherent friction between these surfaces as they interact.

Said plunger-like cam member **22** is well suited for being manufactured from a steel rod. A steel rod of appropriate material characteristics and diameter is chosen. In particular, a steel rod with a good ability to be hardened is important, as the cam member **22** is subject to friction from the hammer surface **28**. After choosing the steel rod, the steel rod is cut to the appropriate length and a slot is machined into one side of the cam member **22** to allow proper clearance for the cam member pin **22**. These machining processes which are required to manufacture the cam member **22** are well suited for being performed by a CNC lathe with live tooling. After machining, the cam member **22** may be surface hardened or through hardened using the variety of suitable methods known to the art in order that the cam member **22** be sufficiently strong and durable. The final surface finish of the cam member **22** should be resilient and have a low coefficient of friction, such that drag between the second surface **41** and the hammer surface **59** is reduced during operation of the rapid reset fire control **1**. This reduction in drag between the second surface **41** and the hammer surface **59** allows the hammer surface to glide across the second surface **41** to transfer hammer spring **17** force into the trigger body **35**.

The cam member support **27** provides several important functions in the embodiment of the rapid reset fire control **1** of FIG. **3**. One function of the cam member support **27** is to prevent possible cam member **22** breakage during its use. Another function of the cam member support **27** is allowing for the precise placement of the second surface **41**, such that the proper angle of the second surface **58** is achieved, which is important for proper function of the present invention. A particular benefit of said plunger-like cam member **22** is its ability to be used with high strength hammer springs which can ensure reliable function of the present invention and reliable ignition of ammunition primers.

The dimensions, angle and geometry of the hammer surface **28** of the hammer assembly **15** should be configured such that the bolt carrier assembly **11** reattains its in-battery condition at the proper time in the operation of the firearm **2** with the rapid reset fire control **1** so as to allow sufficient time for the bolt carrier assembly **5** to travel fully in the forward direction **31** such that the firearm **2** will be in-battery before the hammer surface **28** is able to impact the firing pin **43** to fire the second shot, as depicted in FIG. **13** and FIG. **14**.

The width, depth, length, shape and location of all the features of the rapid reset fire control **1** of FIG. **3** are dimensioned as necessary in order for the present invention to work with the host firearm **2** of FIG. **4** in order to cause the desired functions in the firearm **2** as described in the figures. Furthermore, the width, depth, length, shape and location of all features may be dimensioned as necessary in order for the present invention to function properly when utilized with various types of host firearms other than the firearm **2** depicted in FIG. **4**. Furthermore the rapid reset fire control **1** may be configured such that a selector switch may change the firing mode of the rapid reset fire control **1** or alter the forces of spring bias of the rapid reset fire control **1**.

The cam member **22** may alternatively be produced in a mechanical form other than a plunger, including but not limited to the form of a lever, a flat spring, hook or toggle which is configured with geometry which temporarily transfers hammer spring **17** force to the trigger body **35** in an equivalent manner to the cam member **22** illustrated in FIG. **1** through FIG. **16**. The cam member **22** may also alternatively be mounted to the hammer body **36** configured with geometry which temporarily transfers hammer spring **17** force to the trigger body **35** in an equivalent manner to the trigger body **35** mounted form of the cam member **22** illustrated in FIG. **1** through FIG. **16**. The cam member support **27** may alternatively be produced in a mechanical form other than a monolithic structure, including but not limited to a spring, a spring loaded bearing or a surface with an interaction spring. In some alternative embodiments, certain associated features may be eliminated or combined with other features, including the cam member support **27**, cam member hole **25**, cam member pin **24**, cam member pen hole **26**, cam member spring **23** and trigger spring **16**. In embodiments of the rapid reset fire control **1** in which the cam member **22** is produced in the form of a hook or toggle, the pivot pin for the toggle or hook may be positioned on the trigger body **35** or hammer body **36** as required such that the functions of the rapid reset fire control **1** are performed As described in the figures.

The present invention may differ in arrangement, geometry, dimensions and operation as necessary to allow for proper function in various types of host firearms. Host firearms for which the present invention is particularly well suited for incorporation include, but are not limited to: the AR-10 type rifle and its derivatives, the AR-15 type rifle and its derivatives, the AR-18 type rifle and its derivatives, the AK-47 type rifle and its derivatives, the IWI Tavor type rifle and its derivatives, the FN SCAR type rifle and its derivatives, the Galil type rifle and its derivatives as well as other self-loading firearms which are of utility.

The above exemplary embodiments of the present invention can be integrated with, made for or adapted to many types of firearms which are known to the art, these firearm types include but are not limited to handguns, sub-machine guns, shotguns, carbines, rifles and machine guns and many other firearm configurations which are known to the art. The above exemplary embodiments of the present invention can be integrated with, made for or adapted to firearms with various types of firearms operating systems which are known to the art, these firearm operating system types include but are not limited to blowback operation, recoil operation and gas operation. The above exemplary embodiments of the present invention can be integrated with, made for or adapted to many types of firearm fire control groups which are known to the art, these firearm fire control group types include but are not limited to match grade triggers, combat triggers, adjustable triggers, single stage triggers, two stage triggers, multifunction triggers, triggers with integrated safety systems and many other firearm fire control group configurations which are known to the art. This description is made in terms of exemplary and alternative embodiments, and is not intended to be so limited.

What is claimed is:

1. A system for facilitating rapid firing of firearms, comprising: a firearm (**2**), said firearm comprising:

a hammer body (**36**), said hammer body being configured to rotate about a hammer pin (**13**), said hammer body comprising a hammer sear (**19**), said hammer sear being displaced along a path of travel (**63**) as said hammer body rotates about said hammer pin;

a hammer spring (**17**) configured to rotationally bias said hammer body towards engagement with a firing pin (**43**);

a trigger body (**35**), said trigger body comprising a trigger sear (**18**) and a trigger interface (**20**), said trigger body being configured to rotate about a trigger pin (**12**); and

a cam member (**22**) disposed along said trigger body, said cam member comprising a first surface (**46**) and a second surface (**41**), said hammer body being engageable with said first surface such that said cam member is displaced with respect to said trigger body, a slidable engagement between said hammer body and said second surface being configured such that bias from said hammer spring causes said trigger body to rotate about said trigger pin such that said trigger sear rotates into said path of travel of said hammer sear as said trigger interface is manipulated by a rearward force (**47**) sufficient to cause the discharge of said firearm.

2. A fire control mechanism for increasing the firing rate of a firearm comprising:

a trigger assembly (**14**) comprising:

a trigger body (**35**) having a trigger interface (**20**) and a trigger sear (**18**), said trigger body configured to rotate about a trigger pin (**12**);

a cam member spring (**23**), said cam member spring seated against said trigger body;

a cam member (**22**) having a first surface (**46**) and a second surface (**41**), said cam member seated against said cam member spring such that said first surface is biased away from said trigger body; and

a hammer assembly (**15**) comprising:

a hammer body (**36**) having a hammer surface (**28**) and a hammer sear (**19**), said hammer body configured to rotate about a hammer pin (**13**), said hammer sear being displaced along a path of travel (**63**) as said hammer body rotates about said hammer pin;

a hammer spring (**17**) configured to rotationally bias said hammer body about said hammer pin toward a firing pin (**43**); and

wherein, upon manipulation of said trigger interface by a rearward force (**47**) such that said firearm discharges, impetus from the discharge of said firearm causes a bolt carrier surface (**11**) to engage said hammer body such that said hammer body is rotated toward said cam member such that said hammer surface comes in contact with said first surface; and

wherein said hammer spring imparts rotational force against said hammer body causing said hammer body to impart a rotation upon said trigger body by a cam engagement between said hammer surface and said second surface; and

wherein the above-recited rotation of said trigger body causes said trigger sear to rotate into said path of travel of

said hammer sear as said trigger interface is manipulated by said rearward force sufficient to cause the discharge of said firearm.

3. The fire control mechanism as recited in claim **2**, wherein said cam member is configured such that engagement between said hammer surface and said first surface causes said cam member to be displaced with respect to said trigger body, said hammer surface disengaging from said first surface such that said second surface is displaced into an arcing path of travel of the hammer surface (**59**) by the bias of the cam member spring.

4. The fire control mechanism as recited in claim **2**, wherein said cam engagement is configured such that said hammer surface disengages from said second surface after said trigger sear is rotated into said path of travel of said hammer sear.

* * * * *

Exhibit 7

U.S. Department of Justice

Bureau of Alcohol, Tobacco,
Firearms and Explosives

Martinsburg, WV 25405

www.atf.gov

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3311/301071

October 8, 2013

Mr. Michael Stakes
President
Tactical Fire Control, Inc
44047 North 43 Avenue
Suite 74243
Phoenix, AZ 85087

Dear Mr. Stakes,

This is in reference to your correspondence (including copy of a patent application), with accompanying AR-type fire-control components, received by the Firearms Technology Branch (FTB), Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF). In your cover letter, you asked FTB to examine this "3MR™" trigger assembly (see enclosed photo) and determine its classification.

For your reference in this matter, the National Firearms Act, 26 U.S.C. Section 5845(b), defines "**machinegun**" 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 term shall also include the frame or receiver of any such weapon,* ***any part designed and intended solely and exclusively, or combination of parts designed and intended, for use in converting a weapon into a machinegun,*** *and any combination of parts from which a machinegun can be assembled if such parts are in the possession or under the control of a person.*

As indicated, your prototype trigger has three modes: safe mode, a match grade semi-automatic mode, and another match grade semiautomatic mode with a positive reset characteristic. In support of this product, you point out that it will provide tactical and competition shooters with a "safer, faster, and more reliable trigger group." It is also intended to provide positive resets between each shot.

The FTB examination confirmed that the trigger unit consists of a housing, hammer, trigger, disconnector, selector, springs, and reset lever that are designed to be used in an AR-15 type platform. Our examination disclosed that when the selector is placed in the vertical position (apex at 12 o'clock), the trigger, disconnector, and hammer function as any AR-semiautomatic type trigger is designed to do. Further examination also showed that when the selector was placed in the horizontal position (apex at 3 o'clock), the reset lever pivots forward, and the hammer engages/contacts the lever during the cycling of the rifle. In this position, the hammer contacts the reset lever during cocking, which applies force to the trigger, forces the shooter's finger forward, and allows the trigger to reset rapidly.

In the course of our evaluation, FTB personnel installed the submitted 3MR™ trigger into an AR-15 type rifle housed in the ATF National Firearms Collection for test firing. During this phase, a function test was performed before live-fire was conducted. The 3MR™ functioned only semi automatically during both the field test and live-firing.

In conclusion, FTB has determined that the 3MR™ trigger assembly is not a part or combination of parts that will convert a semiautomatic firearm into a machinegun. Your sample will be returned via the FedEx account number provided in your cover letter.

We thank you for your inquiry and trust the foregoing has been responsive to your evaluation request.

Sincerely yours,

Earl Griffith
Chief, Firearms Technology Branch

Enclosure

Tactical Fire Control 3MR™ Trigger

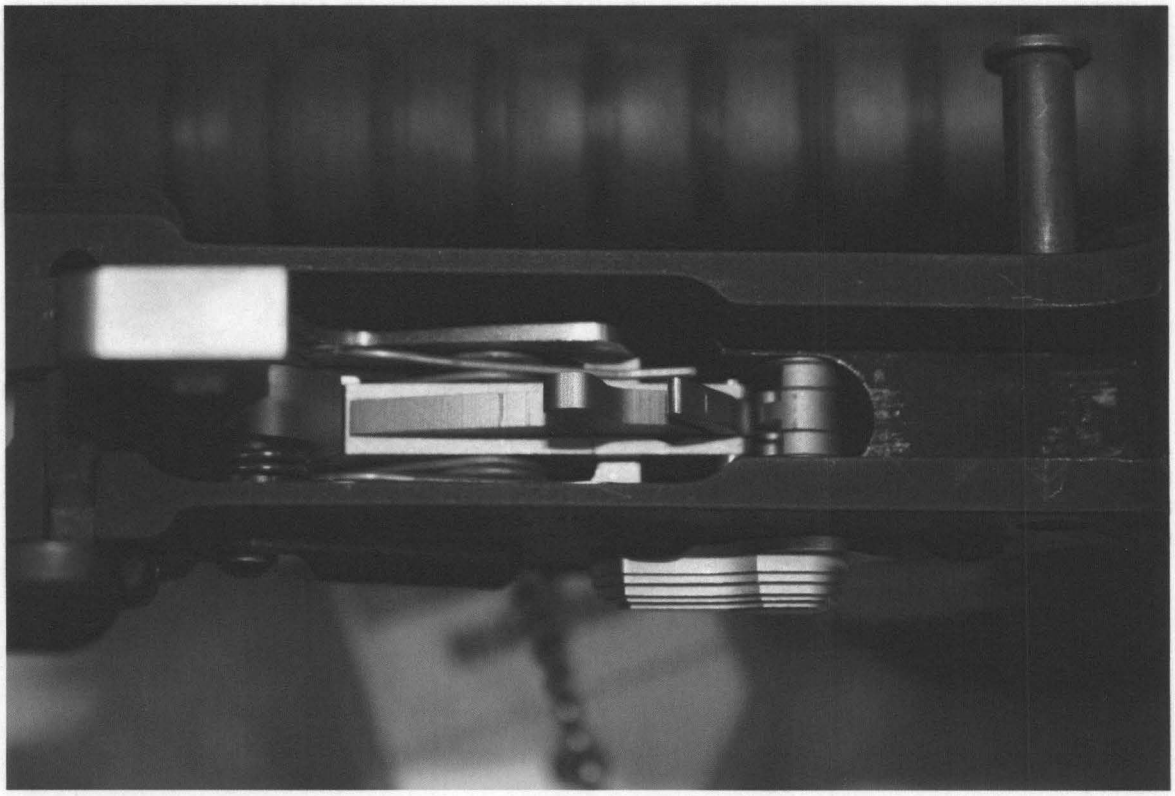

Exhibit 8

DO-IT-ALL AR TRIGGER

Dropped into a Red Creek Apache LT carbine, the Tac-Con trigger is fast, precise and allows for accurate fire with sharply decreased split times.

Tactical Fire Control's new drop-in trigger puts the squeeze and reset settings at your fingertips!

(By David Bahde)

Popularity across a broad range has spawned a massive accessory market for AR-style rifles. Many alterations are cosmetic, improving operations little. Ergonomic changes make ARs fit better. Changing barrels, gas systems, safeties and other devices can enhance their operation. But the most critical enhancement is choosing a trigger to fit your needs.

Originally designed as a military weapon, the M16's trigger is heavy—it needed to pass drop tests. Fantastic in a war, mil-spec triggers do little to wring out the best in this weapon system. When the platform moved into the civilian realm, little changed. Sure, original triggers could be polished, but that generally caused more problems than solutions. As demand increased, newly manufactured triggers made huge improvements and could be installed easily. Depending on the rifle's intended application, AR triggers can be super-light for competition or precision work, clean with heavier pulls for duty use, and either in a single- or two-stage configuration. In that same vein, because many triggers are designed for their specific missions, they do not always cross over. Many competition triggers have no place outside the gaming world and are completely unsuitable for home defense or duty use. Those suited for defensive carry can be difficult to win with on the weekend. A trigger that does it all would be nice, and Tactical Fire Control Inc. may have just the ticket.

SET YOUR SQUEEZE

Using a proprietary safety that activates in the third position (full-auto or burst-fire on a select-fire AR), the Tac-Con trigger provides something new: a choice. The standard semi-automatic setting provides a high-quality, 4.5-pound, single-stage trigger. Move the selector one more position and you get a very short reset at the same weight. There are no adjustments to work loose. Dropping into any properly specified AR lower receiver, it is not an NFA device, eliminating the need for BATFE transfers and paperwork.

The Tac-Con trigger is high quality. Built from the finest materials, it is not a gimmick designed to spread lead around the berm. Components are fully ED-machined from tool steel and fully CNC-machined from billet. The Tac-Con's parts are then coated with NP3 for consistency and longevity. The outer housing is hardcoat anodized and self-contained. A proprietary three-position safety is supplied. New pins are provided, but the Tac-Con trigger system works with standard pins. The trigger pull is the same in either position, and units are available with either 4- or 4.5-pound trigger weights. For tactical use, the 4.5-pound version will work for most LE agency policies; the lighter trigger is suitable for competition use. Both Tac-Con units are drop-in, meaning they'll fit into most AR lowers.

CUSTOM PLATFORM

Ernie Bray at Red Creek Tactical had just completed a custom 5.56mm AR build to my specifications; it was perfect for this test. I had asked him to build one AR that could go directly from the street to a competition and win—not just play, but win. My profession sends me to all kinds of tactical training schools, so it also needed to handle high round counts using practice ammunition in the harshest conditions with 100 percent reliability. The Tac-Con seemed a perfect match this purpose.

"The standard semi-automatic setting provides a high-quality, 4.5-pound, single-stage trigger. Move the selector one more position and you get a very short reset at the same weight."

The Tac-Con trigger is completely self-contained, with no adjustable parts to come loose or fail. During testing, it proved consistent and reliable.

The base rifle, the Apache Light Tactical (LT), is well balanced, weighing in at a bit over 6 pounds. Given its billet construction and custom Lilja barrel, keeping it that light was impressive. For aiming, I added a Bushnell Elite Tactical SMRS 1-6.5x24mm scope with a BTR-2 reticle in an Alamo Four Star mount. Parallax free at 1X, the scope is very fast at CQB ranges, and 6.5X magnification takes you to the limits of the 5.56mm cartridge. SureFire's KE2C Scout light, mated to Haley Strategic's Thorntail offset mount and an SR06 switch, takes care of lighting. Backup sighting is handled with a Vortex Razor red dot at 1 o'clock and Troy Industries' flip-up sights. Finished in an IR-resistant camouflage Cerakote, the custom Apache LT fits nicely in just about any realm.

Installing the Tac-Con trigger was simple and straightforward, taking all of five minutes. The only trick is tilting the mechanism up a bit as you insert it under the safety. Push the pins from right to left and you are done. The "safe" position blocks the trigger, semi-auto is a crisp, 4.5-pound, single-stage pull. Move to the third position and you get the same pull weight with a very short reset for controlled rapid fire, with doubles, triples and purposeful, sustained fire in mind.

ROUNDS DOWNRANGE

Most of the testing was completed using Federal M193F 55-grain FMJ ammunition. I used Hornady's 75-grain Match and Silver State Armory's 77-grain OTM ammo for accuracy testing. With its previous trigger, this rifle produced consistent 0.5-inch or less groups with this ammunition. Selecting semi-automatic mode, there was no change; my best group measured 0.43 inches at 100 yards using the Silver State Armory load. I chose to test the 4.5-pound trigger unit, as this weight was perfect for me. The Tac-Con proved to be as good as any high-end trigger on the market, and it allowed for precision with solid control.

Moving to the third position gets you a short reset, facilitating very rapid fire. The trigger pull remained at 4.5 pounds with all but zero take-up and no overtravel. Starting with controlled sustained fire, this trigger is fast. After a couple hundred rounds, it was almost as fast as my M16 on select-fire. After an hour or so of moving and shooting two to five rounds rapidly from 5 to 25 yards, nothing fell outside of a 12-inch circle. Most hits were well inside 10 inches. The Tac-Con is fast *and* very controllable. Spending the day practicing entry tactics and typical patrol work, it quickly became my preference over any select-fire weapon. Fast doubles followed by well-aimed singles were downright easy—not something most can do with a select-fire M16 under the best conditions.

Given this rifle's multipurpose role, it was time to check split times on multiple targets. Competitive shooters must be accurate, but they live or die on time, and there are only so many places you can make up time, especially at the top levels. Taken over the entirety of a competition, your split times add up quickly. While other things can really cut down on time, top shooters are all very close, so shaving even 0.02 seconds adds up quickly. Short-reset triggers allow top-notch shooters to shoot amazingly fast. The Tac-Con was no exception. On a good day with this rifle and its previous trigger, my split times hover between 0.15 and 0.17 seconds, with 0.15 being the norm. After a half-dozen or so passes with the Tac-Con installed, my average split time dropped to 0.14 seconds. Shaving off 0.01 seconds may not be a game-changer for me, but I bet an accomplished 3-Gunner will see some amazing times. Most pros are running at 0.12 seconds or faster most of the time—taking 0.02 seconds off of that can make a huge difference.

— Continued on page 95

***ABOVE:** When in the third position (shown), typically for full-auto or burst fire, the Tac-Con has the same pull weight but a very short reset for fast doubles and triples.*

***RIGHT:** The Tac-Con trigger was easy to install in the Red Creek Tactical Apache LT lower. Requiring no special tools, the unit should drop into most standard AR lowers.*

DIY UPGRADE

Continued from page 23

TAC-PROS

The Tac-Con three-position trigger is BATFE compliant—there's no need to fill out NFA paperwork. It drops into most AR lowers in a matter of minutes using your standard pins. My Apache LT uses a Seekins Precision billet lower using KNS pins, but I also tested it in a PWS MK116 using a forged mil-spec lower with no issues. This is a huge advantage whether you are competing, target shooting or even in law enforcement, as acquiring and maintaining select-fire rifles is a royal pain, even if you are part of an agency.

Maybe the biggest advantage is the ability to ignore the third position most of the time. Semi-automatic mode will serve 99 percent of anyone's needs, but having that third position is nice when rapid or suppressive fire is required. Its versatility is unmatched at this point. You get speed when you need it, never losing precision or control.

ELITE DURABILITY

Built from the highest-quality parts, none of the Tac-Con is going to come loose. Installation is simple and straightforward. The only real transition is the operation of the safety. Proprietary designs limit your safety choices, and running that third position takes some practice. Most people cannot reach the safety with their control hand while remaining in the pocket. Given the short reset, it is imperative to keep the safety off the third position until you are on target. Moving the rifle back under your arm to activate the safety with your off-side hand works for most. Plan on some retraining to use the safety properly.

Long-term testing will tell us if it holds up, but it has undergone some truly intensive testing already by some rather elite military operators. The Tac-Con trigger unit has proven flawless for me, even after 1,000 rounds of rapid fire in two different rifles. And I plan on continuing to use it. Offering superior control, no loss in precision or accuracy, and rapid fire in one trigger, it is pretty revolutionary. For more information, visit tacfirecon.com or call 623-282-1881.

EDITOR'S NOTE: Craving more rapid-fire action? Check out the author running the super-slick Tac-Con trigger in a Primary Weapons Systems MK116 in 5.56mm NATO at tactical-life.com.

Exhibit 9

Video File: Remington 11 Action Function

Exhibit 10

Video File: Remington 11 Trigger Function