

(19)



(11)

EP 3 540 360 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
14.10.2020 Bulletin 2020/42

(51) Int Cl.:
F41A 19/32 ^(2006.01) **F41A 19/12** ^(2006.01)

(21) Application number: **19160599.7**

(22) Date of filing: **04.03.2019**

(54) FIRING MECHANISM FOR A SPORTING FIREARM

ABFEUERUNGSMECHANISMUS FÜR EINE SPORTWAFFE

MÉCANISME DE DÉCLENCHEMENT POUR UN ARME À FEU DE SPORT

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

(30) Priority: **13.03.2018 IT 201800003479**

(43) Date of publication of application:
18.09.2019 Bulletin 2019/38

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(56) References cited:
**WO-A1-2014/084757 DE-A1- 4 125 148
US-A- 2 224 758 US-A- 3 950 876
US-B1- 6 634 129**

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Description

Technical field

[0001] The invention relates to the sector of weapons.

[0002] More in detail, the invention relates to a firing mechanism for a sporting firearm, and precisely of carbine type.

Background art

[0003] A carbine firearm essentially comprises a stock, a barrel with chamber, a breech block and a firing mechanism.

[0004] In general terms the breech block of a carbine is provided with:

- a mainspring, which can be loaded to counteract the cocking force and can release the energy accumulated during firing;
- a firing pin, which receives the elastic energy from the mainspring and converts it into kinetic energy, in the form of motion characterized by rectilinear trajectory, so as to strike the primer of the round of ammunition with force, causing it to explode.

[0005] The firing mechanism is the assembly of mechanical parts destined to cause, when operated by the shooter, release of the firing pin that produces the impact thereof against the bottom of the round of ammunition contained in the chamber.

[0006] In order to operate, the firing mechanism must be provided with a ratchet, the purpose of which is to hold back the mainspring or the firing pin in the cocking position, through a detent pawl. This latter in turn counteracts a trigger pawl that is operated, through sliding, by a control mechanism composed of various elements and levers located at the end of which is the trigger, i.e., an end lever on which the finger of the shooter rests and that, under the pulling action of the shooter, activates the assembly of the components of the firing mechanism.

[0007] A conventional firing mechanism comprises:

- a release lever comprising a detent pawl adapted to cooperate reversibly with the firing pin of the weapon;
- a trigger;
- a plurality of levers, interposed between said trigger and said release lever, adapted, upon activation of said trigger, to cause the rotation of said release lever about its fulcrum and to free the firing pin;
- a containment structure (8) adapted to house all the aforesaid components,

[0008] The most widely used firing mechanisms are sear devices, consisting of a first sear belonging to the trigger pawl and a second sear belonging to one of the levers connected to the trigger.

[0009] Said first and said second sear engage with

each other, partially overlapping, during loading of the firearm, slide in relation to each other during actual firing until they disengage completely, with consequent yielding of the detent pawl, release of the preloaded firing pin and priming of the round of ammunition.

[0010] Firing mechanisms must be fluid in the mutual movements of their components, to prevent deviation of the firearm line of fire during activation of the trigger, and at the same time precise, to ensure operating safety, eliminating the possibility of unwanted accidental shots going off.

[0011] In detail, in order for the shot to be successful, it is fundamental for sliding between the two sears to be as "fluid" as possible and for release of the firing pin to be as "sharp" as possible.

[0012] To obtain sharp and fluid firing, the sears must be very smooth, hardened and mirror polished, and there must be substantially no friction between them. Therefore, it is clear that the overlapped portion of the two sears must be as small as possible.

[0013] Managing very light firing mechanisms is much more difficult and there is always the risk of the shot being fired accidentally, but if they are correctly dosed, they can have excellent performance. However, it is fundamental for the release to always be clear and clean and for shooter to be able to decide the exact moment at which to fire the shot and to do so the trigger must not be subject to frictions and delays.

[0014] Besides these objective difficulties during use, the firing devices described above have an evident disadvantage: the compression force of the mainspring, usually around 15 kg, rests, at least until the time of firing, on an extremely small portion of the overlapping sears, with the risk of friction occurring.

[0015] Moreover, the components of the firing mechanism, in particular the levers and the sears, over time can become worn and interact with one another with greater difficulty also causing frictions and compromising the efficacy of the device.

[0016] Optimal setting of the firearm, and hence also of the firing mechanism, is therefore extremely difficult and must necessarily be customized by the shooter considering, time by time, the boundary conditions, making it necessary to disassemble and reassemble the firearm, without being able to check the new settings until the weapon has been completely reassembled again.

[0017] Document US 3 950 876 A discloses a firing mechanism for a sporting firearm of the type comprising a barrel with a chamber, a breech block comprising a firing pin driven by a mainspring and positioned to strike a round of ammunition contained in said chamber, and a firing mechanism adapted to cooperate with said firing pin.

[0018] Said firing mechanism comprises:

- a release lever comprising a detent pawl adapted to cooperate reversibly with said firing pin;
- a trigger;

- a plurality of levers, interposed between said trigger and said release lever, adapted, upon activation of said trigger, to cause the rotation of said release lever about its fulcrum and to free said firing pin;
- a containment structure adapted to house said components;
- elastic means applied to said release lever, adapted to oppose the rotation thereof caused by the force exerted by the mainspring on the firing pin held back by the detent pawl.

[0019] Said elastic means comprise a tensioned coil spring.

[0020] Said elastic means are applied to said release lever on the side opposite said detent pawl with respect to the fulcrum of the lever; said tensioned coil spring comprises a first end and a second end, where said first end is associated with said release lever, and said second end is associated, at least indirectly, with said containment structure of said firing mechanism.

Presentation of the invention

[0021] The invention intends to overcome these limits, producing a firing mechanism for a sporting firearm that is precise, to ensure sharp and fluid firing, but which is at the same time safe to avoid accidental yielding of the ratchet that blocks the breech block.

[0022] Another object of the invention is to minimize the resistance to release of the firing pin that must be overcome by the user pressing the trigger, also offering the user the opportunity to adjust this resistance as a function of his/her sensitivity to release of the shot.

[0023] These objects are achieved with a firing mechanism for a sporting firearm of the type comprising a barrel with a chamber, a breech block comprising a firing pin driven by a mainspring and positioned to strike a round of ammunition contained in said chamber, and a firing mechanism adapted to cooperate with said firing pin, where said firing mechanism comprises:

- a release lever comprising a detent pawl adapted to cooperate reversibly with said firing pin;
- a trigger;
- a plurality of levers, interposed between said trigger and said release lever, adapted, upon activation of said trigger, to cause the rotation of said release lever about its fulcrum and to free said firing pin;
- a containment structure adapted to house said components;
- elastic means applied to said release lever, and adapted to oppose the rotation thereof caused by the force exerted by the mainspring on the firing pin held back by the detent pawl,

wherein:

- said elastic means are applied to said release lever

on the opposite side to said detent pawl with respect to the fulcrum of the lever;

- said elastic means comprise a tensioned coil spring, comprising a first and a second end, where said first end is associated with said release lever, and said second end is associated, at least indirectly, with said containment structure of said firing mechanism, characterized in that said elastic means comprise means for regulating the elastic force of said tensioned coil spring.

[0024] Advantageously, said regulating means comprise a screw accessible from outside said containment structure.

[0025] According to further aspects of the invention, said regulating means comprise a lever rotatably associated with said containment structure and having a first and a second arm, where:

- said first arm is associated with the second end of said tensioned coil spring;
- said second arm is associated with said screw,

where the reversible turning of said screw causes the rotation of said lever about its fulcrum and the consequent extension, or release, of said tensioned coil spring.

[0026] A firing mechanism for a sporting firearm according to the invention has many advantages.

[0027] The elastic means associated with the firing mechanism minimize the resistance to the release of the firing pin, partially offsetting the force exerted by the spring of the breech block on the detent pawl.

[0028] In this way the user, acting on the trigger, must overcome a minimum force to cause rotation of the release lever and thus disengagement of the firing pin by the detent pawl, also attenuating sliding and friction on the sears, ensuring fluid and sharp firing.

[0029] Attenuation on the sears can be dosed by offsetting the pressing force of the spring of the breech block by means of the resistive elastic force of the coil spring.

[0030] The elastic force of the coil spring adapted to oppose the force exerted by the mainspring of the firing pin on the detent pawl can be calibrated through specific regulating means.

[0031] The user of the firearm, acting on these regulating means, can modify the pressure that he/she must exert on the trigger to overcome the pressing force responsible for the friction between the sears, to take account of its sensitivity, of a wide variety of environmental disturbance or wear factors that can occur and that can interfere with the precision of the shot and with the efficacy of the firing mechanism.

[0032] Said regulating means are advantageously accessible from outside the firearm and thus make rapid and constant adjustment of the firearm possible without the need to disassemble and reassemble it.

[0033] The arrangement of said regulating means of the elastic means, accessible from outside the firearm

by means of the rotation of a screw makes the regulation simple and immediate.

Brief description of the drawings

[0034] The advantages of the invention will be more apparent below, in the description of a preferred embodiment, provided by way of nonlimiting example, and with the aid of the drawings, wherein:

Figs. 1-3 represent, in partial longitudinal section, a firing mechanism for a sporting firearm according to the invention, in three different operating steps of the firing mechanism;

Fig. 4 represents, in partial longitudinal section, a detail (regulating means) of the firing mechanism according to the invention.

[0035] Detailed description of preferred embodiments of the invention

[0036] With reference to Figs. 1-3, a portion of a sporting firearm A with firing mechanism 1 according to the invention is shown.

[0037] Said firearm A substantially comprises:

- a barrel 2 with chamber, provided with a longitudinal axis inside which a round of ammunition M can travel;
- a breech block 3, activatable through a control knob 33, and comprising a mainspring 23, which can transfer the cocking force to a firing pin 13 during firing;
- a firing mechanism 1, adapted to cooperate with said firing pin 13 to determine the impact against the round of ammunition M and cause the explosion thereof.

[0038] Said firing mechanism 1 comprises:

- a release lever 4, pivoted in a fulcrum 14 and having a first 4' and a second 4" end, comprising, along its arm, a detent pawl 24, adapted to reversibly cooperate with said firing pin 13;
- a trigger 5;
- a plurality of levers 6, 7, interposed between said trigger 5 and said release lever 4, adapted, upon activation of said trigger 5, to cause the rotation of said release lever 4 about its fulcrum 14 and to free said firing pin 13;
- a containment structure 8 adapted to house said components.

[0039] In detail, said levers comprise a first lever 6, responsible for travel of the trigger 5, and a second lever 7 (this latter defined in technical jargon detent counter-pawl), both rotatably associated with said containment structure 8, respectively in a first 16 and in a second fulcrum 17, and adapted to transmit a force, reducing it, from said trigger 5 to said release lever 4.

[0040] The sears that determine the efficacy of the actual firing mechanism 1 are located between said second lever 7 and said release lever 4.

5 **[0041]** A first sear 40 belongs to said release lever 4, obtained at the first end 4' thereof, and a second sear 70 belongs to said second lever 7 connected to the trigger 5.

[0042] Said first 40 and said second 70 sear mutually engage, partially overlapping, during loading of the firearm A (Fig. 2), slide in relation to each other during the actual firing until they become completely disengaged, with consequent yielding of the detent pawl 24, release of the firing pin 13 preloaded by the spring 23 of the breech block and priming of the round of ammunition M (Fig. 3).

10 **[0043]** In the variant illustrated, said firing mechanism 1 further comprises elastic means applied to said release lever 4, and adapted to oppose its rotation determined by the action of said trigger 5 or, in other terms, to oppose the force transferred by the mainspring 23 to the detent pawl 24.

[0044] In particular, said elastic means are applied to said release lever 4 on the side opposite said detent pawl 24 with respect to the fulcrum 14 of the lever.

25 **[0045]** With reference to Fig. 4, said elastic means comprise a coil spring 9 having a first 9' and a second 9" end.

[0046] The first end 9' of said coil spring 9 is associated with the second end 4" of said release lever 4; the second end 9" of said coil spring 9 is instead associated with said containment structure 8 of said firing mechanism 1.

30 **[0047]** Said elastic means comprise means 10 for regulating the elastic force of said coil spring 9.

[0048] Said regulating means 10 comprise a calibration screw 11, accessible from outside said containment structure 8, and hence from outside the firearm A, and an L-shaped lever 12 rotatably associated with said containment structure 8.

[0049] Said L-shaped lever 12 comprises a first 12a and a second 12b arm.

40 **[0050]** Said first arm 12a is associated with the second end 9" of said coil spring 9, while said second arm 12b is in supporting constraint with said screw 11.

[0051] Operation of the firing mechanism 1 according to the invention is described below.

45 **[0052]** In the initial condition represented by Fig. 1, i.e. before firing, when the breech block 3 of the firearm A is still open, the round of ammunition M is inserted in the chamber of the barrel 2, and the breech block 3 is still not cocked.

50 **[0053]** The firing mechanism 1 is in neutral position: the detent pawl 24 is not engaging the firing pin 13, the sears 40, 70 of the release lever 4 and of the second lever 7 connected to the trigger 5 are not in contact.

55 **[0054]** In the condition of preparing the firearm A represented by Fig. 2, the breech block 3 of the firearm A is closed and the firing mechanism 1 is calibrated by the user, i.e., the shooter.

[0055] Acting on the knob 33 of the breech block 3, the

shooter cocks the firing pin 13 preloading the mainspring 23, and the firing mechanism 1 is arranged in locked configuration: the detent pawl 24 blocks the firing pin 13 fully absorbing the pressing force of the mainspring 23; the two sears 40, 70 are in contact with each other, partially overlapped.

[0056] To calibrate the firing mechanism 1 the user, in relation to his/her experience and sensitivity, to the features of the firearm, to the type of projectile used, to external environmental factors, etc..., acts on the regulating means 10 of the elastic means.

[0057] Reversible turning of said screw 11 causes the rotation of said lever 12 about its fulcrum 22 and the consequent extension, or release, of said coil spring 9.

[0058] The user proceeds in steps.

[0059] Firstly, the user screws the calibration screw 11 and loads the coil spring 9 as much as possible, increasing its extension and thereby absorbing all the force transferred to the detent pawl 24 by the firing pin 13 pushed by the mainspring 23. In this situation, even if the trigger 5 is pressed no shot is fired because the resistive force of the coil spring 9 is greater than the force of the mainspring 23 of the breech block 3.

[0060] Proceeding delicately, the user gradually unscrews the calibration screw 11 relaxing the coil spring 9 until finding the right point of balance between the force that is absorbed by the detent pawl 24 and the force exerted on the coil spring 9, the sum of which must be just below 15 kg transferred by the mainspring 23 of the breech block 3.

[0061] After calibration has taken place the shot can be fired, pressing the trigger 5, which will be light, sharp and fluid, according to regulation.

[0062] When the firing operation begins, the weapon A must be immobile and the previous operations, calibration of the firearm, breathing and aiming, must have already been carried out successfully.

[0063] The firing operation is composed of a first half and a second half, this latter responsible for disengagement of the firing pin 13 by the detent pawl 24.

[0064] In the final condition represented by Fig. 3, i.e., when the shot has been fired, the sears 40, 70 are completely disengaged, with consequent rotation of the release lever 4 and yielding of the detent pawl 24, release of the preloaded firing pin 13 and priming of the round of ammunition M.

Claims

1. Firing mechanism (1) for a sporting firearm (A) of the type comprising a barrel (2) with a chamber, a breech block (3) comprising a firing pin (13) driven by a mainspring (23) and positioned to strike a round of ammunition (M) contained in said chamber, the firing mechanism (1) being adapted to cooperate with said firing pin (13), where said firing mechanism (1) comprises:

- a release lever (4) comprising a detent pawl (24) adapted to cooperate reversibly with said firing pin (13);
- a trigger (5);
- a plurality of levers (6, 7), interposed between said trigger (5) and said release lever (4), adapted, upon activation of said trigger (5), to cause the rotation of said release lever (4) about its fulcrum (14) and to free said firing pin (13);
- a containment structure (8) adapted to house said components (4,5,6,7);
- elastic means applied to said release lever (4), and adapted to oppose the rotation thereof caused by the force exerted by the mainspring (23) on the firing pin (13) held back by the detent pawl (24),

wherein:

- said elastic means are applied to said release lever (4) on the side opposite said detent pawl (24) with respect to the fulcrum (14) of the lever;
- said elastic means comprise a tensioned coil spring (9), comprising a first end (9') and a second end (9''), where said first end (9') is associated with said release lever (4), and said second end (9'') is associated, at least indirectly, with said containment structure (8) of said firing mechanism (1), **characterized in that** said elastic means comprise means (10) for regulating the elastic force of said tensioned coil spring (9).

2. Firing mechanism according to claim 1, **characterized in that** said regulating means (10) comprise a screw (11) accessible from outside said containment structure (8).
3. Firing mechanism according to claim 2, **characterized in that** said regulating means (10) comprise a lever (12) rotatably associated with said containment structure (8) and having a first arm (12a) and a second arm (12b), where:

- said first arm (12a) is associated with the second end (9'') of said tensioned coil spring (9);
- said second arm (12b) is associated with said screw (11), where the reversible turning of said screw (11) causes the rotation of said lever (12) about its fulcrum (22) and the consequent extension, or release, of said tensioned coil spring (9).

Patentansprüche

1. Abfeuerungsmechanismus (1) für eine Sportwaffe (A) des Typs, umfassend einen Lauf (2) mit einer Kammer und einen Verschlussblock (3), der einen

Zündstift (13) umfasst, er von einer Hauptfeder (23) angetrieben wird, und so positioniert ist, dass er eine in der besagten Kammer enthaltene Munitionsladung (M) trifft, wobei der Abfeuerungsmechanismus (1) geeignet ist, mit dem Zündstift (13) zusammenzuwirken, wobei besagter Abfeuerungsmechanismus (1) Folgendes umfasst:

- einen Auslösehebel (4), umfassend eine Sperrklinke (24), die dazu geeignet ist, mit dem besagten Zündstift (13) reversibel zusammenzuwirken;
- einen Auslöser (5);
- eine Vielzahl von Hebeln (6, 7), die zwischen dem besagten Auslöser (5) und dem besagten Auslösehebel (4) angeordnet sind, geeignet, um bei Betätigung des besagten Auslösers (5) die Drehung des besagten Auslösehebels (4) um seinen Drehpunkt (14) zu bewirken und den besagten Zündstift (13) freizugeben;
- eine Eindämmungsstruktur (8), geeignet, um die besagten Komponenten (4,5,6,7) zu beherbergen;
- elastische Mittel, die auf den besagten Auslösehebel (4) angewendet werden und geeignet sind, dessen Drehung entgegenzuwirken, die durch die Kraft verursacht wird, die von der Hauptfeder (23) auf den durch die Sperrklinke (24) zurückgehaltenen Zündstift (13) ausgeübt wird,

wobei:

- die besagten elastischen Mittel auf den besagten Auslösehebel (4) auf der Seite gegenüber der besagten Sperrklinke (24) in Bezug auf den Drehpunkt (14) des Hebels angewendet werden;
- die besagten elastischen Mittel eine gespannte Spiralfeder (9) umfassen, die ein erstes Ende (9') und ein zweites Ende (9'') aufweisen, wobei das besagte erste Ende (9') mit dem besagten Auslösehebel (4) verbunden ist, und das besagte zweite Ende (9'') zumindest indirekt mit der besagten Eindämmungsstruktur (8) des besagten Abfeuerungsmechanismus (1) verbunden ist, **dadurch gekennzeichnet, dass** die besagten elastischen Mittel Mittel (10) zum Regulieren der elastischen Kraft der gespannten Spiralfeder (9) umfassen.

2. Abfeuerungsmechanismus gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die besagten Regulierungsmittel (10) eine Schraube (11) umfassen, die von außerhalb der besagten Eindämmungsstruktur (8) zugänglich ist.

3. Abfeuerungsmechanismus gemäß Anspruch 2, **da-**

durch gekennzeichnet, dass die besagten Regulierungsmittel (10) einen Hebel (12) umfassen, der drehbar mit der besagten Eindämmungsstruktur (8) verbunden ist und einen ersten Arm (12a) und einen zweiten Arm (12b) besitzt, wobei:

- der besagte erste Arm (12a) mit dem zweiten Ende (9'') der besagten Spiralfeder (9) verbunden ist;
- der besagte zweite Arm (12b) mit der besagten Schraube (11) verbunden ist, wobei die reversible Drehung der besagten Schraube (11) die Drehung des Hebels (12) um seinen Drehpunkt (22) und die daraus folgende Ausdehnung oder Freigabe der besagten gespannten Spiralfeder (9) bewirkt.

Revendications

1. Mécanisme de déclenchement (1) pour une arme à feu de sport (A) du type comprenant un canon (2) avec une chambre, un bloc de culasse (3) comprenant un percuteur (13) entraîné par un ressort principal (23) et positionné pour percuter une munition (M) contenue dans ladite chambre, le mécanisme de déclenchement (1) étant adapté pour coopérer avec ledit percuteur (13), où ledit mécanisme de déclenchement (1) comprend :

- un levier de libération (4) comprenant un cliquet d'arrêt (24) adapté pour coopérer de manière réversible avec ledit percuteur (13) ;
- une gâchette (5) ;
- une multitude de leviers (6, 7), interposés entre ladite gâchette (5) et ledit levier de libération (4), adaptés, lors de l'activation de ladite gâchette (5), pour provoquer la rotation dudit levier de libération (4) autour de son point d'appui (14) et pour libérer ledit percuteur (13) ;
- une structure de confinement (8) adaptée pour abriter lesdits composants (4, 5, 6, 7) ;
- des moyens élastiques appliqués audit levier de libération (4) et adaptés pour s'opposer à la rotation de celui-ci provoquée par la force exercée par le ressort principal (23) sur le percuteur (13) retenu par le cliquet d'arrêt (24),

où :

- lesdits moyens élastiques sont appliqués audit levier de libération (4) sur le côté opposé audit cliquet d'arrêt (24) par rapport au point d'appui (14) du levier ;
- lesdits moyens élastiques comprennent un ressort hélicoïdal tendu (9) comprenant une première extrémité (9') et une deuxième extrémité (9''), où ladite première extrémité (9') est asso-

ciée audit levier de libération (4), et ladite deuxième extrémité (9") est associée, au moins indirectement, à ladite structure de confinement (8) dudit mécanisme de déclenchement (1). **caractérisé par le fait que** lesdits moyens élastiques comprennent des moyens (10) pour réguler la force élastique dudit ressort hélicoïdal (9). 5

2. Mécanisme de déclenchement selon la revendication 1, **caractérisé par le fait que** lesdits moyens de régulation (10) comprennent une vis (11) accessible depuis l'extérieur de ladite structure de confinement (8). 10

3. Mécanisme de déclenchement selon la revendication 2, **caractérisé par le fait que** lesdits moyens de régulation (10) comprennent un levier (12) associé en rotation à ladite structure de confinement (8) et ayant un premier bras (12a) et un second bras (12b), où : 15 20

- ledit premier bras (12a) est associé à la deuxième extrémité (9") dudit ressort hélicoïdal (9) ;
 - ledit second bras (12b) est associé à ladite vis (11), où la rotation réversible de ladite vis (11) provoque la rotation dudit levier (12) autour de son point d'appui (22) et l'extension, ou le relâchement, consécutif dudit ressort hélicoïdal (9). 25

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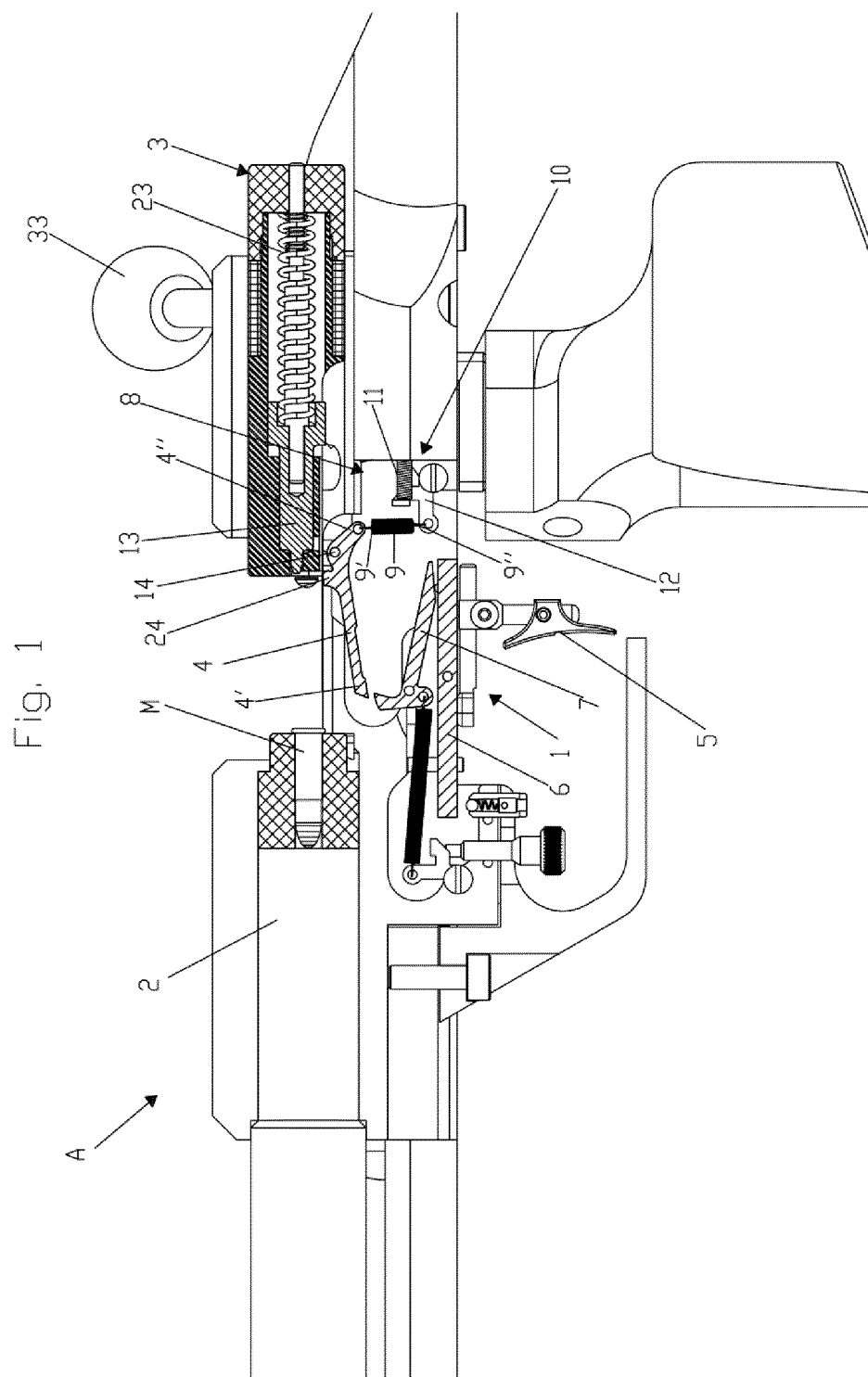


Fig. 2

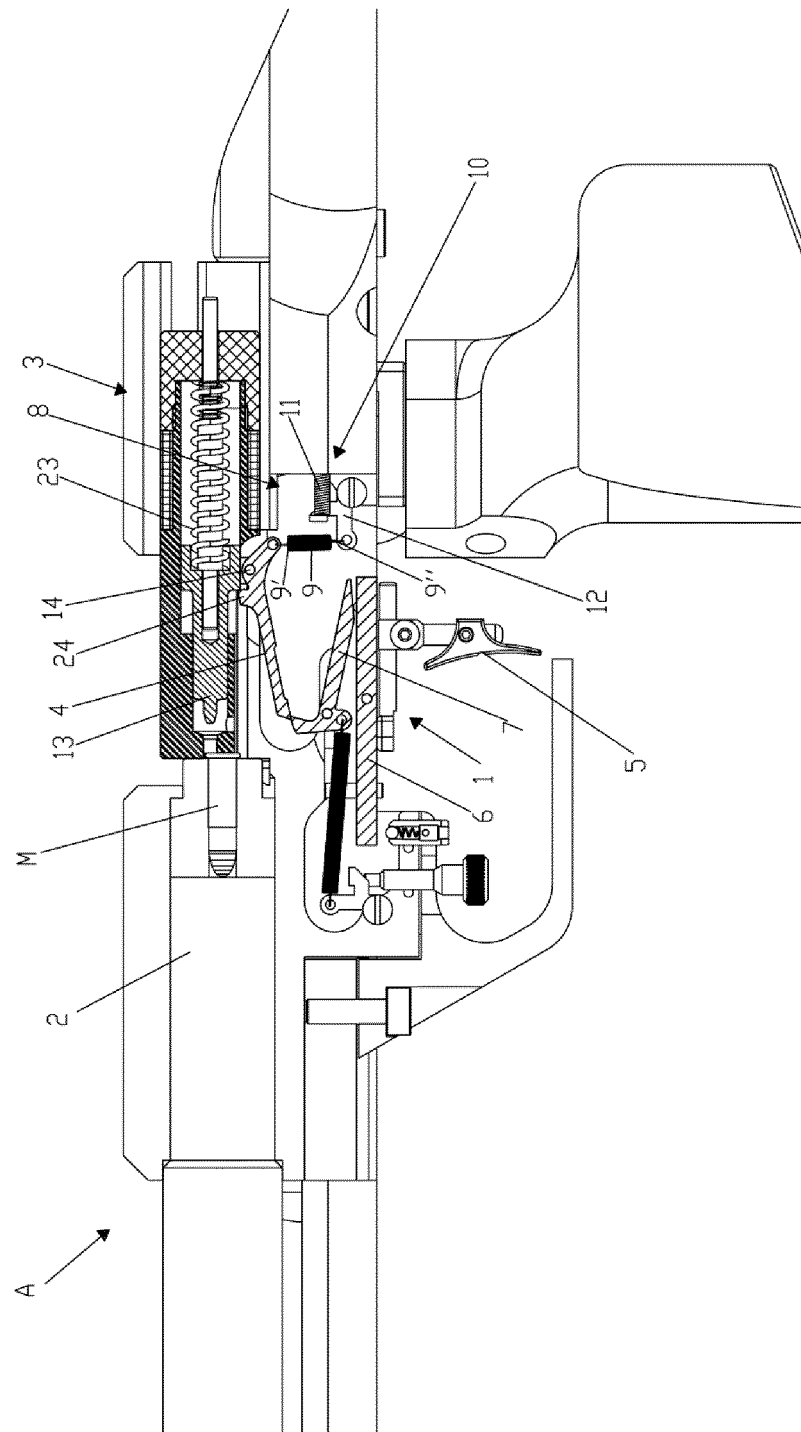
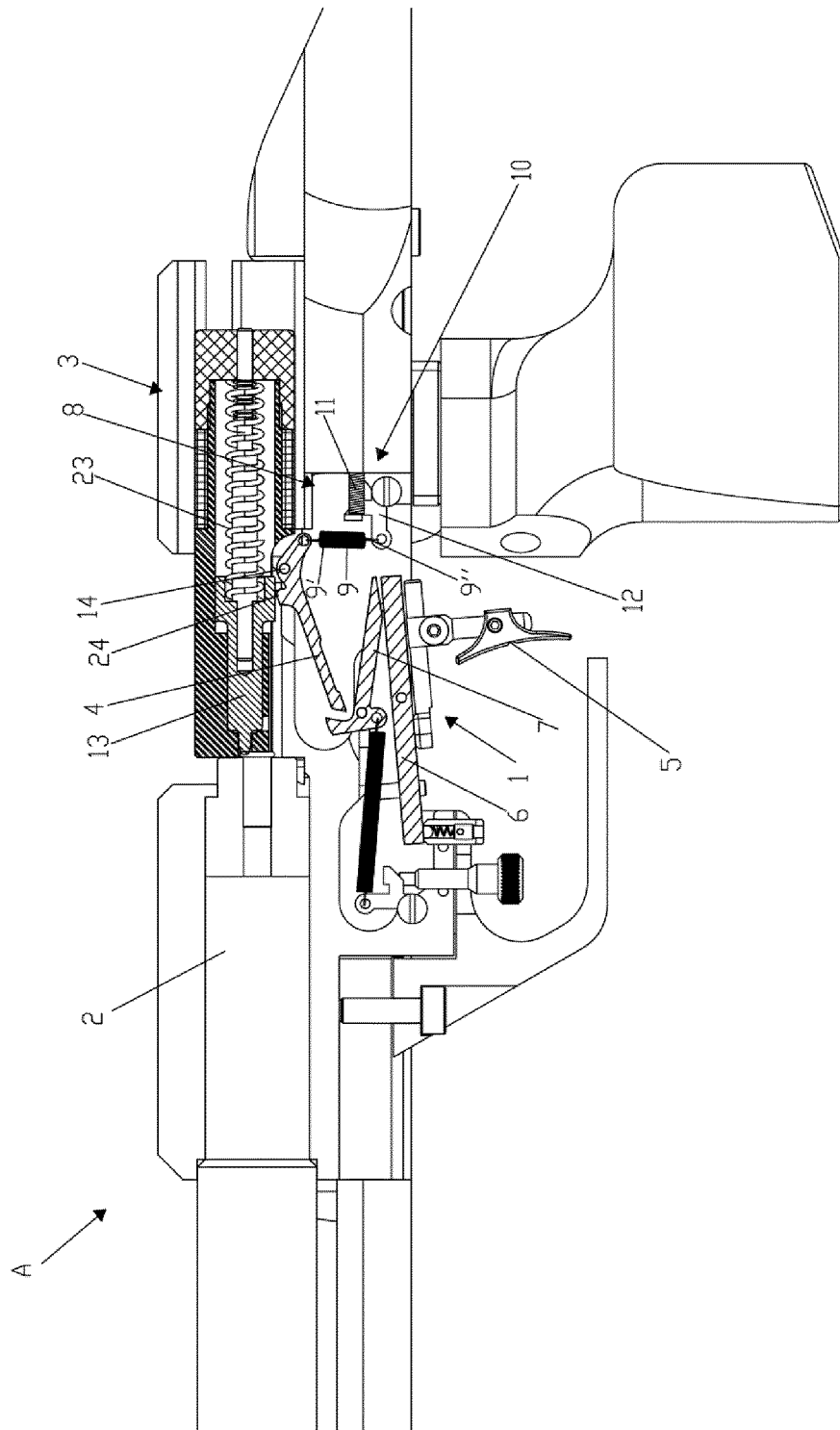
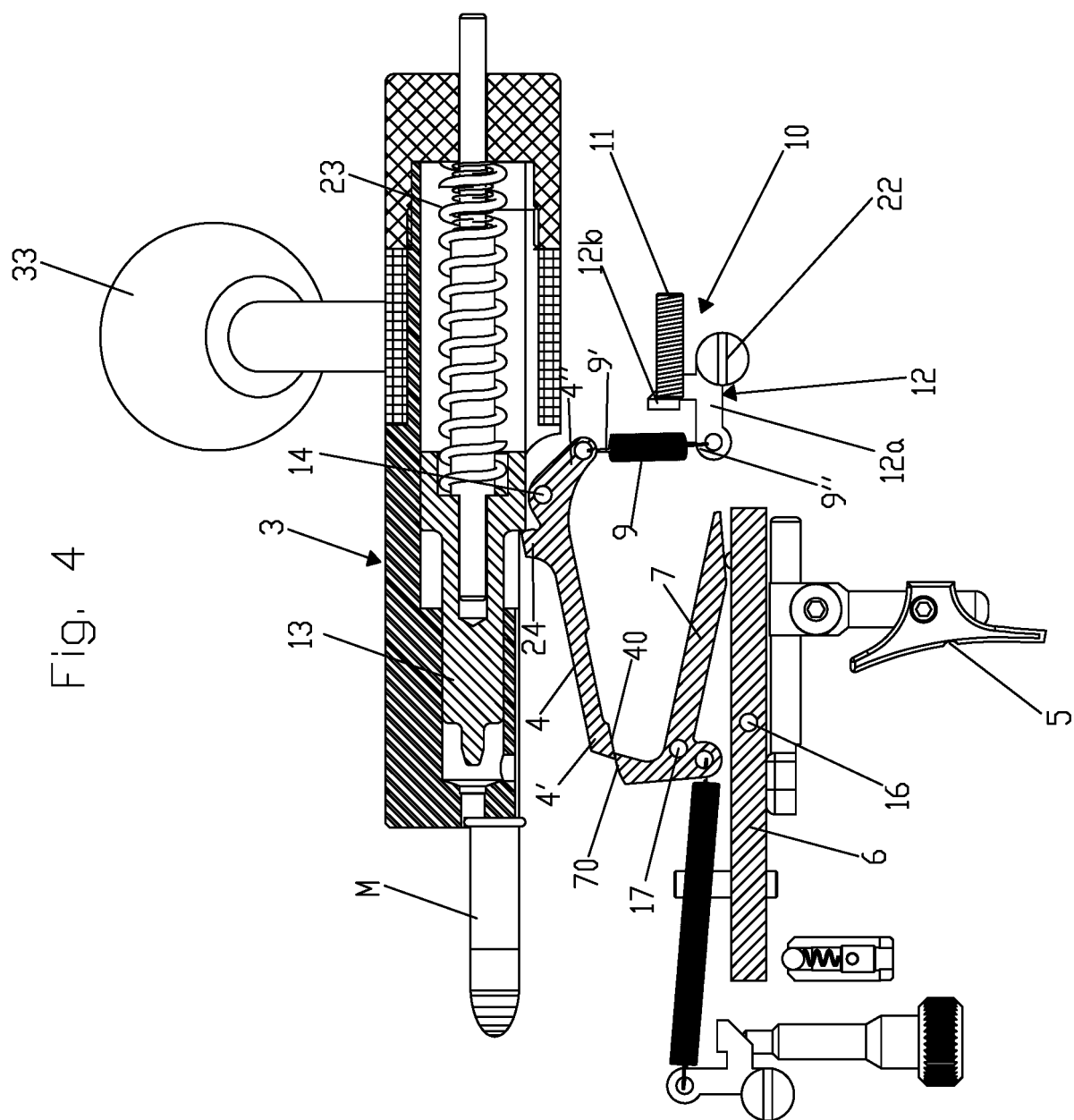


Fig. 3





REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 3950876 A [0017]