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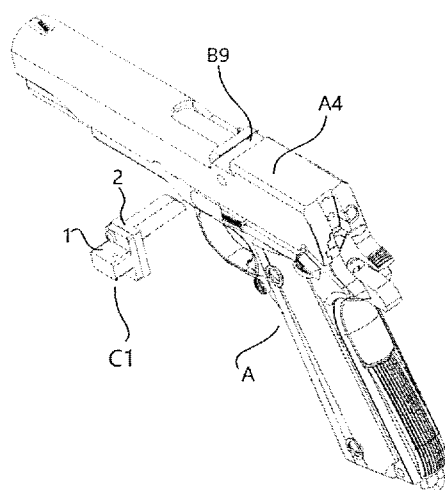


FIG 1.5

(57) Abstract: Safety lock mechanisms (C1-C28) for a portable weapon is disclosed. Such a mechanism includes an actuator (M3), and locking means operable from an unlocked state to a locked state by the actuator (M3) for blocking a firing sequence of said portable weapon. The blocking of the firing sequence is carried out at a trigger, a trigger lever, a hammer, or a firing pin of the portable weapon. The actuator (M3) may be a push-pull solenoid or servo motor.



**SAFETY LOCK MECHANISMS FOR PORTABLE WEAPONS, INCLUDING
CROSSBOWS AND FIREARMS, SUCH AS GUNS, RIFLES AND ALIKE
CROSS-REFERENCE TO RELATED APPLICATIONS**

[0001] N/A

**STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR
DEVELOPMENT**

[0002] N/A

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[0004] N/A

BACKGROUND OF THE INVENTION

Field of the Invention

[0005] The present invention directs to safety lock mechanisms for portable weapons, including, but not limited to, crossbows and firearms, such as guns, rifles and alike.

Description of Related Art

[0006] Portable weapons, such as crossbows and firearms, for example, guns (such as handguns, for example, pistols and/or revolvers), rifles and alike, are often used for recreational and/or sporting purposes, self-defense where law allows, and/or carried by authorized personals, such as police, military, etc. However, safety issues related thereto are always concerns for the public. Many of portable weapons used today shares substantially similar firing sequence from pulling of a trigger to a firing pin striking a bullet or alike to fire a bullet or alike therefrom. Many of these portable weapons are equipped with primary safety lock mechanisms; however, these primary safety lock mechanisms may be released manually by its operator(s) and, thus, there is no other means to ensure operational safety of the portable weapon after the primary safety lock mechanisms is released.

[0007] There have been a number of attempts that have been made to ensure operational safety of the portable weapon. For example, US Patent No. 4,488,370 to Lemelson (Lemelson) discloses a weapon control system and method to prevent it from being accidentally operated or operated by a person who is not the owner of the weapon or someone who is not authorized to use the weapon. Lemelson further discloses a lock mechanism, which is hidden inside the grip of the pistol for locking / unlocking the trigger.

[0008] US Patent No. 6,550,175 to Parker (Parker) discloses a user friendly gunlock, which is attached to a trigger guard of a firearm, which releases the lock to block the trigger based on a number combination (or similar) is entered properly to the gunlock.

[0009] US Patent No. 6,563,940 to Recce (Recce) discloses unauthorized user prevention device and method, which prevents an unauthorized / unrecognizable operator from using a firearm based on a pressure signature profile / grip profile(s) of an authorized operator(s) for the firearm which are stored. Recce requires, however, a special latching and internal trigger lock mechanism, such that a mechanical force / movement would not be propagated from the trigger to the hammer of the firearm to block the firing sequence thereof.

[0010] US Patent No. 9,857,133 to Kloepper et al. (Kloepper) and US Patent Application Publication No. 2018/0142977 to Kloepper et al. (Kloepper 2) disclose a system and method for authenticating an identity for a biometrically-enabled gun. The biometrically-enabled gun has a biometric sensor for reading the biometric information of an operator (such as finger print) to determine whether the operator is authorized to operate the firearm. Kloepper / Kloepper 2 lock the firing sequence by obstructing movement of a trigger bar.

[0011] Many of prior attempts, as it can be seen in Lemelson, Parker, Recce, Kloepper and Kloepper 2 merely concern about unlocking firearm only by an authorized operator, thus they would not be able to provide any solution for instantaneously blocking the firing sequence when required / desired.

[0012] Accordingly, in order to improve operational safety of the portable weapons, locking and unlocking conditions or environment including time, place, direction and operator / person would need to be considered; however, even such considerations were made, prior attempts would not allow/enable to provide means to promptly lock and unlock the firing sequence, automatically or autonomously. Therefore, there has been a long-felt need(s) for a primary, complementary or secondary safety mechanism, either automatic or semi-automatic in nature, promptly to lock or to lock and unlock a firing sequence of a portable weapon.

BRIEF SUMMARY OF THE INVENTION

[0013] The present invention directs to safety lock mechanisms for portable weapons, including, but not limited to, crossbows and firearms, such as guns, rifles and alike, that provide enabling means to automatically or semi-automatically lock, or lock and unlock a firing sequence thereof.

[0014] According to one aspect of the present invention, it provides a safety lock mechanism for a portable weapon, comprising an actuator, and locking means operable from an unlocked state to a locked state by the actuator for blocking a firing sequence of the portable weapon.

The actuator may include an electromagnet, and a permanent magnet, wherein the permanent magnet is affixed to the locking means, and the electromagnet actuates the locking means through the permanent magnet. The locking means may include a bar member for blocking the firing sequence at a trigger, a trigger lever, a hammer, or a firing pin of the portable weapon. The locking means is operable from the locked state to the unlocked state. Alternatively, the actuator comprises a motor; and a gear, wherein the gear cooperates with the locking means, and the motor actuates the locking means through the gear.

[0015] According to another aspect of the present invention, it provides an automatic spring-type lock mechanism for a portable weapon, such as a handgun or alike, comprising a lock cover, a lock shell, and a lock tongue actuator, which would be installed at the front end of the firing pin of the portable weapon.

[0016] According to yet another aspect of the present invention, it provides an automatic spring-type lock mechanism for a handgun or alike, which is disposed on the slide near the hammer of the handgun.

[0017] According to a further aspect of the present invention, it provides an automatic spring-type lock mechanism for a handgun or alike, which is disposed at the grip of a handgun, which blocks the trigger at the rear side of the trigger of the handgun.

[0018] According to a further aspect of the present invention, it provides an automatic spring-type lock mechanism for a handgun or alike, which is disposed at the trigger guard to block or release at the rear of the trigger of the handgun.

[0019] According to a further aspect of the present invention, it provides an automatic spring-type lock mechanism for a handgun or alike, which is disposed at the position which is about or is adjacent to the front end of the firing pin on the slide of the handgun to block or release the firing pin from rushing to a bullet.

[0020] According to a further aspect of the present invention, it provides an automatic spring-type lock mechanism for a handgun or alike, which is mounted on the position corresponding to firing pin circular slot of the gun slide on the handgun to block or release the firing pin from moving.

[0021] According to a further aspect of the present invention, it provides an automatic spring-type lock mechanism for a handgun or alike, which is disposed at the end of the slide, which is adjacent with the hammer to block or release the hammer from hitting the firing pin.

[0022] According to a further aspect of the present invention, it provides a gear-type trigger lock mechanism for a handgun or alike for blocking or releasing a pulling action for the trigger of the handgun.

[0023] According to a further aspect of the present invention, it provides a gear-type trigger lock mechanism for a handgun or alike, which includes a lock shell, a lock cover and a lock tongue actuator, including a motor, a driving gear, an idler gear and/or gear set, and a bar member, where the bar member blocks or releases the trigger of the handgun.

[0024] According to a further aspect of the present invention, it provides a gear-type trigger lock mechanism for a handgun or alike, which includes a lock shell, a lock cover and a lock tongue actuator, including a motor, a driving gear(s), and a bar member, where the bar member blocks / releases the trigger of the handgun.

[0025] According to a further aspect of the present invention, it provides a gear-type trigger lock mechanism, which includes a lock shell, a lock cover and a lock tongue actuator, including a motor, a driving gear(s), and a bar member, where the bar member blocks or releases the firing pin of the handgun.

[0026] According to a further aspect of the present invention, it provides a gear-type trigger lock mechanism for a handgun or alike, includes a lock shell, a lock cover and a lock tongue actuator, including a motor, a driving gear(s), an idler gear and/or gear set, and a bar member, where the bar member blocks or releases the hammer from hitting the firing pin of the handgun.

[0027] According to a further aspect of the present invention, it provides a semi-automatic electromagnetic telescoping lock mechanism for a handgun or alike, which includes a lock shell, a lock cover and a lock tongue actuator, including a lock tongue spring, an electromagnet, a lock tongue limit spring, lock tongue limit block and a bar member, where the bar member blocks the trigger of the handgun.

[0028] According to a further aspect of the present invention, it provides a semi-automatic lock mechanism for a handgun or alike, which includes a lock shell, lock cover and a lock tongue actuator, including a lock tongue spring, an electromagnet, a lock tongue limit spring, a lock tongue limit block and an arc member, where the arc member blocks the trigger of the handgun.

[0029] According to a further aspect of the present invention, it provides a semi-automatic lock mechanism, which includes a lock shell, lock cover and a lock tongue actuator, including a lock tongue spring, an electromagnet, a lock tongue limit spring, lock tongue limit block and a bar member, where the bar member blocks the trigger of the handgun.

[0030] According to a further aspect of the present invention, it provides a semi-automatic lock mechanism, which includes a lock shell, a lock cover and a lock tongue actuator, including a lock tongue spring, an electromagnet, a lock tongue limit spring, a lock tongue limit block and an arc member, where the arc member blocks the trigger of the handgun.

[0031] According to a further aspect of the present invention, it provides a semi-automatic lock mechanism for a handgun or alike, which includes a lock shell, a lock cover and a lock tongue actuator, including a lock tongue spring, an electromagnet, a lock tongue limit spring, lock tongue limit block and a bar member, where the arc member blocks the trigger of the handgun.

[0032] According to a further aspect of the present invention, it provides a semi-automatic lock mechanism for a handgun or alike, comprises a lock shell, a lock cover and a lock tongue actuator, including a lock tongue spring, a push-pull solenoid and an arc member, where the arc member blocks the trigger of the handgun.

[0033] According to a yet further aspect of the present invention, it provides a pull-rod style trigger lock mechanism for a handgun or alike, includes a lock shell, a bar member, a pull-rod, and a self-holding solenoid, where the bar member operably extends / retract to block / release the movement of the trigger of the handgun.

[0034] According to a yet further aspect of the present invention, it provides a trigger lever lock mechanism for a handgun or alike, which blocks or release the trigger lever of the handgun.

[0035] According to a yet further aspect of the present invention, it provides a tapeline-type trigger lock mechanism that may be installed on a trigger guard of a handgun or alike. The lock mechanism has a lock tongue which is attached to a trigger of the handgun and a tapeline which is wind around a tapeline disk, where the movement of the trigger is controlled by controlling the movement of the tapeline disk.

[0036] According to a yet further aspect of the present invention, it provides a box-style lock mechanism that may be installed around or about a trigger guard of a handgun or alike. The lock mechanism has a finger window / hole for providing/restricting an access to the trigger. An actuator slidably operates the finger window to allow or restrict the access to the trigger.

[0037] According to a yet further aspect of the present invention, it provides a block style lock mechanism installed on a handgun, having a block which lock / release the movement and/or access to the trigger. The block may be actuated by a self-holding solenoid, a motor with a screw rod or a like.

[0038] According to a yet further aspect of the present invention, it provides a lock mechanism that may be installed on a handgun or alike that replaced a rotary shaft and actuating lever of the original safety mechanism of the handgun.

[0039] According to a yet further aspect of the present invention, it provides a torsional smart gun trigger lock mechanism installed on a trigger guard of a handgun or alike, having a lock tongue which lock / release the movement of the trigger. The tongue may be actuated by an electromagnet or alike.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

[0040] The present invention is described in more detail with reference to the accompanying drawings, in which:

[0041] FIG 1.0 is a block diagram of a safety lock mechanism of the present invention;

[0042] FIG 1.1 is a right-side view of an automatic spring-type gun lock C1 installed at the front end of the firing pin of the firearm according to a first preferred embodiment of the present invention;

[0043] FIG 1.2 is a perspective view of the automatic spring-type gun lock mechanism C1;

[0044] FIG 1.3 is an exploded view of the lock mechanism C1;

[0045] FIG 1.4 is a perspective view of the assembly of the lock mechanism C1;

[0046] FIG 1.5 is a partially exploded perspective view of the lock mechanism C1;

[0047] FIG 1.6 is a perspective view of a lock shell 1 of the lock mechanism C1;

[0048] FIG 1.71 is a partial cross-sectional view of the lock mechanism C1 installed at the front end of the firing pin of the firearm and the lock mechanism C1 is in locked state;

[0049] FIG 1.72 is a partially enlarged view of position I of FIG. 1.71;

[0050] FIG 1.81 is a partial cross-sectional view of the lock mechanism C1 installed at the front end of the firing pin of the firearm and the lock tongue is at the state of retraction;

[0051] FIG 1.82 is the partially enlarged view of position II of FIG. 1.81;

[0052] FIG 2.1 is a right-side view of a second embodiment of a lock mechanism C2 of the present invention, being installed at the front end of the hammer of the firearm;

[0053] FIG 2.2 is a perspective view of the assembly of the lock mechanism C2 installed at the front end of the hammer of the firearm and the lock tongue is at the state of retraction;

[0054] FIG 2.3 is an exploded view of the lock mechanism C2;

[0055] FIG 2.4 is a bottom plan view of the lock mechanism C2 in locked state;

[0056] FIG 2.5 is a bottom plan view of the lock mechanism C2 in unlocked state;

[0057] FIG 2.6 is a cross-sectional view of lock shell of the lock mechanism C2;

[0058] FIG 2.71 is a rear perspective view of the assembly of the lock mechanism C2 in locked state;

[0059] FIG 2.72 is a partially enlarged view of position I2a in FIG 2.71;

[0060] FIG 2.81 is a rear perspective view of the lock mechanism C2 in unlocked state;

[0061] FIG 2.82 is a partially enlarged view of position I2b of FIG 2.81;

[0062] FIG 3.1 is a right-side view of a third embodiment of a lock mechanism C3 of the present invention, being installed on the handgun grip and locates at trigger guard;

[0063] FIG 3.2 is a left-side view of the lock mechanism C3 installed on the handgun grip and locates at trigger guard;

[0064] FIG 3.3 is a front view of the lock mechanism C3 installed on the handgun grip;

[0065] FIG 3.4 is an exploded view of the lock mechanism C3;

[0066] FIG 3.5 is an exploded view of the lock mechanism C3 with an U-shaped clamp;

[0067] FIG 3.6 is a perspective view of the assembly of the lock mechanism C3;

[0068] FIG 3.7 is a partially cross-sectional view of FIG 3.6;

[0069] FIG 3.81 is a right-side view of the lock mechanism C3 installed on a grip of a rifle;

[0070] FIG 3.82 is a partially enlarged view of position I3 of FIG 3.8;

[0071] FIG 4.1 is a right-side view of a fourth embodiment of a lock mechanism C4 of the present invention, being installed on the handgun grip and locates at trigger guard;

[0072] FIG 4.2 is a front view of the lock mechanism C4 installed on the handgun grip;

[0073] FIG 4.3 is an exploded view of the lock mechanism C4;

[0074] FIG 4.4 is a perspective view of the mechanical lock C4;

[0075] FIG 4.5 is a cross-sectional view of FIG 4.4;

[0076] FIG 4.61 is a right-side view of the lock mechanism C4 installed on a grip of a rifle;

[0077] FIG 4.62 is a partially enlarged view of position I4 of FIG 4.61;

[0078] FIG 5.1 is a right-side view of a fifth embodiment of a lock mechanism C5 of the present invention, being installed at the lower end of a trigger guard and the lock mechanism C5 is in locked state;

[0079] FIG 5.2 is a front view of the lock mechanism C5 installed at the lower end of the trigger guard;

[0080] FIG 5.3 is an exploded view of the lock mechanism C5;

[0081] FIG 5.4 is a perspective view of the assembly of the lock mechanism C5;

[0082] FIG 5.5 is a cross-sectional view of the lock mechanism C5;

[0083] FIG 5.61 is a right-side view of the lock mechanism C5 in locked state;

[0084] FIG 5.62 is a partially enlarged view of position I5 of FIG 5.61;

[0085] FIG 6.1 is a right-side view of a sixth embodiment of a lock mechanism C6 of the present invention, being installed at the front end of the firing pin of firearms;

[0086] FIG 6.2 is a perspective view of the assembly of the lock mechanism C6 installed at the front end of the firing pin of the firearm;

[0087] FIG 6.3 is an exploded view of the lock mechanism C6;

[0088] FIG 6.4 is a cross-sectional view of the lock mechanism C6 in unlocked state;

[0089] FIG 6.5 is a cross-sectional view of the lock mechanism C6 in unlocked state;

- [0090] FIG 6.61 is a cross-sectional view of the lock mechanism C6 in locked state;
- [0091] FIG 6.62 is a partially enlarged view of position I6a of FIG 6.61;
- [0092] FIG 6.71 is a cross-sectional view of the lock mechanism C6 in unlocked state;
- [0093] FIG 6.72 is an enlarged drawing of position I6b of FIG 6.71;
- [0094] FIG 7.1 is a right-side view of a seventh embodiment of a lock mechanism C7 of the present invention, being installed at the rear of the firing pin of the firearm;
- [0095] FIG 7.2 is a perspective view of the assembly of the lock mechanism C7 installed at the rear of the firing pin of the firearm;
- [0096] FIG 7.3 is an exploded view of the lock mechanism C7.
- [0097] FIG 7.4 is a cross-sectional view of the lock mechanism C7 in locked state;
- [0098] FIG 7.5 is a cross-sectional view of the lock mechanism C7 in unlocked state;
- [0099] FIG 7.61 is a cross-sectional view of the lock mechanism C7 installed at the rear of firing pin of the firearm and the lock tongue is at the state of protruding;
- [0100] FIG 7.62 is a partially enlarged view of position I7a of FIG 7.61;
- [0101] FIG 7.71 is a cross-sectional view of the lock mechanism C7 installed at the rear of the firing pin of the firearm and the lock tongue is at the state of retraction;
- [0102] FIG 7.72 is a partially enlarged view of position I7b of the FIG 7.71;
- [0103] FIG 7.81 is a cross-sectional view of the lock mechanism C7 installed at the rear of the firing pin of the firearm and the lock tongue is at the state of protruding and the semicircular fork of the lock tongue is stuck at the firing pin circular slot;
- [0104] FIG 7.82 is a partially enlarged view of position I7c of FIG 7.81;
- [0105] FIG 8.1 is a perspective view of an eighth embodiment of a lock mechanism C8 of the present invention, being installed at the front end of the hammer of the firearm;
- [0106] FIG 8.2 is a right-side view of the lock mechanism C8 when the lock gun is installed at the front end of the hammer of the firearm;
- [0107] FIG 8.3 is an exploded view of the lock mechanism C8;
- [0108] FIG 8.4 is a cross-sectional view of the lock shell of the lock mechanism C8;
- [0109] FIG 8.5 is a cross-sectional view of the lock mechanism C8 in locked state;
- [0110] FIG 8.6 is a cross-sectional view of the lock mechanism C8 in unlocked state;
- [0111] FIG 8.71 is a rear perspective view of the lock mechanism C8 in locked state;
- [0112] FIG 8.72 is a partially enlarged view of position I8a of FIG 8.71;
- [0113] FIG 8.81 is a rear perspective view of the lock mechanism C8 installed at the front end of the hammer of the firearm and the lock mechanism C8 is in unlocked state;
- [0114] FIG 8.82 is a partially enlarged view of position I8b of FIG 8.81;

[0115] FIG. 9.1 is a right-side view of a ninth embodiment of a lock mechanism C9 of the of the present invention, being installed on a handgun;

[0116] FIG 9.2 shows a front view of the lock mechanism C9 installed on a handgun;

[0117] FIG. 9.3 is an exploded view of the lock mechanism C9;

[0118] FIG. 9.4 is a perspective view of the lock cover in the lock mechanism C9;

[0119] FIG. 9.5 is another perspective view of the lock mechanism C9;

[0120] FIG. 9.61 is a right-side view of the lock mechanism C9 installed on a rifle;

[0121] FIG. 9.62 is an enlarged diagram of the position marked as I9 in FIG. 9.61;

[0122] FIG 10.1 is a right-side view of a tenth embodiment of a lock mechanism C10 of the present invention;

[0123] FIG 10.2 is a left-side view of the lock mechanism C10;

[0124] FIG. 10.3 is a front view of the lock mechanism C10;

[0125] FIG. 10.4 is an exploded view of the lock mechanism C10;

[0126] FIG. 10.5 is a perspective view of the lock mechanism C10;

[0127] FIG. 10.6 is a perspective view of the lock cover in the lock mechanism C10.

[0128] FIG. 10.71 is a right-side view of the lock mechanism C10 installed on a rifle;

[0129] FIG. 10.72 is an enlarged diagram of the position marked as I10 in FIG. 10.71;

[0130] FIG 11.1 is a right-side view of an eleventh embodiment of a lock mechanism C11 of the present invention;

[0131] FIG 11.2 is a left-side view of the lock mechanism C11;

[0132] FIG. 11.3 is a front view of the lock mechanism C11;

[0133] FIG. 11.4 is an exploded view of the lock mechanism C11;

[0134] FIG. 11.5 is a perspective view of the lock mechanism C11;

[0135] FIG. 11.6 is a perspective view of the lock cover of the lock mechanism C11;

[0136] FIG. 11.71 is a right-side view of the lock mechanism C11 installed on a rifle;

[0137] FIG. 11.72 is an enlarged diagram of the position marked as I11 in FIG. 11.71;

[0138] FIG. 12.1 is a right-side view of a twelfth embodiment of a lock mechanism C12 of the present invention;

[0139] FIG. 12.2 is a perspective view of the lock mechanism C12;

[0140] FIG. 12.3 is an exploded view of the lock mechanism C12;

[0141] FIG. 12.4 is a cross-sectional view of the lock mechanism C12 in locked position;

[0142] FIG. 12.5 is a cross-sectional view of the lock mechanism C12 in unlocked state;

[0143] FIG. 12.61 is a cross-sectional view of the lock mechanism C12 in unlocked position;

[0144] FIG. 12.62 is an enlarged diagram of the position marked as I12a in FIG. 12.61;

[0145] FIG. 12.71 is a cross-sectional view of the lock mechanism C12 in locked state;
[0146] FIG. 12.72 is an enlarged diagram of the position marked as I12b in FIG. 12.71;
[0147] FIG. 12.8 is a perspective view of the rack lock tongue of the lock mechanism C12;
[0148] FIG. 12.9 is a perspective view of the firing pin;
[0149] FIG 13.1 is a right-side view of a thirteenth embodiment of a lock mechanism C13 of the present invention;
[0150] FIG. 13.2 is a rear perspective view of the lock mechanism C13;
[0151] FIG. 13.31 is an exploded view of the lock mechanism C13;
[0152] FIG. 13.32 is the second assembly extension diagram of the lock mechanism C13;
[0153] FIG. 13.41 is a cross-sectional view of the lock mechanism C13 in locked state;
[0154] FIG. 13.42 is a cross-sectional view of the lock mechanism C13 in unlocked state;
[0155] FIG. 13.51 is a rear perspective view of the lock mechanism C13 in locked state;
[0156] FIG. 13.52 is an enlarged view of the position marked as I13a in FIG. 13.51;
[0157] FIG. 13.61 is a rear perspective view of the lock mechanism C13 in unlocked state;
[0158] FIG. 13.62 is an enlarged view of the position marked as I13b in FIG. 13.61;
[0159] FIG.14.1 is a left-side view of a fourteenth embodiment of a lock mechanism C14 of the present invention;
[0160] FIG.14.21 is a cross-sectional view of the lock mechanism C14 in locked state;
[0161] FIG.14.22 is a cross-sectional view of the lock mechanism C14 in unlocked state;
[0162] FIG.14.3 is a perspective view of the lock mechanism C14;
[0163] FIG.14.4 is an exploded view of the lock mechanism C14;
[0164] FIG.14.51 is a right-side view of the lock mechanism C14 installed on a rifle;
[0165] FIG.14.52 is an enlarged view of the position marked as I14 in FIG.14.51;
[0166] FIG.15.1 is a left-side view of a fifteenth embodiment of a lock mechanism C15 of the present invention;
[0167] FIG.15.21 is a cross-sectional view of the lock mechanism C15 in locked state;
[0168] FIG.15.22 is a cross-sectional view of the lock mechanism C15 in unlocked state;
[0169] FIG.15.3 is a perspective view of the lock mechanism C15;
[0170] FIG.15.4 is an exploded view of the lock mechanism C15;
[0171] FIG.15.51 is a right-side view of the lock mechanism C15 installed on a rifle;
[0172] FIG.15.52 is an enlarged view of the position marked as I15 in FIG. 15.51;
[0173] FIG. 16.1 is a left-side view of a sixteenth embodiment of a lock mechanism C16 of the present invention;
[0174] FIG.16.2 is a perspective view of the lock mechanism C16;

- [0175] FIG.16.3 is an exploded view of the lock mechanism C16;
- [0176] FIG.16.41 is a left-side view of the lock mechanism C16 installed on a rifle;
- [0177] FIG.16.42 is an enlarged view of the position marked as I16 in FIG. 16.41;
- [0178] FIG. 17.1 is a right-side view of a seventeenth embodiment of a mechanical lock C17 of the present invention;
- [0179] FIG. 17.2 is an exploded view of the lock mechanism C17;
- [0180] FIG. 17.3 is another exploded view of the lock mechanism C17;
- [0181] FIG. 17.4 is a perspective view of the lock mechanism C17;
- [0182] FIG. 17.51 is a right-side view of the lock mechanism C17 installed on a rifle;
- [0183] FIG. 17.52 is an enlarged drawing of the position marked as I17 in FIG. 17.51;
- [0184] FIG. 18.1 is a right-side view of an eighteenth embodiment of a mechanical lock C18 of the present invention;
- [0185] FIG. 18.2 is a left-side view of the lock mechanism C18 installed on handgun;
- [0186] FIG. 18.3 is an exploded view of the lock mechanism C18;
- [0187] FIG. 18.4 is a perspective view of the lock mechanism C18;
- [0188] FIG. 18.51 is a right-side view of the lock mechanism C18 installed on a rifle;
- [0189] FIG. 18.52 is an enlarged view of the position marked as I18 in FIG. 18.51;
- [0190] FIG. 19.1 is a right-side view of a nineteenth embodiment of a mechanical lock C19 of the present invention;
- [0191] FIG. 19.2 is a left-side view of the lock mechanism C19;
- [0192] FIG. 19.3 is an exploded view of the lock mechanism C19;
- [0193] FIG. 19.4 is a perspective view of the lock mechanism C19;
- [0194] FIG. 19.5 is a front view of the lock mechanism C19;
- [0195] FIG 19.61 is a perspective view of the lock mechanism C19 installed on a rifle;
- [0196] FIG.19.62 is an enlarged drawing of the position marked as I19 in FIG.19.61;
- [0197] FIG. 20.1 is a right-side view of a lock mechanism C20 of the present invention;
- [0198] FIG 20.2 is an exploded view of the lock mechanism C20;
- [0199] FIG 20.3 is a cross-sectional view of the lock mechanism C20 in locked state;
- [0200] FIG 20.4 is a cross-sectional view of the lock mechanism C20 in firing state;
- [0201] FIG 20.5 is a cross-sectional view of the lock mechanism C20 in unlocked state;
- [0202] FIG 20.6 is a perspective view of the lock mechanism C20;
- [0203] FIG 21.1 is a perspective view of a twenty-first embodiment of a lock mechanism C21 of the present invention;
- [0204] FIG 21.2 is an exploded view of the lock mechanism C21;

- [0205] FIG 21.3 is a left-side view of the trigger lever B5 and the limit hole B6 in firearms with the lock mechanism C21;
- [0206] FIG 21.4 is a perspective view of the firearm frame A1 of firearms with the lock mechanism C21;
- [0207] FIG 21.41 is an enlarged drawing of position I21a of FIG 21.4. in FIG 21.41;
- [0208] FIG 21.5 is a cross-sectional view of the lock mechanism C21;
- [0209] FIG 21.6 is a cross-sectional view of the lock mechanism C21 in unlocked state;
- [0210] FIG 21.61 is an enlarged drawing of the position marked as I21b of FIG 21.6;
- [0211] FIG 21.7 is a cross-sectional view of the lock mechanism C21 in locked state;
- [0212] FIG 21.71 is an enlarged drawing of position marked as I21c in FIG 21.7;
- [0213] FIG 22.1 is a perspective view of assembly of a twenty-second embodiment of a lock mechanism C22 of the present invention;
- [0214] FIG 22.2 is a cross-sectional view of the lock mechanism C22;
- [0215] FIG 22.21 is an enlarged drawing of position marked as I22 of FIG 22.2, when the lock mechanism C22 is in locked state;
- [0216] FIG 22.22 is an enlarged drawing of marked as position I22 of FIG 22.2, when the lock mechanism C22 is in unlocked state;
- [0217] FIG 22.3 is an exploded view of the lock mechanism C22;
- [0218] FIG 23.1 is a right-side view of a twenty-third embodiment of a lock mechanism C23 of the present invention;
- [0219] FIG 23.2 is a perspective view of the lock mechanism C23;
- [0220] FIG 23.3 is an exploded view of the lock mechanism C23;
- [0221] FIG 23.4 is a cross-sectional view of the lock mechanism C23;
- [0222] FIG 23.5 is a top cross-sectional view of the lock mechanism C23 in unlocked state;
- [0223] FIG 23.51 is an enlarged view of the mechanic lock C23 in unlocking state, the position marked as I23a in FIG 23.5;
- [0224] FIG 23.6 is a top cross-sectional view of the lock mechanism C23 in locked state;
- [0225] FIG 23.61 is an enlarged drawing of the lock mechanism C23 in locked state, the position marked as I23b in FIG 23.6;
- [0226] FIG 23.7 is a cross-sectional view of the lock mechanism C23;
- [0227] FIG 24.1 is a left-side view of the lock mechanism C24 installed on a handgun;
- [0228] FIG 24.2 is an exploded view of the lock mechanism C24;
- [0229] FIG 24.3 is a perspective view of a lock shell 1w of the lock mechanism C24;
- [0230] FIG 24.4 is a perspective view of the lock mechanism C24;

- [0231] FIG 24.5 is a top plan view of a lock tongue spring 4w of the lock mechanism C24;
- [0232] FIG 25.1 is a left-side view of a lock mechanism C25 installed on a handgun;
- [0233] FIG 25.2 is an exploded view of the lock mechanism C25;
- [0234] FIG 25.3 is a perspective view of a side clamp cover of the lock mechanism C25;
- [0235] FIG 25.4 is a partly exploded perspective view of the lock mechanism C25;
- [0236] FIG 26.1 is a left-side view of a lock mechanism C26 installed on a handgun;
- [0237] FIG 26.2 is an exploded view of the lock mechanism C26;
- [0238] FIG 26.3 is a perspective view of the lock mechanism C26;
- [0239] FIG 26.4 is a perspective view of a lock tongue 3'y of the lock mechanism C26;
- [0240] FIG 26.5 is a left-side of a variant of a lock mechanism C26';
- [0241] FIG 26.6 is an exploded view of another variant of a lock mechanism C26'';
- [0242] FIG 26.7 is a perspective view of a lock tongue 3''y of a lock mechanism C26'';
- [0243] FIG 26.8 is an exploded view of another variant of a lock mechanism C26''';
- [0244] FIG 26.9 is a perspective view of a lock tongue 3'''y of a lock mechanism C26''';
- [0245] FIG 27.1 is a left-side view of a lock mechanism C27 installed on a handgun;
- [0246] FIG 27.2 is a perspective view of the lock mechanism C27 installed on the handgun;
- [0247] FIG 27.3 is a perspective view of the lock mechanism C27;
- [0248] FIG 27.4 is an exploded view of the lock portion mechanism C27;
- [0249] FIG 27.5 is a partial exploded view of the lock mechanism C27;
- [0250] FIG 27.6 is a partial exploded view of a safety mechanism of an M1911 Class handgun;
- [0251] FIG 27.7 is a partial exploded view of the safety mechanism of a BERETTAM92F Class handgun;
- [0252] FIG 27.8 is a perspective view of the safety mechanism of the BERETTAM92F Class handgun;
- [0253] FIG 27.9 is a front exploded view of a variant of a lock mechanism C27';
- [0254] FIG 27.10 is a rear exploded view of the variant of the lock mechanism C27';
- [0255] FIG 27.11 is an exploded view of the variant of the lock mechanism C27';
- [0256] FIG 27.12 is a perspective view of the variant of the lock mechanism C27' installed on a handgun;
- [0257] FIG 28.1 is a right-side view of a lock mechanism C28 installed on a handgun;
- [0258] FIG 28.2 is a cross-sectional view of the lock mechanism C28, where the lock mechanism C28 is in an unlocked state;
- [0259] FIG 28.3 is a cross-sectional view of the lock mechanism C28, where the lock mechanism C28 is in a locked state;

[0260] FIG 28.4 is an exploded view of the lock mechanism C28;

[0261] FIG 28.5 is a perspective view of the lock mechanism C28; and

[0262] FIG 28.6 is an exploded view of the lock mechanism C28.

DETAILED DESCRIPTION OF THE INVENTION

[0263] Referring to FIG 1.0, a safety lock mechanism of the present invention would be controlled by a controller M1. The controller M1 may include peripherals, such as sensors, wireless or wired communication module (such that remote control information/command may be communicated to the controller M1), etc., for ensuring the safe environment / condition for use of the portable weapon, and usually, resides on or is installed on the portable weapon. One purpose of the controller M1 is, in order to maintain its operational safety of the portable weapon, upon confirmation / detection of operational conditions of the portable weapon, to control a driver M2 for driving an actuator M3 to actuate the safety lock mechanism for locking/allowing manual unlocking or locking / unlocking the firing sequence of the portable weapon. Thus, the controller M1, when the controller M1 enters in an operational state, would ensure that the firing sequence of the portable weapon is locked initially. The controller M1 would permit unlocking the firing sequence of the portable weapon only when the controller M1 conforms/detects the safe environmental condition(s) to use it or receives a remote control information / command(s), etc. During the operation of the portable weapon (in unlocked state), when the controller M1 confirms / detects any issue contrary to the safe environmental condition(s) or receives a remote control information / command(s), etc. to lock the sequence, then the controller M1 controls the driver M2 to drive an actuator M3 for actuating the safety lock mechanism to lock the firing sequence of the portable weapon. It is essential that the firing sequence of the portable weapon to be locked promptly in order to avoid, for example, shooting in a wrong direction or unsafe area. Accordingly, because the use of manual operation of the locking mechanism by a person / user has been minimized or eliminated, the controller M1 would lock/allow manual unlocking or lock / unlock the firing sequence of the portable weapon instantly, within 150 ms or so (or less) from when the controller M1 conforms/detects or receives a remote information/commands to lock/unlock.

[0264] There are various and multiple options or variations for a safety lock mechanism for a portable weapon in accordance with the present invention, and exemplary embodiments of the present invention are shown with referring to accompanied drawings hereinbelow.

FIRST PREFERRED EMBODIMENT

[0265] According to a first preferred embodiment of the present invention, it provides an automatic spring-type lock mechanism C1, which is installed at the middle of the slide A5, which corresponds to the front end B9 of the firing pin A6, as shown in FIGs. 1.1 and 1.2.

[0266] Referring to FIGs. 1.3, 1.4 and 1.5, the lock mechanism C1 includes a lock cover 2, a lock shell 1, a lock tongue actuator 3. The lock shell 1 has a lock core cavity 11, which includes a lock tongue slot 112 and an electromagnet installing slot 113. The lock tongue slot 112 and electromagnet installing slot 113 are in communication with each other via an opening being defined therebetween. A magnet slot 282 and a lock tongue extending hole 28 are located on the lock cover 2, and the magnet slot 282 corresponds to a permanent magnet 30. The lock tongue slot 112 and the electromagnet installing slot 113 on the lock shell 1 correspond to the lock tongue extending hole 28 and the magnet slot 282 on the lock cover 2.

[0267] The lock tongue actuator 3 actuates a lock tongue actuator rod or a bar member 314, the lock tongue actuator 3 comprises the permanent magnet 30, the lock tongue actuator rod 314, a spring 4, and an electromagnet 5(f). The permanent magnet 30 is disposed at one end of the lock tongue actuator rod 314. The electromagnet 5(f) is disposed to correspond to the permanent magnet 30. The electromagnet 5(f) is disposed at one end of the electromagnet installing slot 113 at the lock shell 1, and the permanent magnet 30 is movable along the electromagnet installing slot 113. The lock tongue actuator rod 314 operably extends out from or retracts in the lock tongue extending hole 28.

[0268] The permanent magnet 30 and a spring plate 32 are connected or placed adjacent to each other. The spring plate 32 is disposed at or formed at one end of the lock tongue actuator rod 314 for receiving the spring 4. The spring plate 32 and the lock tongue actuator rod 314, preferably, share the same axis. The permanent magnet 30 locates at the one end of the lock tongue actuator rod 314 and, preferably, forms an L-shape with the lock tongue actuator rod 314 as shown in FIG. 1.3. The plane of the spring plate 32 is, preferably, perpendicular to the axis of the lock tongue actuator rod 314. The spring (or lock tongue spring) 4 is disposed on the spring plate 32, and against the lock shell 1. The lock tongue spring 4, the spring plate 32 and the lock tongue actuator rod 314 operably engages with the lock tongue slot 112. The electromagnet 5(f) is fixed at the one end of the electromagnet installing slot 113 at the lock shell 1. The permanent magnet 30 is movably engages with the electromagnet installing slot 113.

[0269] The lock shell 1 has a lock shell fixing plate 10 and the lock cover 2 has a flange 26(a). The fixing plate 10 has two lock shell fixing holes 10(a) and the flange 26(a) has two fastening screw holes 261, which correspond to the lock shell fixing holes 10(a). The shell fixing plate

10 is fixed with the flange 26(a) by a bolt through the corresponding holes 10(a) and 261. A dovetail block 27 is extending from the lock cover 2. The lock shell 2 is inserted into the slide via the dovetail block 27. The lock tongue actuator rod 314 has a cut 319 thereon for blocking a firing pin A6.

[0270] When the handgun A is locked, the lock tongue actuator rod 314 is in the initial state, where the lock tongue actuator rod 314 extends out through the lock tongue extending hole 28. The lock tongue actuator rod 314 blocks the space between the firing pin A6 and a bullet (as shown in FIG 1.71, FIG 1.72, the firing pin A6 is behind the lock tongue actuator rod 314, thus not shown therein). Even if the firing pin A6 has the energy to rush towards the bullet, the strike action will only reach the lock tongue actuator rod 314, but will not reach to the bullet, so the bullet cannot be fired.

[0271] When the handgun A is in use, the electromagnet 5(f) may be electrified for 10 ~ 100 ms, and obtain a current to generate a sufficient magnet pole for attracting the permanent magnet 30. The permanent magnet 30 will, then, overcome the elastic force of the lock tongue spring 4. The lock tongue spring 4 is, thus, compressed by the spring plate 32 due to the force of the permanent magnet 30 and the electromagnet 5(f). And the lock tongue actuator rod 314 is retracted and locates in the lock tongue slot 112.

[0272] As shown in FIG 1.82, the lock tongue actuator rod 314 retracts back. The firing pin A6 is not blocked by the lock tongue actuator rod 314 and can hit the bullet without barrier. The gun A can, therefore, be fired.

[0273] A current to the electromagnet 5(f) may be initiated by a current driver (not shown) which may be controlled by a controller (not shown).

[0274] If the controller (not shown) detected an abnormal condition while the handgun A is in use, for example, the controller (not shown) may work on the current driver (not shown) on the handgun A, such that the electromagnet 5(f) will instantly get electrified reversely for 10 ~ 100 ms to drive the reverse current, thus producing a magnetic pole that is the same as the magnetic pole of the permanent magnet 30 in order to produce a magnetic repulsion force. The electromagnet 5(f) may, optionally, be sufficiently electrified reversely to produce a stronger magnetic repulsion force. The lock tongue actuator rod 314, then, is pushed out instantly by the repulsive force exerted with the lock tongue spring 4 and/or the magnetic repulsion, for example, within 150 ms from when the controller detected the condition for locking the firing sequence. The lock tongue actuator rod 314 blocks the space between the firing pin A6 and the bullet (not shown), as shown in FIG 1.71 and 1.72, and the firing pin A6 is blocked by the lock tongue actuator rod 314.

SECOND PREFERRED EMBODIMENT

[0275] Referring to FIGs. 2.1 to 2.82, according to a second preferred embodiment of the present invention, it provides an automatic spring-type lock mechanism C2, which is disposed at a position B7 adjacent to the hammer A5 on the slide A4 of the handgun A.

[0276] The automatic spring-type lock mechanism C2 comprises a lock tongue actuator 3a that blocks the space B10 between the firing pin A6 and the hammer A5 with a lock tongue actuator rod 314a as shown in FIGs. 2.71 and 2.72.

[0277] The structure of the lock core and lock shell 1a of the lock mechanism C2 are similar to those of the lock mechanism C1 as shown in FIGs. 1.1 to 1.82.

[0278] The lock mechanism C2 comprises a lock cover 2a, which has two symmetrical side plates: a first lock cover side plate 29a and a second lock cover side plate 29a(a). The distance between the first lock cover side plate 29a and the second lock cover side plate 29a(a) substantially corresponds to or matches with the width of the slide end adjacent to the hammer A5. A lock tongue extending hole 28a and a magnet slot 282a locate on the first lock cover side plate 29a. The lock tongue extending hole 28a is adjacent to the magnet slot 282a. The front end of the lock tongue actuator rod 314a extends out through or retracts into the lock tongue extending hole 28a, and the permanent magnet 30a movably engages with the magnet slot 282a. The lock tongue positioning slot 281a on the second lock cover side plate 29a(a) corresponds to lock tongue extending hole 28a.

[0279] The lock mechanism C2 includes the lock cover 2a, the lock shell 1a, and the lock tongue actuator 3a. The magnet slot 282a and a lock tongue extending hole 28a are located on the lock cover 2a, and the magnet slot 282a corresponds to the permanent magnet 30a. The lock tongue slot 112a and the electromagnet installing slot 113a on the lock shell 1a correspond to the lock tongue extending hole 28a and the magnet slot 282a on the lock cover 2a.

[0280] The lock tongue actuator 3a actuates a lock tongue actuator rod or a bar member 314a, the lock tongue actuator 3a comprises the permanent magnet 30a, the lock tongue actuator rod 314a, a spring 4a, and an electromagnet 5a(f). The permanent magnet 30a is disposed at one end of the lock tongue actuator rod 314a at the lock shell 1a. The electromagnet 5a(f) is disposed to correspond to the permanent magnet 30a. The electromagnet 5a(f) is disposed at one end of the electromagnet installing slot 113a at the lock shell 1a, and the permanent magnet 30a is movably disposed in the electromagnet installing slot 113a. The lock tongue actuator rod 314a operably extends out of or retracts in the lock tongue extending hole 28a.

[0281] There are mounting screw holes 93a corresponding to lock shell 1a on the first lock cover side plate 29a. The lock shell 1a is screwed on the first lock cover side plate 29a. There

are corresponding mounting screws 92a on the first lock cover side plate 29a and the second lock cover side plate 29a(a) in order to mount / affix these two components at the rear of the handgun A. The lock tongue actuator rod 314a has, preferably, a cylindrical structure, however, the structure of the lock tongue actuator rod 314a may be in other shapes, as long as it facilitates blocking the hammer A5 from striking the firing pin A6 as described below.

[0282] When the handgun A is not in use, the lock tongue actuator rod 314a is normally in the state of extending out through the lock tongue extending hole 28a, and the lock tongue actuator rod 314a blocks the space B10 between the firing pin A6 and the hammer A5 as shown in FIG. 2.4, FIG. 2.71, FIG. 2.72. Accordingly, when the hammer A5 acts to strike the firing pin A6, the lock tongue actuator rod 314a prevents the hammer A5 from hitting the firing pin A6.

[0283] When the gun is in use, as shown in FIG 2.5, the electromagnet 5a(f) is electrified for 10 ~ 100 ms, and obtains a current, thus producing a magnet pole attracting the permanent magnet 30a in a sufficient force, such that the permanent magnet 30a will overcome the elastic force exerted by the lock tongue spring 4a. The lock tongue spring 4a is compressed by the spring plate 32a due to the force of the permanent magnet 30a and the electromagnet 5a(f) as the permanent magnet 30a and the electromagnet 5a(f) are pulled in together (it is unnecessary to electrify the solenoid this stage). The lock tongue actuator rod 314a is retracted into the lock tongue slot 112a. As shown in FIG 2.5, 2.81 and 2.82, the lock tongue actuator rod 314a is retracted, such that the hammer A5 is not being blocked by the lock tongue actuator rod 314a, and, thus the hammer A5 would be able to hit the firing pin A6. Accordingly, the handgun A can be fired. A current to the electromagnet 5a(f) may be initiated by a current driver (not shown) which may be controlled by a controller (not shown).

[0284] If the controller (not shown) detects an abnormal condition while the handgun A is in use, for example, the controller (not shown) may work on the current driver (not shown) on the handgun A, such that the electromagnet 5a(f) will instantly get electrified reversely for 10 ~ 100 ms, with a reverse current, for producing a magnetic pole repelling the permanent magnet 30a to produce a sufficient magnetic repulsion. The lock tongue actuator rod 314a is rushed out by the repulsive force with the force exerted by the lock tongue spring 4a and/or the magnetic repulsion, for example, within 150 ms from when the controller detected the condition for locking the firing sequence. The lock tongue actuator rod 314a moves to lock tongue positioning slot 281a, blocks the space B10 between the firing pin A6 and the hammer A5. The hammer A5 is now blocked from striking the firing pin A6 by the lock tongue actuator rod 314a.

THIRD PREFERRED EMBODIMENT

[0285] Referring to FIGs. 3.1 to 3.82, according to a third preferred embodiment of the present invention, it provides an automatic spring-type lock mechanism C3, which is disposed at the grip A7 of a gun A, in which a lock tongue actuator 3b blocks the trigger A2 at the rear side of the trigger A2 with a lock tongue actuator rod 314b. The structure of the lock mechanism C3 is similar to those of the lock mechanisms C1 and C2.

[0286] The automatic spring-type lock mechanism C3 comprises a lock shell 1b, which is box-shaped. The lock shell 1b includes a lock core cavity 11b and a lock cover frustum 21b(a). The lock core cavity 11b includes a lock tongue slot 112b and an electromagnet installing slot 113b. The lock cover 2b has a lock tongue extending hole 28b, a lock cover slot 21b. A lock tongue extending hole 28b corresponds to the lock tongue slot 112b on the lock cover 2b, and a lock cover slot 21b corresponds to the lock cover frustum 21b(a).

[0287] The lock tongue actuator rod 314b and lock tongue spring 4b locates in the lock tongue slot 112b, the lock tongue actuator rod 314b extends out of the lock tongue extending hole 28b, the permanent magnet 30b and the electromagnet 5b(f) is disposed at one end of the electromagnet installing slot 113b, at the lock shell 1b.

[0288] The lock mechanism C3 has a clamp 7b fixed on the side wall of the lock shell 1b. The clamp 7b has a screw fastening hole 75b and a special screw 77b (as shown in FIG. 3.5, FIG. 3.6, FIG. 3.7). The clamp 7b matches the grip A7 and is fastened to the grip A7 (as shown in FIGs. 3.1, 3.2, 3.3, 3.81, and 3.82).

[0289] When the handgun A is in use, the electromagnet 5b(f) is electrified for 10 ~ 100 ms, to generate a magnet pole attracting the permanent magnet 30b in a sufficient force, such that the permanent magnet 30b overcomes the elastic force of the lock tongue spring 4b. The lock tongue spring 4b is, then, compressed by the spring plate 32b due to the force of the permanent magnet 30b and the electromagnet 5b(f) as the permanent magnet 30b and electromagnet 5b(f) are pulled in together. And the lock tongue actuator rod 314b is retracted and locates in the lock tongue slot 112b. The trigger A2 is not blocked by the lock tongue actuator rod 314b and can be pulled to fire the gun A. The current to the electromagnet 5b(f) may be initiated by a current driver (not shown) which may be controlled by a controller (not shown).

[0290] If the controller (not shown) detects an abnormal condition while the handgun A is in use, for example, the controller (not shown) may work on the current driver (not shown) on the handgun A, such that the electromagnet 5b(f) will instantly get electrified reversely for 10 ~ 100 ms, and to drive the reverse current, thus producing a magnetic pole same to the permanent magnet 30b to produce a sufficient magnetic repulsion. The lock tongue actuator rod 314b,

then, is pushed out instantly by the repulsive force exerted by the lock tongue spring 4b and/or the magnetic repulsion, for example, within 150 ms from when the controller detected the condition for locking the firing sequence. The lock tongue actuator rod 314b, thus, blocks the trigger A2 from being pulled.

[0291] The automatic spring-type lock mechanism C3 may be used for a portable long-barrelled firearm A' or alike as shown in FIGs. 3.81 and 3.82. The automatic spring-type lock mechanism C3 is disposed in such a manner to interact with a trigger A'2 thereof.

FOURTH PREFERRED EMBODIMENT

[0292] Referring to FIGs 4.1 to 4.62, according to a forth preferred embodiment of the present invention, it provides an automatic spring-type lock mechanism C4, which is disposed at the grip A7 of the handgun A. The lock mechanism C4 comprises a lock tongue actuator 3c, which is operable to block or release a trigger A2 of the handgun A with a lock tongue actuator rod 314c at the rear side thereof.

[0293] The basic structure of the present embodiment is similar to the one shown for C3, and the lock core and the structure of the lock cover 2c are similar to the structure shown for C3, except for the installation.

[0294] The lock mechanism C4 includes a lock cover fastening end 26c, a lock tongue extending hole 28c and a guide frustum 28c(a). The lock cover fastening end 26c has mounting screw holes 93c (as shown in FIG. 4.3, FIG. 4.4, FIG. 4.5, FIG. 4.61, FIG. 4.62). The back side of the lock cover 2c is a lock cover slot 21c. The front end of the lock shell 1c has a lock cover frustum 21c(a) corresponding to the lock cover slot 21c of the lock cover 2c. The lock cover frustum 21c(a) is inserted into the lock cover slot 21c of the lock cover 2c. The lock tongue slot 112c in the lock shell 1c is connected with the lock tongue extending hole 28c on the lock cover 2c.

[0295] The lock mechanism C4 is fixed on the grip A7 at the rear of the trigger A2 by mounting screw holes 93c on the fastening end 26c of the lock cover 2c.

[0296] Operation of the lock mechanism C4 is similar to that of C3. When the handgun A is in use, the electromagnet 5c(f) is electrified for 10 ~ 100 ms, and obtains a current, generates a magnet pole attracting the permanent magnet 30c. The permanent magnet 30c will overcome the elastic force from the lock tongue spring 4c. The lock tongue spring 4c is compressed by the spring plate 32c due to the force of the permanent magnet 30c and electromagnet 5c(f). And the lock tongue actuator rod 314c is retracted and locates in the lock tongue slot 112c. The lock tongue actuator rod 314c, which blocks the trigger A2, retracts back. The trigger A2 is not

blocked by the lock tongue actuator rod 314c and can be pulled. The current to the electromagnet 5c(f) may be initiated by a current driver (not shown) which may be controlled by a controller (not shown).

[0297] If the controller (not shown) detects an abnormal condition while the handgun A is in use, for example, the controller (not shown) may work on the current driver (not shown) on the handgun A, such that the electromagnet 5c(f) will instantly get electrified reversely for 10 ~ 100 ms, and to drive the reverse current, thus producing a magnetic pole same to the permanent magnet 30c to produce a sufficient magnetic repulsion. The lock tongue actuator rod 314c, then, is pushed out instantly by the repulsive force exerted by the lock tongue spring 4c and/or the magnetic repulsion, for example, within 150 ms from when the controller detected the condition for locking the firing sequence. The lock tongue actuator rod 314c, thus, blocks the trigger A2 from being pulled.

[0298] The lock mechanism C4 may be used for a portable long-barrelled firearm A' or alike as shown in FIGs. 4.61 and 4.62. The lock mechanism C4 is disposed in such a manner to interact with a trigger A'2 thereof.

FIFTH PREFERRED EMBODIMENT

[0299] Referring to FIGs 5.1 to 5.62, according to a fifth preferred embodiment of the present invention, it provides an automatic spring-type lock mechanism C5, which is disposed at the trigger guard A3, a lock tongue actuator 3d is operable to block or release at the rear of the trigger A2 of a handgun A with a lock tongue actuator rod 314d.

[0300] The basic structure of the lock mechanism C5 is similar to that of C3, and the lock core and the structure of a lock cover 2d are similar to C4. (The lock mechanisms C3, C4 and C5 are based on the same principle, however, differ in that where and how they are installed).

[0301] The lock mechanism C5 comprises the lock cover 2d, including a lock cover slot 21d, a lock tongue extending hole 28d, and the second clamp slot 22d for clamping at trigger guard A3. Corresponding to the second trigger guard clamp 22d is the clamping plate 7d, which operates together with the second trigger guard clamp 22d. The second trigger guard clamp 22d and the clamping plate 7d cooperates to clamp on the trigger guard A3. (FIG 5.1, FIG 5.2, shown).

[0302] The front end of the lock shell 1d has a lock cover frustum 21d(a) corresponding to the lock cover slot 21d. The lock cover frustum 21d(a) is inserted into the lock cover slot 21d of the lock cover 2d. The lock tongue slot 112d in the lock shell 1d is connected with the lock tongue extending hole 28d of the lock cover 2d (as shown in FIG 5.3, FIG 5.4, FIG 5.5).

[0303] The lock mechanism C5 is fixed to the trigger guard A3 through the second trigger guard clamp 22d and the clamping plate 7d (as shown in FIG. 5.1, FIG. 5.61, FIG. 5.62).

[0304] Operation of the lock mechanism C5 is similar to that of C4. When the handgun A is in use, the electromagnet 5d(f) is electrified for 10 ~ 100 ms, and obtains a current, generates a magnet pole attracting the permanent magnet 30d. The permanent magnet 30d will overcome the elastic force from the lock tongue spring 4d. The lock tongue spring 4d is compressed by the spring plate 32d due to the force of the permanent magnet 30c and electromagnet 5d(f). And the lock tongue actuator rod 314d is retracted and locates in the lock tongue slot 112d. The lock tongue actuator rod 314d, which blocks the trigger A2, retracts back. The trigger A2 is not blocked by the lock tongue actuator rod 314d and can be pulled. The current to the electromagnet 5d(f) may be initiated by a current driver (not shown) which may be controlled by a controller (not shown).

[0305] If the controller (not shown) detected an abnormal condition while the handgun A is in use, for example, the controller (not shown) may work on the current driver (not shown) on the handgun A, such that the electromagnet 5d(f) will instantly get electrified reversely for 10 ~ 100 ms, and to drive the reverse current, thus producing a magnetic pole same to the permanent magnet 30d to produce a sufficient magnetic repulsion. The lock tongue actuator rod 314d, then, is pushed out instantly by the repulsive force exerted by the lock tongue spring 4d and/or the magnetic repulsion, for example, within 150 ms from when the controller detected the condition for locking the firing sequence. The lock tongue actuator rod 314d, thus, blocks the trigger A2 from being pulled.

[0306] The lock mechanism C5 may be used for a portable long-barrelled firearm A' or alike as shown in FIGs. 5.61 and 5.62. The automatic spring-type lock mechanism C5 is disposed in such a manner to interact with a trigger A'2 thereof.

SIXTH PREFERRED EMBODIMENT

[0307] Referring to FIGs 6.1 to 6.72, according to a sixth preferred embodiment of the present invention, it provides an automatic spring-type lock mechanism C6, which is disposed at the position B9, which is about or is adjacent to the front end of the firing pin A6 on the slide A4 of the handgun A.

[0308] The lock mechanism C6 includes a lock cover 2e, a lock shell 1e, a lock tongue actuator 3e. A lock core cavity 11e is in the lock shell 1e. A lock core cavity 11e includes a spring slot 118e, a lock tongue slot 112e and an electromagnet installing slot 113e. The lock tongue slot 112e locates between the spring slot 118e and the electromagnet installing slot 113e. The spring

slot 118e is connected with the electromagnet installing slot 113e through the lock tongue slot 112e. The lock tongue actuator 3e includes a lock tongue actuator rod 314e, a spring plate 32e, a permanent magnet 30e. The lock tongue actuator rod 314e may be square, and the spring plate 32e and the permanent magnet 30e connect both sides of the lock tongue actuator rod 314e, respectively, forming a crossing with the lock tongue actuator rod 314e. The electromagnet 5e(f) is disposed at one end of the electromagnet installing slot 113e at the lock cover 2e. The lock tongue spring 4e is disposed between the spring plate 32e and the lock cover 2e in the spring slot 118e. The lock tongue actuator rod 314e is located in the lock tongue slot 112e. The lower part of the lock shell 1e has a lock tongue hole 119e, and the lower end of the lock tongue actuator rod 314e is located within the lock tongue hole 119e or extends out from the lock tongue hole 119e (FIG. 6.4, FIG. 6.5). The permanent magnet 30e is able to slide within the electromagnet installing slot 113e. The lock tongue spring 4 and the spring plate 32e are set in the spring slot 118e. The lock cover 2e is fixed on the upper part of the lock shell 1e. [0309] The lock shell 1e is provided with two mounting plates 13e. The distance between the two mounting plates 13e and the gun body width at the installation point is matched. The mounting screw holes 93e is locate on the mounting plates 13e, and the mounting plates 13e is mounted at the position B9, which is adjacent with the front end of the firing pin A6 on the slide A4 of the handgun A.

[0310] When the handgun A is not in use, the lock tongue actuator rod 314e extends out of the lock tongue hole 119e, and the lock tongue actuator rod 314e is straight down and blocks the space B12 between the firing pin A6 and the bullet (see FIG. 6.4, FIG. 6.6, FIG. 6.71, FIG. 6.72), Therefore, even if the firing pin A6 has the energy to rush to the bullet, it will only hit the lock tongue actuator rod 314e, but not the bullet. So, the handgun A cannot be fired.

[0311] When the electromagnet 5e(f) is electrified for 10 ~ 100 ms, and obtains a, thus producing a magnet pole attracting the permanent magnet 30e. The permanent magnet 30e will overcome the elastic force exerted by the lock tongue spring 4e. The lock tongue spring 4e is compressed by the spring plate 32e due to the force of the permanent magnet 30e and electromagnet 5e(f), and the lock tongue actuator rod 314e is retracted back and locates in the lock tongue hole 119e. As shown in FIG 6.5, 6.71 and 6.72, the lock tongue actuator rod 314e, which blocks the firing pin A6, retracts back. The firing pin A6 is not blocked by the lock tongue actuator rod 314e, and it can hit the bullet without barrier. According, the gun can be fired. The current to the electromagnet 5e(f) may be initiated by a current driver (not shown) which may be controlled by a controller (not shown).

[0312] If the controller (not shown) detects an abnormal condition while the handgun A is in use, for example, the controller (now shown) may work on the current driver (not shown) on the handgun A, such that the electromagnet 5e(f) will instantly get electrified reversely for 10 ~ 100 ms, and instantaneously get the reverse current, produces a magnetic pole repelling the permanent magnet 30e, and then it produces a sufficient magnetic repulsion. The lock tongue actuator rod 314e is pushed out instantly by the repulsive force exerted by the lock tongue spring 4e and/or the magnetic repulsion as shown in FIG 6.4, FIG 6.61 and FIG 6.62. The firing pin A6 is blocked by the lock tongue actuator 3e, so the bullet cannot be hit, and the gun cannot be fired.

SEVENTH PREFERRED EMBODIMENT

[0313] Referring to FIGs 7.1 to 7.81, according to a seventh preferred embodiment of the present invention, it provides an automatic spring-type lock mechanism C7, which is mounted on the position B8 corresponding to firing pin circular slot B11 of the gun slide A4 on the handgun A.

[0314] The lock mechanism C7 includes a lock cover 2f, a lock shell 1f, and a lock tongue actuator 3f, including a lock tongue actuator rod 314f, a spring plate 32f, a permanent magnet 30f, a lock tongue spring 4f, and an electromagnet 5f(f).

[0315] The lock mechanism C7 is similar to that of C6. The lock tongue actuator rod 314f has a semicircular fork 318f. When the handgun A is not in use, the lock tongue actuator rod 314f extends out from the lock tongue hole 119f. The semicircular fork 318f of the lock tongue actuator rod 314f blocks the firing pin A6 at the firing pin circular slot B11 (as shown in FIG 7.4, FIG 7.61, FIG 7.62, FIG 7.81, FIG 7.82). Even if the hammer A5 hits the firing pin A6, and even if the firing pin A6 would rush towards the bullet, the hammer A5 would only strike the semicircular fork 318f (thus the firing pin A6 is blocked from the hammer A5 by the semicircular fork 318f), and, thus, the bullet cannot be hit and the handgun A cannot be fired. The function of keeping the gun safe when the gun is not in use is realized.

[0316] When the handgun A is normally in use, as shown in FIG 7.5 and 7.71, the electromagnet 5f(f) is electrified for 10 ~ 100 ms, and obtains a current, thus producing a magnet pole attracting the permanent magnet 30f. The permanent magnet 30f will overcome the elastic force exerted by the lock tongue spring 4f. The lock tongue spring 4f is compressed by the spring plate 32f due to the force of the permanent magnet 30f and electromagnet 5f(f), and the lock tongue actuator rod 314f is retracted back and locates in the lock tongue hole 119f. As shown in FIG 7.5 and 7.72, the lock tongue actuator rod 314f retreats back from the firing

pin circular slot B11 of the firing pin A6. Without the blocking of the lock tongue actuator rod 314f, the firing pin A6 can hit the bullet barrier free. The handgun A can be fired. The current to the electromagnet 5f(f) may be initiated by a current driver (not shown) which may be controlled by a controller (not shown).

[0317] If the controller (not shown) detects an abnormal condition while the handgun A is in use, for example, the controller (not shown) may work on the current driver (not shown) on the handgun A, such that the electromagnet 5f(f) will instantly get electrified reversely for 10 ~ 100 ms, and instantaneously get the reverse current, thus producing a magnetic repelling the permanent magnet 30f, and then it produces a sufficient magnetic repulsion. The lock tongue actuator rod 314f is pushed out instantly by the repulsive force exerted by the lock tongue spring 4f and/or the magnetic repulsion within 150ms (as shown in FIG 7.4, FIG 7.61, 7.62) from when the controller detected the condition for locking the firing sequence. The firing pin circular slot B11 is blocked by the semicircular fork 318f on the lock tongue actuator rod 314f and the firing pin A6 cannot reach to the bullet.

EIGHTH PREFERRED EMBODIMENT

[0318] Referring to FIGs 8.1 to 8.82, according to an eighth preferred embodiment of the present invention, it provides an automatic spring-type lock mechanism C8, which is disposed at the end of the slide A4, which is adjacent with the hammer B7. The lock tongue actuator 3g corresponds the position B10 between the firing pin A6 and the hammer A5.

[0319] The structure of the lock mechanism C8 is similar to that of C6, except for its installation position.

[0320] The lock mechanism C8 is disposed on the end of the slide A4, which is adjacent with the hammer A5. The basic structure of the lock mechanism C8 is the same as that of C1, which includes a lock cover 2g, a lock shell 1g, and a lock tongue actuator 3g, including a lock tongue actuator rod 314g, a spring plate 32g, a permanent magnet 30g, a lock tongue spring 4g and an electromagnet 5g(f).

[0321] In this embodiment, two mounting plates 13g on the lock shell 1g are lengthened, comparing them with those of C7. The width between the two mounting plates 13g and the position where the gun mounted are matched. The lock tongue hole 119g is set at the bottom of the lock tongue slot 112g (as shown in FIG. 8.3, FIG. 8.4, FIG. 8.5, and FIG. 8.6, respectively). The electromagnet 5g(f) is mounted on the upper end of the electromagnet installing slot 113g (see FIG. 8.5).

[0322] When the gun is not in use, the lock tongue actuator rod 314g extends out of the lock tongue hole 119g, and the lock tongue actuator rod 314g blocks the space B10 between the firing pin A6 and hammer A5 (as shown in FIG 8.1, FIG 8.5, FIG 8.71/8.72). The size or diameter of the lock tongue actuator rod 314g is sufficiently large to cover the firing pin A6 to keep the hammer A5 from striking the firing pin A6. So even when the hammer A5 strikes, the hammer A5 will only hit the lock tongue actuator rod 314g and will not hit the firing pin A6. The function of keeping the gun safe when the handgun A is not in use is realized.

[0323] When the handgun A is normally in use and there is no emergency situation exists, as shown in FIG 8.6, the electromagnet 5g(f) is electrified for 10 ~ 100 ms, and obtains a current, thus producing a magnet pole attracting the permanent magnet 30g. The permanent magnet 30g will overcome the elastic force exerted by the lock tongue spring 4g. The lock tongue spring 4g is compressed in a spring slot 118g by the spring plate 32g due to the force of the permanent magnet 30g and electromagnet 5g(f) (it is unnecessary to electrify the solenoid continuously for an extended period of time), and the lock tongue actuator rod 314g is retracted and locates in the lock tongue hole 119g. As shown in FIG 8.5-8.82, the lock tongue actuator rod 314g, which blocks the hammer A5, retracts back. The hammer A5 is not blocked by the lock tongue actuator rod 314g and can strike the firing pin A6, thus, the gun A can be fired. The current to the electromagnet 5g(f) may be initiated by a current driver (not shown) which may be controlled by a controller (not shown).

[0324] If the controller (not shown) detects an abnormal condition while the handgun A is in use, for example, the controller (not shown) may work on the current driver (not shown) on the handgun A, such that the electromagnet 5g(f) will instantly get electrified reversely for 10 ~ 100 ms, and instantaneously get the reverse current, thus producing a magnetic pole repelling the permanent magnet 30g, and then it produces a sufficient magnetic repulsion. The lock tongue actuator rod 314g is pushed out instantly by the repulsive force exerted by the lock tongue spring 4g and/or the magnetic repulsion within 150ms from when the controller detected the condition for locking the firing sequence. The lock tongue actuator rod 314g extends and blocks the space B10 between the firing pin A6 and the hammer A5 as shown in FIG 8.71 and 8.72. The hammer A5 is blocked by the lock tongue, thus the gun cannot be fired.

NINTH PREFERRED EMBODIMENT

[0325] Referring to FIGs. 9.1 to 9.62, according to a ninth preferred embodiment of the present invention, it provides a gear-type trigger lock mechanism C9 for a firearm or alike.

[0326] The lock mechanism C9 includes a lock shell 1h, a lock cover 2h and a lock tongue actuator 3h, including a motor 5h(b), a driving gear 5h(d), an idler gear and/or gear set 5h(e) and a bar member 314h. The lock cover 2h has a motor placement slot 25h inside. The motor placement slot 25h receives the motor 5h(b), and the drive shaft of motor 5h(b) is connected with the driving gear 5h(d). The lock shell 1h and/or the lock cover 2h have a lock cylinder cavity 11h, which includes a gear mounting cavity 116h and a lock tongue slot 112h. The driving gear 5h(d) locates inside the gear mounting cavity 116h. The bar member 314h is mounted in lock tongue slot 112h, and the driving gear 5h(d) is engaged with the rack 316h.

[0327] When the center distance between the driving gear 5h(d) and the rack 316h is too short (i.e. the drive gear and the rack cannot be engaged), the idler gear and/or gear set 5h(e) can be added to increase the center distance. The driving gear 5h(d) is engaged with the idler gear and/or gear set 5h(e) and the idler gear and/or gear set 5h(e) is engaged with the rack 316h of the bar member 314h. The lock shell 1h or the lock cover 2h has an idler shaft 117h, and the idler gear and/or gear set 5h(e) is rotated with respect to the axis of the idler shaft 117h. The number of idler gear and/or gear set can be adjusted/changed according to center distance(s), rotation direction(s), and/or shifting(s).

[0328] A first part of the bar member 314h has a stroke slot 315h, a first half part of the bar member 314h corresponding to the driving gear 5h(d) is the rack 316h, and a second half of the bar member 314h is a mounting surface 317h. The mounting surface 317h is matched with and mounted inside the lock tongue slot 112h, and the bar member 314h moves towards the direction of the lock tongue slot 112h.

[0329] The stroke limiter 20h (a cylinder limits the position the bar member 314h) corresponding to the stroke slot 315h of the bar member 314h is set within the lock shell 1h or the lock cover 2h. The limiter locates within the stroke slot 315h.

[0330] The lock cover 2h has a mounting base 7h(b), and the mounting base 7h(b) is disposed on the outer side of the motor placement slot 25h. The mounting base 7h(b) has mounting holes, and the gear-type lock mechanism C9 mechanism is mounted on the gun grip A7 via the mounting base 7h(b). A lock hole is provided on the trigger guard A3. The bar member 314h can extend through the lock hole in the trigger guard A3 when it protrudes. The bar member 314h passes through the lock hole and locates at the rear of the trigger A2. The bar member 314h blocks the backward stroke of the trigger A2 so that the trigger A2 cannot be pulled and the gun cannot be fired. This achieves the function of locking firearms when they are not in use.

[0331] When the gun is used normally, the motor 5h(b) is positively electrified for 10 to 100 ms, and the motor 5h(b) begins to rotate for driving the driving gear 5h(d) and the idler gear and/or gear set 5e to retract the bar member 314h into the lock tongue slot 112h. The bar member 314h retracts from the rear side of the trigger A2, then the motor 5h(b) does not need to be electrified. The backward stroke of the trigger A2 is not blocked and the gun is unlocked.

[0332] When an abnormal condition(s) is detected, the motor 5h(b) is electrified reversely for 10-100 ms, and the motor 5b starts to rotate the driving gear 5h(d) and the idler gear and/or gear set 5h(e) to extend the bar member 314h out from the lock tongue slot 112h. The bar member 314h moves to the rear side of the trigger A2, then the motor 5h(b) does not need to be electrified. The backward stroke of the trigger A2 is blocked and the gun is locked.

[0333] The gear-type trigger lock C9 may be used for a portable long-barrelled firearm A' or alike as shown in FIGs. 9.61 and 9.62. The gear-type trigger lock C9 is disposed in such a manner to interact with a trigger A'2 thereof.

TENTH PREFERRED EMBODIMENT

[0334] Referring to FIGs. 10.1 to 10.72, according to a tenth embodiment of the present invention, it provides a gear-type trigger lock mechanism C10, which includes a lock shell 1i, a lock cover 2i and a lock tongue actuator 3i, including a motor 5i(b), a driving gear 5i(d), an idler gear and/or gear set 5i(e), and a bar member 314i. The lock cover 2i has a motor placement slot 25i inside. The motor placement slot 25i receives the motor 5i(b), and the drive shaft of motor 5i(b) is connected with a driving gear 5i(d). The lock shell 1i and/or the lock cover 2i have a lock cylinder cavity 11i, which includes a gear mounting cavity 116i and a lock tongue slot 112i. The driving gear 5i(d) locates inside the gear mounting cavity 116i. The bar member 314i is mounted in lock tongue slot 112i, and the driving gear 5i(d) is engaged with the rack 316i of the bar member 314i.

[0335] When the center distance between the driving gear 5i(d) and the rack 316i is too short (i.e. the drive gear and the rack cannot be engaged), the idler-wheel 5i(e) can be added to increase the center distance. The driving gear 5i(d) is engaged with the idler gear and/or gear set 5i(e) and the idler gear and/or gear set 5i(e) is engaged with the rack 316i of the bar member 314i. The lock shell 1i or the lock cover 2i has an idler shaft 117i, and the idler gear and/or gear set 5i(e) is rotated with respect to the axis of the idler shaft 117i. The number of idler gear and/or gear set can be adjusted/changed according to center distance(s), rotation direction(s), and/or shifting(s).

[0336] A first part of the bar member 314h has a stroke slot 315i, a first half part of the bar member 314i corresponding to the driving gear 5i(d) is the rack 316i, and a second half of the bar member 314i is a mounting surface 317i. The mounting surface 317i is matched with and mounted inside the lock tongue slot 112i, and the bar member 314i moves towards the direction of the lock tongue slot 112i.

[0337] The stroke limiter 20i (a cylinder limits the position of the bar member 314i) corresponding to the stroke slot 315i of the bar member 314i is set within the lock shell 1i or the lock cover 2i. The limiter locates within the stroke slot 315i.

[0338] The lock mechanism C10 is mounted on the grip A7 of the handgun A. The structure of the lock shell 1i, the driving gear 5i(d), the idler gear and/or gear set 5i(e), the shape and the installation of the bar member 314i are all the same as those of the lock mechanism C9, except for the installation position of the lock mechanism C10. While the shapes and structures of the lock shell 2i is different from those previously shown in the lock mechanism C9.

[0339] The other side of the motor placement slot 25i stretches out of the mounting base 7i(b) and is attached to the clamp 7i. The shape of U-shaped clamp 7i matches the handgun A. The clamp 7i is fixed with the mounting base 7i(b) via the clamp connection plate 74i. The U-shaped clamp 7i is fastened to the grip A7 of the handgun A by fastening means, such as screws. The bar member 314i locates on the side of the trigger A2. The bar member 314i extends to the rear side of the trigger A2. Then the bar member 314i blocks the backward stroke of the trigger A2, so that the trigger A2 cannot be pulled and the gun cannot be fired. The function of locking the trigger when the gun is not in use can be realized.

[0340] When the gun is normally used, the motor 5i(b) is positively electrified for 10 to 100 milliseconds, and the motor 5i(b) begins to rotate and drives the driving gear 5i(d) the idler gear and/or gear set 5i(e), and to retract the bar member 314i in the lock tongue slot 112i. The bar member 314i, which locates in the lock shell 1i, retracts from the rear side of the trigger A2, then the motor 5i(b) does not need to be electrified. The backward stroke of the trigger A2 is not blocked (released) and the trigger A2 is free to be pulled to fire the gun.

[0341] The lock mechanism C10 may be used for a portable long-barrelled firearm A' or alike as shown in FIGs. 10.71 and 10.72. The lock mechanism C10 is disposed in such a manner to interact with a trigger A'2 thereof.

ELEVENTH PREFERRED EMBODIMENT

[0342] Referring to FIGs. 11.1 to 11.72, according to an eleventh preferred embodiment of the present invention, it provides a gear-type trigger lock mechanism C11, which includes a lock

shell 1j, a lock cover 2j and a lock tongue actuator 3j, including a motor 5j(b), a driving gear 5j(d), an idler gear and/or gear set 5j(e), and a bar member 314j. The lock cover 2j has a motor placement slot 25j inside. The motor placement slot 25j receives the motor 5j(b), and the drive shaft of motor 5j(b) is connected with a driving gear 5j(d). The lock shell 1j and/or the lock cover 2j has a lock cylinder cavity 11j, which includes a gear mounting cavity 116j and a lock tongue slot 112j. The driving gear 5j(d) locates inside the gear mounting cavity 116j. The bar member 314j is slidably mounted on a lock tongue slot 112j, and the driving gear 5j(d) is engaged with the rack 316j of the bar member 314j.

[0343] When the center distance between the driving gear 5j(d) and the rack 316j is too short (i.e. the drive gear and the rack cannot be engaged), the idler-wheel 5j(e) can be added to increase the center distance. The driving gear 5j(d) is engaged with the idler gear and/or gear set 5j(e) and the idler gear and/or gear set 5j(e) is engaged with the rack 316j of the bar member 314j. The lock shell 1h or the lock cover 2j has an idler shaft 117j, and the idler gear and/or gear set 5j(e) is rotated with respect to the axis of the idler shaft 117j. The number of idler gear and/or gear set can be adjusted/changed according to center distance(s), rotation direction(s), and/or shifting(s).

[0344] A first part of the bar member 314j has a stroke slot 315j, a first half part of the bar member 314j corresponding to the driving gear 5j(d) is the rack 316j, and a second half of the bar member 314j is a mounting surface 317j. The mounting surface 317j is matched with and mounted inside the lock tongue slot 112j, and the bar member 314h moves towards the direction of the lock tongue slot 112j.

[0345] The stroke limiter 20j (a cylinder limits the position of the bar member 314j) corresponding to the stroke slot 315j of the bar member 314j is set within the lock shell 1j or the lock cover 2j. The limiter locates within the stroke slot 315j.

[0346] The structure of the lock mechanism C11 is basically the same as that of the lock mechanism C9, except for the installation. The lock mechanism C11 structure of the embodiment is mounted on the grip A7 of the handgun A. The structure of the lock shell 1j, the shape and installation of the bar member 314j, the driving gear 5j(d) and bar member 314j are the same as those of the lock mechanism C9, except for the shape and the structure of the lock cover 2j.

[0347] The motor placement slot 25j connects the mounting base 7j(b), and the gear-type lock mechanism C11 structure is mounted on the grip A7 of the handgun A via the mounting base 7j(b). The bar member 314j locates on one side of the trigger A2, and the bar member 314j locates at the rear end of the trigger A2 when it protrudes. The bar member 314j blocks the

backward stroke of the trigger A2, so that the trigger A2 cannot be pulled and the gun cannot be fired. The function of locking the firearms when the firearms are not in use is realized.

[0348] When the gun is normally used, the motor 5j(b) is positively electrified for 10 to 100 ms, and the motor 5j(b) begins to rotate to drive the driving gear 5j(d) and the idler gear and/or gear set 5j(e), then to drive the rack 316j. The bar member 314j, which locates in the lock shell 1j, retracts from the rear end of the trigger A2, then the motor 5j(b) does not need to be electrified. The backward stroke of the trigger A2 is not blocked (released) and the trigger A2 is free to be pulled to fire the gun.

[0349] The lock mechanism C11 may be used for a portable long-barrelled firearm A' or alike as shown in FIGs. 11.71 and 11.72. The lock mechanism C11 is disposed in such a manner to interact with a trigger A'2 thereof.

TWELFTH PREFERRED EMBODIMENT

[0350] Referring to FIGs. 12.1 to FIG. 12.9, according to a twelfth preferred embodiment of the present invention, it provides a gear-type trigger lock mechanism C12, which includes a lock shell 1k, a lock cover 2k and a lock tongue actuator 3k. The lock tongue actuator 3k includes a motor 5k(b), a driving gear 5k(d), an idler gear and/or gear set 5k(e), and a bar member 314k. The lock cover 2k has a motor placement slot 25k inside. The motor placement slot 25k receives the motor 5k(b), and the drive shaft of the motor 5k(b) is connected with a driving gear 5k(d). The lock shell 1k and/or the lock cover 2k has a lock cylinder cavity 11k, which includes a gear mounting cavity 116k and a lock tongue slot 112k. The driving gear 5k(d) locates inside the gear mounting cavity 116k. The bar member 314k is mounted in lock tongue slot 112k, and the driving gear 5k(d) is engaged with the rack 316k of the bar member 314k.

[0351] When the center distance between the driving gear 5k(d) and the rack 316k is too short (i.e. the drive gear and the rack cannot be engaged), the idler-wheel 5k(e) can be added to increase the center distance. The driving gear 5k(d) is engaged with the idler gear and/or gear set 5k(e) and the idler gear and/or gear set 5k(e) is engaged with the rack 316k of the bar member 314k. The lock shell 1k or the lock cover 2k has an idler shaft 117k, and the idler gear and/or gear set 5k(e) is rotated with respect to the axis of the idler shaft 117k. The number of idler gear and/or gear set can be adjusted/changed according to center distance(s), rotation direction(s), and/or shifting(s).

[0352] A first part of the lock tongue actuator 3k has a stroke slot 315k for slidably receiving the bar member 314k. A first half part of the bar member 314k which is corresponding to the

driving gear 5k(d)/ the idler-wheel 5k(e) is the rack 316k, and a second half of the bar member 314k has a mounting surface 317k. The mounting surface 317k is matched with and mounted inside the lock tongue slot 112k, and the lock tongue actuator 3k moves towards the direction of the lock tongue slot 112k.

[0353] The stroke limiter 20k (a cylinder limits the position the lock tongue actuator 3k) corresponding to the stroke slot 315k of the lock tongue actuator 3k is set within the lock shell 1k or the lock cover 2k. The limiter locates within the stroke slot 315k.

[0354] The structure of the lock mechanism C12 is basically the same as that of the lock mechanism C9, except for the installation. The lock mechanism C12 of the present embodiment is installed at the rear of the slide A4 on the handgun A. The structure of the lock shell 1k, the shape and installation of the driving gear 5k(d) and bar member 314k are the same as those of the lock mechanism C9, but the shape and structure of the bar member 314k are different.

[0355] The lock mechanism C12 controls the firing pin A6, and a firing pin circular slot B11 is set at the rear of the firing pin A6.

[0356] As shown in FIG. 12.3, the present embodiment includes a lock shell 1k and a lock cover 2k which are fixed together. The lock cover 2k has a motor placement slot 25k. A cover side gear mounting cavity 116k is set at the front end of the motor placement slot 25k. The cover side gear mounting cavity 116k has a stroke limiter 20k and an idler shaft 117k. The stroke limiter 20k locates inside the stroke slot 315k, and the idler shaft 117k is connected with the idler gear and/or gear set 5k(e). A motor 5k(b) is installed inside the motor placement slot 25k, and the drive shaft of the motor 5k(b) connects a driving gear 5k(d). The driving gear 5k(d) connects the bar member 314k via the idler gear and/or gear set 5k(e).

[0357] A mounting base 7k(b) is on one side of the lock cover 2k, and it locates at the lower side of the motor placement slot 25k near the side gear mounting cavity 116k. The gear-type lock mechanism C12 is mounted via the mounting base 7k(b) at the rear of the gun slide A4.

[0358] As shown in FIG. 12.8, the bar member 314k has a stroke slot 315k. There is a semicircular fork 318k at the lower part of the bar member 314k. On one side of the bar member 314k, there exists a rack 316k. The idler gear and/or gear set 5k(e) meshes with the rack 316k.

[0359] The gear-type lock mechanism C12 is mounted at the rear of the slide A4 on the handgun A. When the bar member 314k protrudes, the semicircular fork 318k matches the firing pin circular slot B11 at the rear of the firing pin A6. The semicircular fork 318k is stuck at the firing pin circular slot B11. The bar member 314k fastens the firing pin A6 and the gun cannot be fired, as shown in FIG. 12.5 and FIG. 12.7.

[0360] When the gun is not in use, as shown in FIG. 12.5 or 12.7, the bar member 314k of the gear-type lock mechanism C12 structure is at the state of protruding, or namely, the semicircular fork 318k of the bar member 314k is stuck at the firing pin circular slot B11. Even if the hammer A5 hits the firing pin A6 and the firing pin A6 has the energy to hit the bullet, it will still be stuck and offset by the semicircular fork 318k, and cannot strike the bullet, thus the gun cannot be fired. This realizes the function of locking the firearms when it is not in use.

[0361] Referring to FIGs. 12.4, 12.6, and 12.9, when the gun A is normally used, the motor 5k(b) is positively electrified for 10 ~ 100 ms, and a forward current signal drives the motor 5k(b) to rotate forward, driving the driving gear 5k(d). Then the driving gear 5k(d) rotates the idler gear and/or gear set 5k(e). In this way, the idler gear and/or gear set 5k(e) rotates and moves the rack 316k, so the bar member 314k retracts back with the rack 316k. Then the motor 5k(b) does not need to be electrified. The semicircular fork 318k of the bar member 314k rapidly retreats back from the firing pin circular slot B11. The firing pin A6 is not blocked by the bar member 314k and can hit bullets.

[0362] The control motor 5k(b) rotates reversely when the lock needs to be closed.

THIRTEENTH PREFERRED EMBODIMENT

[0363] Referring to FIGs. 13.1 to 13.62, according to a thirteenth preferred embodiment of the present invention, it provides a gear-type trigger lock mechanism C13 includes a lock shell 11, a lock cover 21 and a lock tongue actuator 31, including a motor 5l(b), a driving gear 5l(d), an idler gear and/or gear set 5l(e), and a bar member 314l. The lock cover 21 has a motor placement slot 25l inside. The motor placement slot 25l receives the motor 5l(b), and the drive shaft of motor 5l(b) is connected with a driving gear 5l(d). The lock shell 11 and/or the lock cover 21 has a lock cylinder cavity 111, which includes a gear mounting cavity 116l and a lock tongue slot 112l. The driving gear 5l(d) locates inside the gear mounting cavity 116l. The lock tongue actuator 31 is mounted in lock tongue slot 112l, and the driving gear 5l(d) is engaged with the rack 316l of the lock tongue actuator 31.

[0364] When the center distance between the driving gear 5l(d) and the rack 316l is too short (i.e. the drive gear and the rack cannot be engaged), the idler-wheel 5l(e) can be added to increase the center distance. The driving gear 5l(d) is engaged with the idler gear and/or gear set 5l(e) and the idler gear and/or gear set 5l(e) is engaged with the rack 316l of the lock tongue actuator 31. The lock shell 11 or the lock cover 21 has an idler shaft 117l, and the idler gear and/or gear set 5l(e) is rotated with respect to the axis of the idler shaft 117l. The number of

idler gear and/or gear set can be adjusted/changed according to center distance(s), rotation direction(s), and/or shifting(s).

[0365] A first part of the lock tongue actuator 31 has a stroke slot 3151 for slidably receiving the bar member 3141. A first half part of the bar member 3141 which is corresponding to the driving gear 51(d) / the idler-wheel 51(e) is the rack 3161, and a second half of the bar member 3141 has a mounting surface 3171. The mounting surface 3171 is matched with and mounted inside the lock tongue slot 1121, and the lock tongue actuator 31 moves towards the direction of the lock tongue slot 1121.

[0366] The stroke limiter 201 (a cylinder limits the position the lock tongue actuator 31) corresponding to the stroke slot 3151 of the lock tongue actuator 31 is set within the lock shell 11 or the lock cover 21. The limiter locates within the stroke slot 3151.

[0367] The structure of the lock mechanism C13 is basically the same as that of the lock mechanism C9, except for the installation. The lock mechanism C13 is installed at the rear of the slide A4 of the handgun A. The basic structure of the lock shell 11, the shape and installation of the driving gear 51(d), the idler gear and/or gear set 51(e), the bar member 3141 are the same as those of the lock mechanism C9. The shape and structure of the lock tongue actuator 31, the lock shell 1 and the lock cover 21 are partially different from the lock mechanism C9, C10, C11 or C12.

[0368] The lock mechanism C13 is mounted at the rear of slide A4 of the handgun A. The lock mechanism C13 structure includes a lock shell 11 and a lock cover 21, which are fastened together. The lock cover 21 has a motor placement slot 251, and the lock shell 11 or the lock cover 21 has a gear mounting cavity 1161. The motor placement slot 251 has a motor 51(b) inside. The drive shaft of the motor 51(b) is connected with a driving gear 51(d), and the driving gear 51(d) connects the bar member 3141 via the idler gear and/or gear set 51(e). The bar member 3141 has a stroke slot 3151. The gear mounting cavity 1161 has a stroke limiter 201. The stroke limiter 201 locates in the stroke slot 3151. The gear mounting cavity 1161 has an idler shaft 1171, and the idler shaft 1171 connects the idler gear and/or gear set 51(e). The bar member 3141 has a rack 3161 on one side. The idler gear and/or gear set 51(e) meshes with the rack 3161. The lower end of the lock shell 11 has a fixing clamp plate 131. The lock mechanism C13 is mounted on the rear of slide A4 of the handgun A via a fixing clamp plate 131. The bar member 3141 blocks between the firing pin A6 and the hammer A5. When the bar member 3141 extends, it prevents the hammer A5 from striking the firing pin A6, so the gun cannot be fired.

FOURTEENTH PREFERRED EMBODIMENT

[0369] Referring to FIGs. 14.1 to 14.52, according to a fourteenth preferred embodiment of the present invention, it provides a semi-automatic electromagnetic telescoping lock mechanism C14, which includes a lock shell 1m, a lock cover 2m and a lock tongue actuator 3m, including a lock tongue spring 4m, an electromagnet 5m(f), a lock tongue limit spring 5m(g), lock tongue limit block 5m(h) and a bar member 314m. The lock mechanism C14 is mounted on handgun A via the lock shell 1m. The lock shell 1m and / or lock cover 2m defines a lock tongue groove 112m and an electromagnet groove 113m. The lock tongue groove 112m has an opening / lock tongue extending hole 28m at one end thereof, that faces to the rear of trigger A2. The bar member 314m is slidably engaged with the lock tongue groove 112m and is biased by the lock tongue spring 4m, which is located at the closed end (opposite to the lock tongue extending hole 28m) of the lock tongue groove 112m. The first clamp slot 321m and the second clamp slot 321m(a) are located on the bar member 314m. The lock shell 1m has lock handle sliding groove 320m(a); and the position of the lock shell 1m is corresponding with the lock tongue actuator 3m. The lock tongue reset handle 320m is in communication with the bar member 314m to retract the bar member 314m.

[0370] The lock tongue limit block 5m(h) is embedded in the first clamp slot 321m or the second clamp slot 321m(a). The electromagnet (or push-pull solenoid) 5m(f), the lock tongue limit spring 5m(g), and the lock tongue limit block 5m(h) are disposed inside the electromagnetic groove 113m. The lock tongue limit block 5m(h) is designed to correspond with a first clamp slot 321m and a second clamp slot 321m(a) on the bar member 314m. The electromagnet 5m(f) may be driven by a driver (not shown), which may be controlled by a controller (now shown).

[0371] The guard slot 12m is on the side opening of lock shell 1m. The guard slot 12m is designed to match with the trigger guard A3. A clamp plate 7m is installed on the side of the lock cover 2m. The second guard slot 22m is built on top of the clamp plate 7m and corresponds to the guard slot 12m. the clamp plate 7m is screwed on the lock cover 2m. The second guard slot 22m and the guard slot 12m form a clipped-shape, which correspond with the trigger guard A3 in order to allow the lock mechanism 14 to clamp on the trigger guard A3 tightly. The bar member 314m may be in cylindrical shape; however, the structure of the bar member 314m may be in other shapes, as long as it facilitates blocking the trigger A2 from being pulled. When the bar member 314m is driven to extend out, the bar member 314m blocks the trigger A2 from behind. The lock mechanism C14 is installed below the trigger guard A3 of the handgun A. A safety sensing control system (not shown) may be installed on the handgun A to control the

lock mechanism C14. A hole is drilled at the bottom of the trigger guard A3 of the handgun A to allow the bar member 314m to go through the drilled hole.

[0372] The lock mechanism C14 may be used for a portable long-barrelled firearm A' or alike as shown in FIGs. 14.51 and 14.52. The semi-automatic lock mechanism C14 is disposed in such a manner to interact with a trigger A'2 thereof.

FIFTEENTH PREFERRED EMBODIMENT

[0373] Referring to FIGs. 15.1 to 15.52, according to a fifteenth embodiment of the present invention, it provides a semi-automatic lock mechanism C15, which includes a lock shell 1n, lock cover 2n and a lock tongue actuator 3n, including a lock tongue spring 4n, an electromagnet 5n(f), a lock tongue limit spring 5n(g), a lock tongue limit block 5n(h) and an arc member 314n. The lock mechanism C15 is mounted on the handgun A via lock shell 1n. The lock shell 1n and/or lock cover 2n defines a lock tongue groove 112n and an electromagnet groove 113n. The lock tongue groove 112n has an opening / lock tongue extending hole 28n at one end thereof, that faces to the rear of trigger A2. The arc member 314n is slidably engaged with the lock tongue groove 112n and is biased by the lock tongue spring 4n, which is located at the closed end (opposite to the lock tongue extending hole 28n) of the lock tongue groove 112n. The first clamp slot 321n and the second clamp slot 321n(a) are located on the arc member 314n. The lock shell 1n has a lock handle sliding groove 320n(a); and the position of the lock shell 1n is corresponding with the arc member 314n. A lock tongue reset handle 320n is in communication with the arc member 314n to retract the arc member 314n.

[0374] The lock tongue limit block 5n(h) is embedded in the first clamp slot 321n or the second clamp slot 321n(a). The electromagnet (or push-pull solenoid) 5n(f), the lock tongue limit spring 5n(g), and the lock tongue limit block 5n(h) are disposed inside the electromagnetic groove 113n. The lock tongue limit block 5n(h) is designed to correspond with the first clamp slot 321n and the second clamp slot 321n(a) located on the arc member 314n. The electromagnet 5n(f) may be driven by a driver (not shown), which may be controlled by a controller (now shown).

[0375] The lock tongue groove 112n is designed to be shaped in correspondence with the arc shape of the arc member 314n. The lock shell 1n and/or lock cover 2n define the lock tongue groove 112n and the electromagnet groove 113n. The guard slot 12n is defined by an opening surface of the lock shell 1n and lock cover 2n. The second guard slot 22n is defined by the clamp plate 7n and it is designed to match with the guard slot 12n. The clamp plate 7n is clipped on top of the lock shell 1n and lock cover 2n. The guard slot 12n and the second guard slot 22n

correspond to the outer shape of the trigger guard A3 for clamping thereto, thus the lock mechanism C15 may be clamped to the trigger guard A3. When lock tongue actuator 3n locks, due to its unique shape, it extends behind the trigger from the side in order to prohibit pulling trigger A2.

[0376] The lock mechanism C15 may be used for a portable long-barrelled firearm A' or alike as shown in FIGs. 15.51 and 15.52. The lock mechanism C15 is disposed in such a manner to interact with a trigger A'2 thereof.

SIXTEENTH PREFERRED EMBODIMENT

[0377] Referring to FIGs. 16.1 to 16.4, according to a sixteenth preferred embodiment of the present invention, it provides a semi-automatic lock mechanism C16, which includes a lock shell 1o, lock cover 2o and a lock tongue actuator 3o, including a lock tongue spring 4o, an electromagnet 5o(f), a lock tongue limit spring 5o(g), lock tongue limit block 5o(h) and a bar member 314o. The lock mechanism C16 is mounted on a handgun A via the U-shaped clamp plate 7o. The lock shell 1o and/or lock cover 2o defines a lock tongue groove 112o and an electromagnet groove 113o. The lock tongue groove 112o has an opening / lock tongue extending hole 28o at one end thereof, that faces to the rear of the trigger A2. The bar member 314o is slidably engaged with the lock tongue groove 112o and is biased by the lock tongue spring 4o, which is located at the closed end (opposite to the lock tongue extending hole 28o) of the lock tongue groove 112o. The first clamp slot 321o and the second clamp slot 321o(a) are located on the bar member 314o. The lock shell has lock handle sliding groove 320o(a); and the position of the lock shell 1o is corresponding with the lock tongue actuator 3o. The lock tongue reset handle 320o connects to the bar member 314o.

[0378] The lock tongue limit block 5o(h) is embedded in the first clamp slot 321o or the second clamp slot 321o(a). The electromagnet (or push-pull solenoid) 5o(f), lock tongue limit spring 5o(g), and lock tongue limit block 5o(h) are disposed inside the electromagnetic groove 113o. The lock tongue limit block 5o(h) is designed to correspond with a first clamp slot 321o and a second clamp slot 321o(a) on the bar member 314o. The electromagnet 5o(f) may be driven by a driver (not shown), which may be controlled by a controller (not shown).

[0379] The structure of the lock mechanism C16 is similar to that of the lock mechanism C13, except the installing method and position. The clamp plate 7o is designed in a U-shaped and the area inside 76o, which is used to hold gun grip A7. The clamp connection plate 74o is built on the inner side of the U-shaped clamp plate 7o, the lock shell 1o and lock cover 2o is installed on the clamp connection plate 74o; and the lock mechanism C16 can be installed on the gun

grip A7 through the U-shaped clamp plate 7o. The lock mechanism C16 is adjustable by adjusting a screw(s) 77o. Screws 77o are used to connect the U-shaped clamp plate 7o with lock shell 1o and lock cover 2o to improve its stability and safety.

[0380] The lock mechanism C16 may be used for a portable long-barrelled firearm A' or alike as shown in FIGs. 16.41 and 16.42. The semi-automatic lock mechanism C16 is disposed in such a manner to interact with a trigger A'2 thereof.

SEVENTEENTH PREFERRED EMBODIMENT

[0381] Referring to FIGs. 17.1 to 17.52, according to a seventeenth preferred embodiment of the present invention, it provides a semi-automatic lock mechanism C17, which includes a lock shell 1p, a lock cover 2p and a lock tongue actuator 3p, including a lock tongue spring 4p, a push-pull solenoid 5p (which is equivalent to use of a combination of electromagnet, lock tongue limit spring and lock tongue limit block as used in C14, C15, C16, C18, etc.) and an arc member 314p. The lock mechanism C17 is mounted on the handgun A via U-shaped clamp plate 7p. The lock shell 1p and/or lock cover 2p defines a lock tongue groove 112p and an electromagnet groove (not shown). The lock tongue groove 112p has an opening / lock tongue extending hole 28p at one end thereof, that faces to the rear of trigger A2. The arc member 314p is slidably engaged with the lock tongue groove 112p and is biased by the lock tongue spring 4p, which is located at the closed end (opposite of the lock tongue extending hole 28p) of the lock tongue groove 112p. The first clamp slot 321p and the second clamp slot 321p(a) are located on the arc member 314p. The lock cover 2p has a lock handle sliding groove 320p(a); and the position of the lock shell 1p is corresponding with the arc member 314p. The lock tongue reset handle 320p is in communication with the arc member 314p to retract the arc member 314p.

[0382] The iron core 51p operably engages with the first clamp slot 321p or the second clamp slot 321p(a). The push-pull solenoid 5p is disposed inside the electromagnetic groove (not shown). The iron core 51p is designed to correspond/operate (engage or release) with the first clamp slot 321p and the second clamp slot 321p(a) located on the arc member 314p. The push-pull solenoid 5p may be driven by a driver (not shown), which may be controlled by a controller (not shown).

[0383] The lock mechanism C17 is designed to be installed on the firearm grip A7, along with the U-shaped clamp plate 7p, including lock shell 1p and lock cover 2p. The arc-shaped lock tongue groove 112p is welded on the lock shell 1p. The shape of the arc-shaped member 314p is matched with that of the lock tongue groove 112p. The shape of the second sliding groove

17p, which is locating on the lock tongue groove 112p, is designed to match with the lock handle sliding groove 320p(a), where lock tongue reset handle 320p is in communication with the arc member 314p. The shape of iron core 51p is matched with the second clamp slot 321p(a) and the first clamp slot 321p. The lock shell 1p and lock cover 2p are installed on the side of the U-shaped clamp plate 7p. The lock mechanism C17 is mounted on the firearm grip A7 via the U-shaped clamp plate. When the lock tongue actuator 3p extends the arc member 314p to lock the handgun A, the arc member 314p extends behind the trigger A2 from the side of the handgun A. The lock tongue actuator 3p is disposed inside the lock cover 2p; the push-pull solenoid 5p has similar capabilities as the composing elements of the electromagnetic telescoping lock mechanism: a combination of electromagnet, lock tongue limit spring and lock tongue limit block as discussed in other mechanical locks C14, C15, C16 and C18. This lock mechanism C17 is screwed on the firearm grip A7 via the U-shaped clamp plate 7p. The position thereof is adjustable.

[0384] The principle of the operation in the semi-automatic lock mechanism C17 is similar to the semi-automatic lock mechanism C15; whereas, the lock mechanism is fixed on the grip A7 and the lock tongue actuator 3p extends behind the trigger A2 from the side to prohibit pulling the trigger A2 in its locking position.

[0385] The lock mechanism C17 may be used for a portable long-barrelled firearm A' or alike as shown in FIGs. 17.51 and 17.52. The lock mechanism C17 is disposed in such a manner to interact with a trigger A'2 thereof.

EIGHTEENTH PREFERRED EMBODIMENT

[0386] Referring to FIGs. 18.1 to 18.52, according to a seventeenth preferred embodiment of the present invention, it provides a semi-automatic lock mechanism C18, which includes a lock shell 1q, a lock cover 2q and a lock tongue actuator 3q, including a lock tongue spring 4q, an electromagnet 5q(f), a lock tongue limit spring 5q(g), lock tongue limit block 5q(h) and a bar member 314q. The lock mechanism C18 is mounted on handgun A via lock shell 1q and/or lock cover 2q. The lock shell 1q and/or lock cover 2q define a lock tongue groove 112q and an electromagnet groove 113q. The lock tongue groove 112q has an opening / lock tongue extending hole 28q at one end thereof, that faces to the rear of trigger A2. The bar member 314q is slidably engaged the lock tongue groove 112q and is biased by the lock tongue spring 4q, which is located at the closed end (opposite to the lock tongue extending hole 28q) of the lock tongue groove 112q. The first clamp slot 321q and the second clamp slot 321q(a) are located on the bar member 314q. The lock shell has lock handle sliding groove 320q(a) and the

position of the lock shell is corresponding with lock tongue actuator 3q. The lock tongue reset handle 320q is in communication with the bar member 314q to retract the bar member 314q.

[0387] The lock tongue limit block 5q(h) is embedded in the first clamp slot 321q or the second clamp slot 321q(a). The electromagnet (or push-pull solenoid) 5q(f), lock tongue limit spring 5q(g), and lock tongue limit block 5q(h) are disposed inside the electromagnetic groove 113m. The lock tongue limit block 5q(h) is designed to correspond with the first clamp slot 321q and the second clamp slot 321q(a) located on the lock tongue actuator 3q. The electromagnet 5q(f) may be driven by a driver (not shown), which may be controlled by a controller (not shown).

[0388] The structure of the lock mechanism (C18) is similar to those of C14 and C16, besides the installing method and position. The lock shell 1q is interlocked with the lock cover 2q. The clamp plate 7q(b) is installed on the mounting surface of lock shell 1q and the lock cover 2q. The lock mechanism C18 is installed on the grip A7 of the handgun A via clamp plate 7q(b). The bar member 314q extends behind the trigger A2 from the side to prohibit pulling the trigger in its locking position.

[0389] The lock mechanism C18 may be used for a portable long-barrelled firearm A' or alike as shown in FIGs. 18.51 and 18.52. The lock mechanism C18 is disposed in such a manner to interact with a trigger A'2 thereof.

NINETEENTH PREFERRED EMBODIMENT

Referring to FIGs. 19.1 to 19.6, according to a nineteenth preferred embodiment of the present invention, it provides a semi-automatic lock mechanism C19, which has a structure similar to that of the lock mechanism C17. The lock mechanism C19 comprises a lock shell 1r, and a lock tongue actuator 3r, including a lock tongue spring 4r, a push-pull solenoid 5r and an arc member 314r. A lock tongue groove 112r is designed to be matched with lock tongue actuator 3r to be arc-shaped, partially welded on lock shell 1r. The second sliding slot numbered as 17r is designed on the lock tongue groove 112r. An electromagnetic telescoping mechanism is composed by the push-pull solenoids 5r, which is installed on the electromagnetic groove 113r located inside lock shell 1r. The lock shell 1r is block-shaped and screwed on grip A7 via thickened guard B13. By utilizing the space created by the thickened guard B13, a portion of the lock mechanism C19 or additional features / functions (such as a printed circuit board therefor or other) may be placed therein. The arc member 314r extends from one side of the gun to the backside of trigger A2 at full extension position. The arc member 314r extends behind the trigger A2 from the side to prohibit pulling the trigger A2 in its locking position. The locked position and unlocked position of the arc member 314r are carried out in the same

manner as shown in the lock mechanism C17. The push-pull solenoid 5r may be driven by a driver (not shown), which may be controlled by a controller (not shown).

OPERATION OF THE LOCK MECHANISMS C14, C15, C16, C17, C18 AND C19

[0390] The operation processes of the mechanical locks C14 through C19 are carried out in a similar manner as described as follow:

[0391] When the handgun A is not in use, the lock tongue spring 4m/4n/4o/4p/4q/4r biases the bar member 314m/314n/314o/314p/314q/314r. The lock tongue limit block 5m(h)/5n(h)/5o(h)/(not shown in C17)/5q(h)/(not shown in C19), or the iron core (not shown in C14)/(not shown in C15)/(not shown in C16)/51p/(not shown in C18)/51r is pointing to the second clamp slot 321m(a)/321n(a)/321o(a)/321p(a)/321q(a)/321r(a). The lock tongue limit block 5m(h)/5n(h)/5o(h)/(not shown in C17)/5q(h)/(not shown in C19) or the iron core (not shown in C14)/(not shown in C15)/(not shown in C16)/51p/(not shown in C18)/51r is being extended onto the second clamp slot 321m(a)/321n(a)/321o(a)/321p(a)/321q(a)/321r(a). The bar member 314m/314n/314o/314p/314q/314r is extended to block a firing sequence of the handgun A. For example, for the bar member 314m, the bar member 314m reaches to the rear side of the trigger A2 from the bottom portion of the trigger guard A3 to prevent the movement of the trigger from being pulled. For the bar member 314n/314o/314p/314q/314r, the bar member 314n/314o/314p/314q/314r reaches to the rear side of the trigger A2 laterally or from the side to prevent the movement of the trigger A2 from being pulled. The purpose is substantially the same for the bar member 314m/314n/314o/314p/314q/314r, which is to reach to the rear side of the trigger A2 such that the bar member 314m/314n/314o/314p/314q/314r prevents the trigger A2 from being pulled (thus blocks the firing sequence of the handgun A).

[0392] The electromagnet 5m(f)/5n(f)/5o(f)/(not shown in C17)/5q(f)/(not shown in C19) may be electrified, in which the magnetic force caused by the electromagnet 5m(f)/5n(f)/5o(f)/(not shown in C17)/5q(f)/(not shown in C19) allows the lock tongue limit block 5m(h)/5n(h)/5o(h)/(not shown in C17)/5q(h)/(not shown in C19) to resist the elastic force caused by the limit spring 5m(g)/5n(g)/5o(g)/(not shown in C17)/5q(g)/(not shown in C19), resulting the limit block 5m(h)/5n(h)/5o(h)/(not shown in C17)/5q(h)/(not shown in C19) to eject from the second clamp slot 321m(a)/321n(a)/321o(a)/321p(a)/321q(a)/321r(a); or as the push-pull solenoid (not shown in C14)/(not shown in C15)/(not shown in C16)/5p/(not shown in C18)/5r is controlled in such a way that the iron core (not shown in C14)/(not shown in C15)/(not shown in C16)/51p/(not shown in C18)/51r is retracted from the first clamp slot 321m/321n/321o/321p/321q/321r. Under such condition, the bar member

314m/314n/314o/314p/314q/314r can be moved freely. The lock tongue reset handle 320m/320n/320o/320p/320q/320r can then be pulled manually against the elastic force caused by spring 4m/4n/4o/4p/4q/4r. The bar member 314m/314n/314o/314p/314q/314r is then pulled back into the lock tongue groove 112m/112n/112o/112p/112q/112r. As the magnetic force caused by the electromagnet 5m(f)/5n(f)/5o(f)/(not shown in C17)/5q(f)/(not shown in C19) has been released, the lock tongue limit block 5m(h)/5n(h)/5o(h)/(not shown in C17)/5q(h)/(not shown in C19) is being bounced into the first clamp slot 321m/321n/321o/321p/321q/321r by the elastic force caused by the limit spring 5m(g)/5n(g)/5o(g)/(not shown in C17)/5q(g)/(not shown in C19); or as the push-pull solenoid (not shown in C14)/(not shown in C15)/(not shown in C16)/5p/(not shown in C18)/5r is controlled in such a way that the iron core (not shown in C14)/(not shown in C15)/(not shown in C16)/51p/(not shown in C18)/51r engages with the first clamp slot 321m/321n/321o/321p/321q/321r. As the lock tongue is now being fixed within the lock tongue groove 112m/112n/112o/112p/112q/112r, the trigger can now be pulled to fire the handgun A.

[0393] The electromagnet 5m(f)/5n(f)/5o(f)/(not shown in C17)/5q(f)/(not shown in C19) may be electrified in order to counter the force exerted by the limit spring 5m(g)/5n(g)/5o(g)/(not shown in C17)/5q(g)/(not shown in C19) just enough to pull the lock tongue limit block 5m(h)/5n(h)/5o(h)/(not shown in C17)/5q(h)/(not shown in C19) out from the first clamp slot 321m/321n/321o/321p/321q/321r located on the bar member 314m/314n/314o/314p/314q/314r; or as the push-pull solenoid (not shown in C14)/(not shown in C15)/(not shown in C16)/5p/(not shown in C18)/5r is controlled to retract the iron core (not shown in C14)/(not shown in C15)/(not shown in C16)/51p/(not shown in C18)/51r to disengage with the first clamp slot 321m/321n/321o/321p/321q/321r. . The elastic force of spring 4m/4n/4o/4p/4q/4r causes the bar member 314m/314n/314o/314p/314q/314r to be extended through from the bottom of the trigger guard A3 of the handgun A to behind the trigger A2. In this position, the trigger A2 is prohibited to be pulled backwards. Meanwhile, the electromagnet 5m(f)/5n(f)/5o(f)/(not shown in C19)/5q(f)/(not shown in C19) or the push-pull solenoid (not shown in C14)/(not shown in C15)/(not shown in C16)/5p/(not shown in C18)/5r is discharged, the lock tongue limit block 5m(h)/5n(h)/5o(h)/(not shown in C17)/5q(h)/(not shown in C19) or the iron core (not shown in C14)/(not shown in C15)/(not shown in C16)/51p/(not shown in C18)/51r is, then, rushed into the second clamp slot 321m(a)/321n(a)/321o(a)/321p(a)/321q(a)/321r(a); the lock tongue actuator 3m/3n/3o/3p/3q/3r is now locked, the trigger A2 cannot be pulled, and the handgun A cannot be fired.

[0394] If standby mode is desired, the electromagnet 5m(f)/5n(f)/5o(f)/(not shown in C17)/5q(f)/(not shown in C19) or the push-pull solenoid (not shown in C14)/(not shown in C15)/(not shown in C16)/5p/(not shown in C18)/5r will be electrified shortly, the limit block 5m(h)/5n(h)/5o(h)/(not shown in C17)/5q(h)/(not shown in C19) or the iron core (not shown in C14)/(not shown in C15)/(not shown in C16)/51p/(not shown in C18)/51r ejects from the second clamp slot 321m(a)/321n(a)/321o(a)/321p(a)/321q(a)/321r(a); meanwhile, the lock tongue reset handle 320m/320n/320o/320p/320q/320r should be pulled manually to be reset.

[0395] The mechanical part of the lock actuator can be composed by push-pull solenoid or servo motor accordingly. The operation principle shall be the same. When a servo motor is used, a control system may directly control the servo motor driver.

TWENTIETH PREFERRED EMBODIMENT

[0396] Referring to FIGs. 20.1 to 20.6, according to a twentieth preferred embodiment of the present invention, it provides a pull-rod style trigger lock mechanism C20.

[0397] The lock mechanism C20 includes a lock shell 1s, a lock cover 2s, a bar member 314s, a pull-rod 32s, a pull-rod screw 32s(a), a pull-rod screw hole 32s(b), a lock tongue spring 4s and a self-holding solenoid 5s(a). The lock shell 1s has a lock core cavity 11s. A lock core cavity plate 111s separates the lock core cavity 11s into two cavities: a first pull-rod cavity 11s(a) and a second pull-rod cavity 11s(b). The bar member 314s comprises a conical frustum 34s, which is disposed one end that connects to the pull-rod 32s, and the bar member 314s is slidably engaged with the first pull-rod cavity 11s(a), slidable along a moving path of the trigger A2. The bar member 314s comprises a trigger clamp 31s for receiving the trigger A2 of the handgun A. The pull-rod 32s is slidably engaged with the second pull-rod cavity 11s(b). The pull-rod 32s comprises a position limiter 33s for limiting the range of the movement of the pull-rod 32s within the second pull-rod cavity 11s(b). In a preferred embodiment of the present invention, the position limiter 33s has a diameter larger than the cavity 111s(a) of the lock core cavity plate 111s, while the diameter of the pull-rod 32s is sufficiently correspond to or smaller than the diameter of the cavity 111s(a) such that the pull-rod 32s freely slides through the cavity 111s(a). The opposite end of the pull-rod 32s is attached to the conical frustum 34s of the bar member 314s. The diameter of the conical frustum 34s is larger than that of the cavity 111s(a) of the lock core cavity plate 111s, such that the range of the movement of the bar member 314s is limited by the lock core cavity plate 111s. The position limiter 33s may be welded with to the pull-rod 32s. The lock tongue spring 4s embraces the pull-rod 32s and biases the position limiter 33s away from the lock core cavity plate 111s. The self-holding solenoid 5s(a) is set

perpendicular to the sliding direction of the bar member 314s. The iron core 51s on the self-holding solenoid 5s(a) extends through the lock core hole 18s on the lock shell 1s and reaches onto the bar member 314s, the conical frustum 34s or the pull-rod 32s. The self-holding solenoid 5s(a) is disposed in the solenoid shell 6s. The trigger clamp 31s engages with the trigger A2 firmly. The lock shell 1s comprises two parts: the upper lock shell 1s and lower lock cover 2s, which are interlocked with each other. The upper and lower lock shells 1s and 2s, respectively, have corresponding/mating shapes and structures.

[0398] Two mounting clamp plates 13s are provided on the lock shell 1s to form a clamp plate slot 14s. The lock mechanism C20 is clamped at the front part of the trigger guard A3 with the clamp plate slot 14s as shown in FIG 20.1. In terms of firearms with Picatinny rails, the clamp plate slot 14s can be replaced by proper Picatinny rails.

[0399] As shown in FIG 20.3, the self-holding solenoid 5s(a) is mounted in a manner that allows the iron core 51s to extend or retract through the lock core hole 18s. There is a cone spring on the iron core 51s (under initial status, the cone spring is at its natural state and the iron core extends outwards). To lock, the iron core 51s extends onto the bar member 314s, such that the conical frustum 34s is placed between the iron core 51s and the lock core cavity plate 111s. In a preferred embodiment of the present invention, the conical frustum 34s fits in a gap defined between the iron core 51s (when extended onto the bar member 314s) and the lock core cavity plate 111s.

[0400] When the handgun A is not in use, the iron core 51s of the self-holding solenoid 5s(a) extends onto the bar member 314s, such that the conical frustum 34s of the bar member 314s is placed between the iron core 51s and the lock core cavity plate 111s, such that the bar member 314s cannot be moved. Accordingly, since the trigger clamp 31s is fastened with the trigger A2, the trigger A2 is blocked and cannot be pulled, therefore the handgun A is unable to fire.

[0401] When the handgun A is in use, the self-holding solenoid 5s(a) of the lock mechanism C20 retracts the iron core 51s, releasing the conical frustum 34s on the bar member 314s, so that the bar member 314s can be pulled outwards. The trigger A2 only needs to overcome the elastic force of the lock tongue spring 4s on the pull-rod 32s to be pulled backward, as shown in FIG. 20.4. After the handgun A is fired, the bar member 314s can automatically move back to its original position under the force exerted by the lock tongue spring 4s and the pull-rod 32s.

[0402] When an abnormal condition(s) is detected, the self-holding solenoid 5s(a) may be electrified to allow the iron core 51s to be extended outward onto the bar member 314s, the

conical frustum 34s or the pull-rod 32s (depending on when the self-holding solenoid 5s(a) is driven in relation to a firing sequence of the handgun A). If the iron core 51s lands on the conical frustum 34s as shown in FIG. 20.4, the pull-rod 32s will eventually move back to its original position under the joint force exerted by the lock tongue spring 4s and the cone at one side of conical frustum 34s, allowing the conical frustum 34s to be settled between the iron core 51s and lock core cavity plate 111s. If the iron core 51s extends onto the bar member 314s, the conical frustum 34s is between the iron core 51s and the lock core cavity plate 111s, thus the handgun A is locked. If the iron core 51s lands on the pull-rod 32s, as shown in FIG. 20.5, the pull-rod 32s will eventually move back to its original position under the joint force exerted by the lock tongue spring 4s and the cone at one side of conical frustum 34s. The iron core 51s would be pushed back to the retraction position by the force of the conical surface 35s, allowing the conical frustum 34s to be settled between the iron core 51s and lock core cavity plate 111s.

TWENTY-FIRST PREFERRED EMBODIMENT

[0403] Referring to FIGs. 21.1 to 21.71, according to a twenty-first embodiment of the present invention, it provides a trigger lever lock mechanism C21.

[0404] The lock mechanism C21 includes a lock shell 1t. The lock core is installed inside the lock core cavity 11t, which includes the lock tongue slot 112t and the electromagnet installing cavity 113t.

[0405] The lock mechanism C21 comprises a self-holding solenoid 5t(a) and a lock tongue actuator 3t. The self-holding solenoid 5t(a) locates in the electromagnet installing slot 113t. A lock hole B1 is on the grip A7 of the handgun A. The trigger lever B5 has a limit hole B6 which is at the corresponding position of lock hole B1. The lock shell 1t of the lock mechanism C21 is mounted on the grip A7, replacing the grip panel A8. After installation, the lock tongue actuator 3t corresponds to the lock hole B1 and the limit hole B6.

[0406] A partition plate 94t locates in the lock shell 1t of the lock mechanism C21, and it separates the lock shell 1t into an electromagnet installing slot 113t and a lock tongue slot 112t.

[0407] As shown in FIG 21.5, the lock mechanism C21 comprises a self-holding solenoid 5t(a) and a lock tongue actuator 3t. The self-holding solenoid 5t(a) locates in the electromagnet installing slot 113t. The electromagnet installing slot 113t receives a lock cover 2t for housing the self-holding solenoid 5t(a). The self-holding solenoid 5t(a) has a round end iron core 52t, which can extend into the lock tongue slot 112t through a hole on the partition plate 94t. The direction of the sliding movement of the lock tongue actuator 3t is perpendicular to that of the iron core 52t in the lock tongue slot 112t. One end of the lock tongue actuator 3t has an arc

surface 313t attaching with the round end of the iron core 52t, and the other end of the lock tongue actuator 3t has a lock tongue actuating lever 314t, which is biased by a lock tongue spring 4t.

[0408] As shown in FIG 21.1 / 21.2 / 21.3 / 21.4 / 21.5, the grip A7 of the gun frame A1 has a frame spring slot B2, and a lock hole B1 locates inside the frame spring slot B2. The lock hole B1 corresponds to the limit hole B6 on the trigger lever B5. The lock shell 1t of the lock mechanism C21 instead of the grip panel A8 is mounted on the grip A7. The lock cover 2t is attached between the grip A7 of handgun A and the self-holding solenoid 5t(a), and one end of the lock tongue spring 4t locates in the frame spring slot B2 pressing against the gun frame A1. The lock tongue actuating lever 314t of the lock tongue actuator 3t enters through the lock hole B1 and to the limit hole B6. The lock tongue actuating lever 314t corresponds to the lock hole B1 and the limit hole B6.

[0409] When the gun is not in use, as shown in FIG 21.7 and 21.71, the lock tongue actuator 3t extends out, as the iron core 52t extends and pressing the lock tongue arc surface 313t. The lock tongue actuator 3t overcomes the elastic force of the tongue lock spring 4t, and the tongue lock actuating lever 314t is pushed into the limit hole B6 on the trigger lever B5. The lock tongue actuating lever 314t extends into the limit hole B6 and, and thus, the trigger lever B5 is locked. Accordingly, the trigger A2 cannot be pulled, so the handgun A cannot fire, thus achieving the object of keeping the firearm locked when it is not in use.

[0410] The state of the lock mechanism C21 when the gun is unlocked is shown in FIG 21.6 / 21.61.

[0411] When a normal condition(s) is detected, the self-holding solenoid 5t(a) may be electrified for 10 to 100 ms (the solenoid 5t(a) itself may have self-holding function, the solenoid 5t(a) may be able to hold its position). Obtaining instantaneous currents, the round iron core 52t instantaneously exits from the lock tongue slot 112t. Then the tongue lock spring 4t is released, such that the lock tongue actuating lever 314t exits from the limit hole B6 by the elastic force. The trigger A2 is no longer blocked and free to be pulled, and the handgun A can fire.

[0412] When an abnormal condition(s) is detected, the self-holding solenoid 5t(a) may be electrified for 10 ~ 100 ms, and the lock tongue actuating lever 314t is pushed back into the limit hole B6 of the trigger lever B5, and the trigger A2 is locked. The limit hole B6 may be a groove, a slot, a through hole, or any type of structures that may cooperate with the lock tongue actuating lever 314t to lock / block the trigger lever B5 from moving.

TWENTY-SECOND PREFERRED EMBODIMENT

[0413] Referring to FIGs. 22.1 to 22.3, according to a twenty-second preferred embodiment of the present invention, it provides a trigger lever lock mechanism C22.

[0414] A lock shell 1u has an electromagnet installed in the slot 113u. A self-holding solenoid 5u(a) locates in the electromagnet installing slot 113u. The lock cover 2u locates at the opening of the electromagnet installing slot 113u, and the iron core 51u extends through the hole in the lock cover 2u. The iron core 51u comprises a lock tongue actuator 3u at one end.

[0415] The gun frame A1 has a lock hole B1. The trigger lever B5 corresponds to a limit hole B6 at the lock hole B1. The iron core 51u corresponds to the frame spring slot B2, and the lock tongue actuator 3u corresponds to the lock hole B1 and the limit hole B6.

[0416] When the handgun A is not in use, the locking state of the lock mechanism C22 is shown in FIG 22.21. The iron core 51u is at the normal stretching position. The iron core 51u extends through the lock cover 2u and the lock hole B1 on the gun frame A1 and stretches into the limit hole B6 on the trigger lever B5. At this time the trigger A2 is locked and cannot be pulled, so that the handgun A cannot be pulled. The purpose of keeping the gun safe when it is not in use is achieved.

[0417] During the handgun A is in normal use, when an abnormal condition(s) is detected, as shown in FIG 22.22, the self-holding solenoid 5u(a) may be reversely electrified for 10 ~ 100 ms (the solenoid 5u(a) itself has the self-holding function). Obtaining the reverse currents, the iron ore 51u retracts and maintains the retraction. At this time the iron core 51u has retracted out of the limit hole B6, so the trigger is no longer obstructed and can be pulled freely, and firearms can fire.

[0418] When an abnormal condition(s) is detected, the self-holding solenoid 5u(a) is positively electrified for 10 ~ 100 ms, the iron core 51u is pushed back into the limit hole B6, and the trigger A2 is locked.

TWENTY-THIRD PREFERRED EMBODIMENT

[0419] Referring to FIGs. 23.1 to 23.7, according to a twenty-third preferred embodiment of the present invention, it provides a trigger lever lock mechanism C23.

[0420] The structure of the lock mechanism C23 is substantially the same with that of the lock mechanism C20; however, one substantially different feature(s) therefrom may include a bilateral lever lock as described hereinafter in detail. The lock shell 1v includes a first lock shell 1v(a) and a second lock shell 1v(b), which are symmetrically connected. The second lock

shell 1v(b) has an electromagnet installing slot 113v receives the self-holding solenoid 5v(a). The iron core 51v of the self-holding solenoid 5v(a) comprises a bend 53v.

[0421] The first lock shell 1v(a) and the second lock shell 1v(b) are mounted on both sides of the grip A7 in order to replace the grip panel A8. The first lock shell 1v(a) and the second lock shell 1v(b) have the first lever slot 110v(a) and the second lever slot 110v(b). The U-shaped lever 9v is slidably engaged with the first lever slot 110v(a) and the second lever slot 110v(b). The first lever slot 110v(a) and the second lever slot 110v(b) communicate with a first lock tongue slot 112v(a) and a second lock tongue slot 112v(b), respectively. The first lock tongue 3v(a) and the second lock tongue 3v(b) are operably engaged with the first lock tongue slot 112v(a) and the second lock tongue slot 112v(b), respectively. The first lock tongue 3v(a) and the second lock tongue 3v(b) comprises a first tongue lock actuating lever 314v(a) and a second tongue lock actuating lever 314v(b), respectively. The first lock tongue 3v(a) and the second lock tongue 3v(b) are biased with a first tongue lock spring 4v(a) and a second lock tongue spring 4v(b), respectively. The bend 53v of the iron core 51v is operably engaged with an embedded slot 91v of the U-shaped lever 9v and actuates the U-shaped lever 9v. As the U-shaped lever 9v is actuated by the iron core 51v, two ball ends 95v(a), 95v(b) of U-shaped lever 9v press on / release the pressures from the arc surface 313v(a) and the arc surface 313v(b) of the first lock tongue 3v(a) and the second lock tongue 3v(b), respectively. When the pressures are applied onto the arc surface 313v(a) and the arc surface 313v(b) of the first lock tongue 3v(a) and the second lock tongue 3v(b), respectively, as a result, the applied pressures cause the first tongue lock actuating lever 314v(a) and the second tongue lock actuating lever 314v(b) move toward each other to block a firing sequence of the handgun A. When the pressures are released from the first tongue lock actuating lever 314v(a) and the second tongue lock actuating lever 314v(b), biasing force of the first tongue lock spring 4v(a) and the second lock tongue spring 4v(b) causes the first tongue lock actuating lever 314v(a) and the second tongue lock actuating lever 314v(b) to move away from each other to allow a firing sequence of the handgun A to be carried out.

[0422] The lock shell 1v has a seal cover 1v(c), and the seal cover 1v(c) has a cavity 110v. The self-holding solenoid 5v(a) slides within the cavity 110v via the U-shaped lever 9v driven by bend 53v of the iron core 51v. In a preferred embodiment of the present invention, the bend 53v of iron core 51v is L-shaped.

[0423] The frame spring slot B2 are on both sides of the grip A7 on the gun frame A1, and a lock hole B1 is opened in the frame spring slot B2. The trigger lever B5 is corresponding to the lock hole B1 with a limit hole B6. The first and second lock tongue actuating levers 314v(a),

314v(b) on the first and second lock tongue 3v(a), 3v(b) match and corresponds to the limit hole B6. The gun trigger is lock, so the gun cannot be fired.

[0424] When the handgun A is not in use, the handgun A may remain locked as its initial state (as shown in FIG 23.61). The first and second lock tongue 3v(a), 3v(b) are protruding toward each other. The first tongue lock lever 314v(a) and the second tongue locking lever 314v(b) both extends through the frame spring slot B2 and through the lock hole B1. The first tongue lock lever 314v(a) and the second tongue locking lever 314v(b) extend to the limit hole B6 on the trigger lever B5. The trigger A2 is locked and cannot be pulled, and the handgun A cannot be fired. The function of locking the handgun A when it is not in use is achieved.

[0425] While the handgun A is in use, as shown in FIG 23.51, and when any abnormal condition(s) is not detected, self-holding solenoid 5v(a) may be reversely electrified for 10 ~ 100 ms (the solenoid 5v(a) itself has the self-holding function). Obtaining a current, the self-holding solenoid 5v(a) instantly drives the U-shaped lever 9v to move away from the first lever slot 110v(a) and the second lever slot 110v(b). The first lock tongue 3v(a) and the second lock tongue 3v(b) are not compressed by the U-shaped lever 9v, and the first lock tongue 3v(a) and the second lock tongue 3v(b) retract under the force exerted by the tongue lock springs 4v(a), 4v(b). The first tongue lock actuating lever 314v(a) and the second tongue lock actuating lever 314v(b) exit from the limit hole B6 on both sides. The trigger A2 can be pulled without barrier and the handgun A can fire freely.

[0426] If the handgun A is in use, and when an abnormal condition(s) is detected, the self-holding solenoid 5v(a) may be positively electrified for 10 ~ 100 milliseconds, then the iron core 51v is actuated to drive the U-shaped lever 9v into the first and second lever slots 110v(a), 110v(b), and the first lock tongue 3v(a) and the second lock tongue 3v(b) are pressed to have the first tongue lock actuating lever 314v(a) and the second tongue lock actuating lever 314v(b) moving into the limit hole B6. The trigger A2 is, thus, locked.

[0427] Two grip panels A8 both are installed the left side and the right side of the grip A7 of the handgun A via two pieces of lock shell 21v(a) and 21v(b). The first tongue lock actuating lever 314v(a) and the second tongue lock actuating lever 314v(b) act on the left and right side of the trigger lever B5, respectively. This lock mechanism C23 is applicable to a variety of firearms, including handguns and rifles.

TWENTY-FOURTH PREFERRED EMBODIMENT

[0428] Referring to FIGs 24.1 to 24.5, according to a twenty-fourth preferred embodiment of the present invention, it provides a tapeline-type trigger lock mechanism C24. The tapeline-

type lock mechanism C24 is installed on a handgun A for controlling movement of the trigger A2.

[0429] The tapeline-type lock mechanism C24 includes a lock shell 1w, a lock tongue spring 4w, a lock tongue (a string member) 3w, a tapeline disk 8w, a lock cover 2w and a self-holding solenoid 5w(a) in a solenoid shell 6w.

[0430] The lock shell 1w defines front, rear, right, left, top and bottom, and has two mounting clamp plates 13w on the right and left sides of the lock shell 1w. The two clamp plates 13w define a clamp plate slot 14w on top of the lock shell 1w. There are mounting holes on the clamp plate slot 14w. The lock shell 1w is fixed on the handgun A through the mounting holes.

[0431] A lock core cavity 11w is located on the bottom of the lock shell 1w. A string hole 16w is located on the front of the lock shell 1w connecting through to the lock core cavity 11w. The tapeline disk 8w is operably mounted in the lock tongue cavity 11w. One end of the lock tongue 3w is attached to and twined around a wire slot 83w defined on the tapeline disk 8w. The other end of the string (i.e. the lock tongue 3w) extends through the string hole 16w and connects to the trigger clamp 31w, which engages with the trigger A2.

[0432] The lock mechanism C24 further comprises a lock cover 2w, and has a lock cover slot 21w, which corresponds to and interface with the lock core cavity 11w of the lock shell 1w. The lock cover hole 211w is located on the lock cover slot 21w. The lock cover 2w engages with the lock core cavity 11w of the lock shell 1w to encase the tapeline disk 8w.

[0433] A round convex plate 19w is situated at the center of the lock core cavity 11w. A lock tongue spring axle 191w is a shaft member, which is located at the axis of the round convex plate 19w. The lock tongue spring axle 191w defines a slot 192w locates along the lengthwise of the lock tongue spring axle 191w.

[0434] The lock tongue spring 4w is mounted within the spring mounting cavity 84w in the tapeline disk 8w. The outer ring hook 42w of the lock tongue spring 4w is fixed within the disk slot 82w. The fixed end of the spring 41w is inserted in the slot 192w. The lock tongue spring 4w is mounted within the spring mounting cavity 84w of the tapeline disk 8w. The tapeline disk 8w has a tapeline disk hole 81w, which corresponds to the lock cover hole 211w.

[0435] The self-holding solenoid 5w(a) is an actuator, that comprises and actuates an iron core 51w, the iron core 51w corresponds to the tapeline disk hole 81w. The iron core 51w is arranged to pass through the lock cover hole 211w and to the tapeline disk hole 81w. The solenoid shell 6w covers the self-holding solenoid 5w(a), and connects to the lock cover 2w.

[0436] The initial state of the iron core 51w extends outward and reaches to the tapeline disk hole 81w, such that the iron core 51w impedes and blocks the movement of the tapeline disk 8w and, thus, the trigger A2 cannot be pulled.

[0437] A Picatinny rail or similar rail interface system can be used to replace the clamp plate slot 14w in order to hold the related components onto the handgun A.

[0438] High strength soft strings, as well as the soft steel strings with low elastic and memory steel strings may be selected to use as lock tongue 3w.

[0439] The tapeline disk 8w can rotate around the axis of the round convex plate 19w on the lock shell 1w and then is repositioned by the force of lock tongue spring 4w, which is substantially similar to the mechanism of a tape measure.

[0440] This tech solution needs a tapping at the front end of trigger guard A3 through which the lock tongue 3w passes and connects the trigger A2 and gets fastened. The lock mechanism C24 may be clamped on other types of firearms or portable weapons, such as cross bows. Preference should be given to the self-holding solenoid 5w(a) when selecting the solenoids.

[0441] When the handgun A is not in use, or an unsafe / abnormal condition or emergency situation is detected by a controller (not shown), the lock mechanism C24 may be controlled to cause the self-holding solenoid 5w(a) popping out the iron core 51w, which passes through the lock cover hole 211w, within, for example, 150 ms from when the controller detected the condition for locking the firing sequence, and engages with the tapeline disk hole 81w, further causing the tapeline disk 8w to be blocked to prevent it from rotating, such that the lock tongue 3w cannot be pulled. Accordingly, the trigger A2 is locked up and the handgun A cannot be fired.

[0442] When the handgun A is in use or permitted for use, the iron core 51w in the self-holding solenoid 5w(a) of the mechanical lock C24 retracts and releases the tapeline disk hole 81w, allowing the tapeline disk 8w to rotate freely.

[0443] The lock tongue spring 4w and the lock tongue 3w make free reciprocating motion and the trigger A2 can be moved freely such that the handgun A can be fired. Once the handgun A fires, the lock tongue spring 4w returns to its original position and drives the tapeline disk 8w return to its original position. The iron core 51w, the lock cover hole 211w and the tapeline disk hole 81w share the same axis, so the handgun A is at unlocked state and can be fired.

TWENTY-FIFTH PREFERRED EMBODIMENT

[0444] Referring to FIG 25.1 to 25.4, according to a twenty-fifth preferred embodiment of the present invention, it provides a box-style lock mechanism C25, which may be installed on a handgun A, around and about a trigger guard A3 of the handgun A.

[0445] The lock mechanism C25 includes a lock shell 1x, a lock cover 2x, a lock tongue 3x, a mounting shell 61x, an electromagnet 5x(f) and a permanent magnet 30x. There is at least one lock tongue slot 112x locating at the lower end of the inner side of the lock shell 1x, the lock tongue 3x is slidably engaged with the lock tongue slot 112x, the permanent magnet 30x connects to the lock tongue 3x, such that the permanent magnet 30x cooperates with the electromagnet 5x(f) mounted in the mounting shell 61x. The lock tongue 3x defines a finger window 36x, and the finger window 36x corresponds to a finger hole 15x defined on the lock shell 1x.

[0446] The electromagnet 5x(f) is housed in the mounting shell 61x and is fastened at one end of the lock shell 1x. The electromagnet 5x(f) is an actuator, and is arranged to cooperate with the permanent magnet 30x. The lock cover 2x and lock shell 1x are arranged to encase the trigger guard A3 from its sides, and the box-style lock mechanism C25 is fastened on the trigger guard A3 by using fastening means, such as mounting screws 92x.

[0447] The guard clamp slot 12x locates at a bottom part of the lock shell 1x. The lock cover 2x is symmetrical to / corresponds to the lock shell 1x. The lock cover 2x further comprises a second guard clamp slot 22 that corresponds to the guard clamp slot 12x, thus, when the lock shell 1x and the lock cover 2x mates to encase the trigger guard A2 from its sides, the guard clamp slot 12x also corresponds and mates with the second guard clamp slot 22x.

[0448] In the lock mechanism C25, the mounting shell 61x comprises fixing ears 611x, defining fixing holes 612x. Fastening means, such as shell fixing screws 613x may be used to mount the mounting shell 61x on the lock shell 1x. There is a sealing plate 23x set at the front-end of the inner side wall of the lock cover 2x.

[0449] In the preferred embodiment of the present invention, there are two lock tongue slots 112x, symmetrically set at the top and bottom ends of the inner side of the lock shell 1x. The lock tongue 3x engages with and slides along the lock tongue slots 112x.

[0450] During the operation, there are two positions of the finger window 36x, which are corresponded with finger hole 15x. When the lock mechanism C25 is unlocked, the finger hole 15w will be placed in finger window 36w. Whereas, the finger hole 15w locates outside of the finger window 36w under locking position.

[0451] There is a block 614x on the fixing ears 611x. The block 614x is used for positioning and guiding of the mounting shell 61x in reference to the lock shell 1x. The block 614x is in touch with the front-end surface of the lock shell 1x.

[0452] When the handgun A is not in use, the lock mechanism C25 is controlled to have the pole of the electromagnet 5x(f) to be the opposite to the pole of the permanent magnet 30x, causing to have the electromagnet 5x(f) and the permanent magnet 30x are attracted each other. The lock tongue 3x is then, because of the attraction force, drawn toward the electromagnet 5x(f). The finger hole 15x is, then, blocked by the lock tongue 3x, preventing a finger from entering through finger hole 15x and the finger window 36x. Accordingly, the trigger A2 inside the trigger guard A2 is now blocked.

[0453] When the handgun A is allowed for operation / use, the electromagnet 5x(f) is controlled have a magnetic polar to be the same as that of the permanent magnet 30x, thus electromagnet 5x(f) pushed the permanent magnet 30x away. In this condition, electromagnet 5x(f) pushes the lock tongue 3x away swiftly, for example, within 100 milliseconds, allowing the finger hole 15x be opened thus allowing a finger to touch the trigger A2 inside the trigger guard A3, and the handgun A can be fired.

[0454] Under an abnormal condition or emergency situation, for example, the electromagnet 5x(f) may be controlled to drive the permanent magnet 30 to be toward each other, such that lock tongue 3x to block the finger hole 15 with the lock tongue 3x. Accordingly, the trigger A2 cannot be touched and the handgun A cannot be fired.

[0455] Once the shooting range officer determines that the shooter's behavior is dangerous (such as, pointing the gun to other people or to the shooter), the officer can send locking signal remotely to the safety control system and control the mechanical lock C to lock the gun.

[0456] This invention can be a replacement of the original trigger guard. It can also be combined as a gun component in production.

TWENTY-SIXTH PREFERRED EMBODIMENT

[0457] Referring to FIG 26.1 to 26.7, according to a twenty-sixth preferred embodiment of the present invention, it provides a block style lock mechanism C26, C26', C26'', C26''', installed on a handgun A having a trigger guard A3 and trigger A2.

[0458] Now referring to FIG. 26.1 to 26.3, the lock mechanism C26 includes: a solenoid shell 6y, a self-holding solenoid 5y(a), a lock tongue 3y and a clamp 7y. The solenoid shell 6y defines a solenoid cavity 6y(f) and mounting screw holes 93y. The clamp 7y includes slot 72y, shell mounting side plate 71y and two mounting screw holes 93y; where the slot 72y is designed

to match the front part of the trigger guard A3. The solenoid shell 6y is screwed on the shell mounting side plate 71y, which forms the solenoid cavity 6y(f). The self-holding solenoid 5y(a) is installed in the solenoid cavity 6y(f). The self-holding solenoid 5y(a) is an actuator, that comprises an iron core 51y that is connected to the lock tongue 3y. The outer shape of lock tongue 3y corresponds to the space between the trigger A2 and the trigger guard A3, and the thickness of the lock tongue 3y further matches with the thickness of trigger guard A3.

[0459] The lock mechanism C26 is fastened to a part of the trigger guard A3 via fastening means, i.e. the screw holes on the solenoid shell 6y and the clamp 7y. The clamp 7y can be fixed on the handgun A instead of drilling on the handgun A. As shown in FIG. 26.1 to 26.3, the iron core 51y and lock tongue 3y align with the front end of the trigger A2.

[0460] The lock tongue 3y may have a different shape where the shape of the cross-section matches the front end of the trigger guard A3, or can be replaced with a lock tongue 3'y. Now, referring to FIG 26.4, the lock tongue 3'y may comprise a trigger slot 38', which corresponds to the shape of the trigger A2, when the lock mechanism C26' is in lock position as shown in FIG 26.5, the trigger A2 sits in the trigger slot 38' while the remaining of the lock tongue 3'y fills the space between the trigger A2 and the trigger guard A3.

[0461] The lock tongue 3y, 3'y include a lock tongue mounting hole 37y, 37'y for receiving the iron core 51y. This lock tongue 3y, 3'y performs reciprocating motion driven by the iron core 51y. When the lock tongue 3'y extends to the trigger A2, for example, the trigger A2 fits into the trigger slot 38'y, and, thus, the lock tongue 3'y blocks the trigger A2 to prevent the use of the handgun A.

[0462] When the handgun A is not in use, the self-holding solenoid 5y(a) of mechanical lock C26 or C26' may be powered off. The self-holding solenoid 5y(a) remains in the locked state, where the lock tongue 3y, 3'y remains within the trigger guard A3. The lock tongue 3y locates in front of the trigger A2, or the trigger A2 locates inside the trigger slot 38' if the lock tongue 3'y is used, which blocks a finger from pulling the trigger A2.

[0463] When the handgun A is permitted to use, the lock mechanism C26 is controlled to cause the iron core 51y and the lock tongue 3y, 3'y to be pulled away from the trigger A2 and the space between the trigger A2 and trigger guard A3. Accordingly, the trigger A2 is accessible to a finger and the trigger A2 can be pulled for firing the handgun A.

[0464] When the handgun A is not permitted for use, the lock mechanism C26 may be controlled to drive the self-holding solenoid 5y(a) to cause the iron core 51y to extend and to push the lock tongue 3y, 3'y toward the trigger A2 and the trigger guard A3 thus the shooter's

finger cannot be entered into the space between the trigger A2 and the trigger guard A3 to pull the trigger A2.

[0465] The actuator, such as the self-holding solenoid 5y(a) shown in FIG 26.2 may be substituted with other types of actuators. For example, referring to FIG 26.6, the lock mechanism C26'' comprises a motor 5''y(b), which may be used to replace the self-holding solenoid 5y(a). A lock tongue 3''y is driven by a screw rod 5''y(c), which is actuated by the motor 5''y(b). Because of the screw rod 5''y(c), the lock tongue 3''y cannot easily be pulled manually.

[0466] The lock mechanism C26'' includes the lock tongue 3''y, clamp 7''y, motor 5''y(b), and motor shell 6''y(a). There is a motor mounting cavity 6''y(d) inside the motor shell 6''y(a). The motor shell 6''y(a) comprises a shell fixing plate 6''y(b). The motor shell 6''y(a) comprises a lock tongue slot 6''y(e) and mounting screw holes 93''y, which are located at the opening surface of a motor mounting cavity 6''y(d), in which the motor 5''y(b) is housed, and the motor 5''y(b) actuates the screw rod 5''y(c). A lock tongue guide rod 6''y(c) extends from the motor shell 6''y(a) being parallel to the screw rod 5''y(c). The lock tongue guide rod 6''y(c) engages with a lock tongue guide hole 39''y so that the lock tongue 3''y moves along the lock tongue guide rod 6''y(c). The outline shape of the lock tongue 3''y matches the outline of the front-end of the trigger A2, the thickness of lock tongue 3''y corresponds to the thickness of the trigger guard A3.

[0467] The lock tongue 3''y may have a different shape and be replaced with, for example, a lock tongue 3'''y as shown in FIGs 26.8 and 26.9. The lock tongue 3'''y comprises a lock tongue spiral hole 310'''y and lock tongue guide hole 39'''y, and has a trigger slot 38'''y. The screw rod 5''y(c) engages with the lock tongue spiral hole 310'''y and the lock tongue guide rod 6''y(c) engages with the lock tongue spiral hole 310'''y.

[0468] Referring to FIGs 26.6 and 26.8, the clamp 7''y includes a slot 72''y, a shell mounting side plates 71''y, and two mounting screw holes 93''y; where the slot 72''y is arranged to match the outline of front end of the trigger guard A3. The motor shell 6''y(a) comprises a shell fixing plate 6''y(b) via the shell mounting side plates 71''y. The lock mechanism C26'' is screwed on the front end of the trigger guard A3 firmly by fastening means through the mounting screw holes 93''y.

[0469] A positive or negative motion of screw rod 5''y(c) is transferred into reciprocating motion of the lock tongue 3''y (or 3'''y) along the screw rod 5''y(c). Thus the lock tongue 3''y (or 3'''y) achieves the same motion ones shown in FIGs 26.1 to 26.5. The lock tongue 3''y (or 3'''y) enters and leaves the trigger guard A3 blocking a finger from pulling the trigger A2. The

lock tongue 3''y (or 3'''y) extends out toward the trigger A2 and the trigger guard A3, then blocks the finger from pulling the trigger A2. Or the trigger A2 is rested inside the trigger slot 38'''y of the lock tongue 3''y.

[0470] A lock tongue convex plate 310'''y(a) may be provided on the lock tongue 3''y for increasing or adjusting the moving range / scope of the lock tongue 3''y along the screw rod 5''y(c) without changing the length of the screw rod 5''y(c).

TWENTY-SEVENTH PREFERRED EMBODIMENT

[0471] Referring to FIG 27.1 to 27.12, according to a twenty-seventh preferred embodiment of the present invention, it provides a lock mechanism C27, C27', installed on a handgun A. The handgun A may be M1911.

[0472] The lock mechanism C27 includes a lock shell 1z and a lock cover 2z. The lock shall 1z defines a lock core cavity 11z for housing a motor 5z(b). The lock shell 1z are arranged to cooperate with the lock cover 2z. The motor 5z(b) comprises a shaft 51z that extends therefrom for actuating a safety lever B20. The safety lever B20 is replaced with an original safety A9 of the safety of the handgun A. The lock shell 1z comprises a fixing plate 10z with screws holes thereon for fastening it on the handgun A.

[0473] The safety lever B20 includes a rotary shaft B15 and a safety actuating lever B17. The rotary shaft B15 is connected with the safety actuating cover B17 through a lever B19.

[0474] The rear end of the rotary shaft B15 has a motor connection hole B18 sharing the same axial with the rotary shaft B15. The safety lever B20 is connected to the drive shaft 51z of motor 5z(b) through the motor connection hole B18.

[0475] The lock cover 2z has a gap 24z thereon, and the rotary shaft B15 extends out of the lock cover 2z through the gap 24z of lock cover 2z.

[0476] As shown in FIG 27.5 and 27.6, the lock mechanism C27 is installed to replace the original safety A9 of the handgun A. The rotary shaft B15 on the safety lever B20 is installed in the original shaft hole B3 of the handgun A. The original safety actuating lever B16 and the safety actuating lever B17 of the present embodiment are symmetrically mounted in the safety hole B4.

[0477] In the case that the handgun A is an M1911, this type of the firearms has its safety only on one side of its body, and the original safety A9 is not a shaft that is inserted into the gun, as shown in FIG 27.6. The original safety A9 includes the original rotary shaft B14 and the original safety actuating lever B16, so the safety lever B20 can be added to the coaxial and symmetric end of the original safety A9, where the safety lever B20 is similar to the original

safety A9 in functionality. The safety lever 20 also has the rotary shaft B15 and the safety actuating lever B17, which does not interfere with the features for the original safety A9. The rotary shaft B15 and the safety actuating lever B17 are symmetrically mounted on both sides of the handgun A, forming two sets of safeties as shown in FIG 27.5. The drive shaft 5z(c) of the motor 5z(b) is fastened together with the safety connection hole B18. The drive shaft 5z(c) can rotate clockwise or counter-clockwise. This rotation allows to lock or unlock the handgun A.

[0478] Initially, the handgun A is in the locked state, where the motor 5z(b) does not rotate the drive shaft 51z, and the lock mechanism C27 stays in the locked position.

[0479] When the handgun A is permitted for use, the motor 5z(b) is powered on, actuating the drive shaft 51z to cause the safety actuating lever B17 to move to unlock position.

[0480] If the handgun A is needed to be locked, the motor 5z(b) is electrified and rotates reversely, actuating the drive shaft 51z to cause the safety actuating lever B17 to move to locked position.

[0481] Referring to FIG.27.7 to 27.12, a lock mechanism C27' may be applicable to and replaces the original safety lock of handgun A, which is similar to a M92F (BERETTA) or similar. The lock mechanism C27' is arranged to be installed on the slide A4 via lock shell 1'z or a Picatinny rail or other rail interface systems may be used.

[0482] The lock mechanism C27' includes a lock shell 1'z, defining a lock core cavity 11'z for housing a motor 5'z(b). The lock shell 1'z is arranged to be installed on the slide A4 of the handgun A. A drive shaft 51'z of the motor 5b is connected with a safety lever B20', and the safety lever B20', which is to replace the original safety A9 on the handgun A.

[0483] As shown in FIG 27.9, 27.10 and 27.11, the safety lever B20' comprises a motor connection hole B18 for receiving the motor drive shaft 5'z(c).

[0484] As shown in FIG 27.9, the lock shell 1'z has a fixed plate 10'z and the mounting screw hole 93'z is on the fixing plate 10'z. The lock mechanism C27' is arranged to be installed on the handgun A by fastening means through mounting screw holes 93'z.

[0485] Referring to FIG 27.7 and 27.8, the original safety A9 of BERETTAM92F, for example, has only one original rotary shaft B14, which serves as a shaft and an actuating lever. The original shaft is inserted into the gun thus no independent symmetrical safety devices can be added, unlike the safety mechanism for an M1911. But BERETTAM92F or this type of firearms, if necessary, the original safety can be removed, a replicated safety lever B20' can be added / replaced like shown above.

[0486] When the handgun A is permitted for use, the motor 5'z(b) is powered on, actuates the driving shaft 51'z to cause the safety lever B20 to unlocked position. After the safety lever B20' reaches the limit position, the motor 5'z(b) stops rotating. The motor 5'z(b) may be able to self-lock by itself, so the safety will not get loose easily. Once the safety is opened, and the handgun A can be used. Optionally, the motor 5'z(b) may be a rotating electromagnet, or similar device(s).

TWENTY-EIGHTH PREFERRED EMBODIMENT

[0487] Referring to FIG 28.1 to 28.6, according to a twenty-eighth preferred embodiment of the present invention, it provides a torsional smart gun trigger lock mechanism C28.

[0488] As shown in FIG 28.2, FIG 28.3, and FIG 28.4, the lock mechanism C28 includes a lock shell 1 α , a lock cover 2 α , and a V-type lock tongue 3 α . The lock shell 1 α defines a core cavity 11 α and a lock tongue slot 112 α . The V-type tongue lock slot 112 α has an opening, and houses the V-type lock tongue 3 α . The lock tongue 3 α comprises a lock tongue control end 312 α (a) and the lock tongue executing end 312 α (b). An angle between the lock tongue control end 312 α (a) and the lock tongue executing end 312 α (b) is about between 100° and 120°. The lock tongue 3 α is hinged on the side wall of the lock tongue slot 112 α via the lock tongue rotary shaft 311 α . The torsional spring 4 α embraces the lock tongue rotary shaft 311 α . One end of the torsional spring 4 α is fixed on the side wall of the lock tongue slot 112 α ; the other end of the torsional spring 4 α is attached with the upper end of the lock tongue executing end 312 α (b). The lock tongue executing end 312 α (b) of the V-type lock tongue 3 α locates at the opening of the upper end of the lock tongue slot 112 α . The lock tongue control end 312 α (a) is connected with the hinge 301 α via the hinge shaft 302 α . The hinge 301 α is connected with the string 303 α . The lock core cavity 11 α is in communication with the lock tongue slot 112 α through the pulling string hole 115 α . The string 303 α extends through the pulling string hole 115 α and connects the permanent magnet 30 α . The electromagnet 5 α (f) is housed in the solenoid installing slot 113 α and the permanent magnet 30 α locates in the matched permanent magnet sliding slot 114 α . The permanent magnet 30 α is arranged to slide along the permanent magnet sliding slot 114 α . The stroke of the permanent magnet sliding slot 114 α matches the lock tongue executing end 312b, which can rotate 90 degree; The lock shell 1 α is symmetrical to the inner cavity of the lock cover 2 α and connects to the lock cover 2 α .

[0489] As shown in FIG 28.4 and FIG 28.5, the lock shell 1 α defines a guard clamp slot 12 α . A clamp 7 α is configured to be fastened on the side of the lock cover 2 α by fastening means. The clamp 7 α has two threaded connection holes which correspond with the guard clamp slot

12a. The clamp 7a is fixed on the outer wall of the lock cover 2a via the fixing screws 73a. The clamp 7a on the lock cover 2a corresponds to with the guard clamp slot 12a. And the lock mechanism C28 is stuck at the lower part of the trigger guard A3 by fastening means via the guard clamp slot 12a and clamp 7a.

[0490] In operation, the electromagnet 5a(f) actuates on the permanent magnet 30a to repel each other, thus pushes the permanent magnet 30a to further push the string 303a into an inclined state and further causes to have the string 303a to be settled in the lock tongue slot 112a (as shown in FIG 28.2). The lock tongue executing end 312a(b) and the torsional spring 4a are moved to be at the top of the V-shaped lock tongue slot 112a, thus the trigger a2 is in an unlocked state.

[0491] On the other hand, the electromagnet 5a(f) actuates the permanent magnet 30a to attract each other, the string 303a is pulled into the permanent magnet sliding slot 114a. The lock tongue executing end 312a(b) and the torsional spring 4a located outside the lock tongue executing end 312a(b) extends vertically and upwards from the V-type lock tongue slot 112a to block the trigger A2. (as shown in FIG 28.3).

[0492] Preferably, the electromagnet 5a(f) may be instantly electrified for about 10 ~ 100 ms to generate sufficient magnetic force between the electromagnet 5a(f) and the permanent magnet 30a.

[0493] The lock mechanism C28 can be installed at the trigger guard A3 of the handgun A, or it may replace the bottom portion of the trigger guard A3.

[0494] According to the present preferred embodiment of the present invention, the solenoid 5a, the permanent magnet 30a, the hinge 301a, the hinge shaft 30a2 and the string 303a may be replaced with a shape memory alloy wire. The shape memory alloy wire may be fastened with the lock tongue end 312a(a) and the bottom of the lock shell 1a. When the shape memory alloy wire is electrified, it retracts back and pulls the lock tongue to rotate.

VARIANTS AND MODIFICATIONS

[0495] Various modifications can be made without departing from the spirit of the present invention. For example, the electromagnet 5(f), 5a(f), 5b(f), 5c(f), 5d(f), 5e(f), 5f(f), 5g(f), 5h(f), 5i(f), 5j(f), 5k(f), 5l(f), 5m(f), 5n(f), 5o(f), (not shown in C1y7), 5q(f), (not shown in C19), 5s(f), 5t(f), 5u(f), 5v(f) may be push-pull solenoid or servo motor. For example, it can be realized by using an existing product on the market, for example, a DC miniature bi-directional self-holding solenoid (such as model: HID PJT-01). The solenoid core of this product is retractable by giving positive and negative currents. It can be at self-holding state at two

positions until the next reverse current is received, then the iron core changes its position. The existing product of the solenoid, combined with the lock tongue, would serve as the actuator of the automatic spring-type gun lock.

[0496] A current to the electromagnet 5(f), 5a(f), 5b(f), 5c(f), 5d(f), 5e(f), 5f(f), 5g(f), 5h(f), 5i(f), 5j(f), 5k(f), 5l(f), 5m(f), 5n(f), 5o(f), (not shown in C17), 5q(f), (not shown in C19), 5s(f), 5t(f), 5u(f), 5v(f) may be initiated / driven by a current driver (not shown) which may be controlled by a controller (not shown).

[0497] The electromagnet the electromagnet 5(f), 5a(f), 5b(f), 5c(f), 5d(f), 5e(f), 5f(f), 5g(f) may disposed at the other end of the electromagnetic installing slot 113, 113a, 113b, 113c, 113d, 113e, 113f, 113g at the lock cover 2, 2a, 2b, 2c, 2d, 2e, 2f, 2g to obtain substantially the same effect as shown for embodiment C1, C2, C3 C4, C5, C6, C7, C8.

CLAIMS

1. A safety lock mechanism for a portable weapon, comprising:
 - a. an actuator;
 - b. a driver;
 - c. locking means operable from an unlocked state to a locked state, being actuated by said actuator driven by said driver for blocking a firing sequence of said portable weapon.
2. The safety lock mechanism as recited in claim 1 further comprises a controller for controlling said driver.
3. The safety lock mechanism as recited in claim 2, wherein said actuator permits said locking means to be operable from said locked state to said unlocked state.
4. The safety lock mechanism as recited in claim 3, wherein said actuator actuates said lock means from said locked state to said unlocked state.
5. The safety lock mechanism as recited in claim 4, wherein said controller controls said locking means causing the portable weapon to be initially in said locked state.
6. The safety lock mechanism as recited in claim 2, wherein said actuator comprising:
 - a. an electromagnet; and
 - b. a permanent magnet, wherein said permanent magnet is affixed to said locking means, and said driver drives said electromagnet to actuate said locking means through said permanent magnet.
7. The safety lock mechanism as recited in claim 6, wherein said locking means comprises a bar member for blocking said firing sequence at a trigger, a trigger lever, a hammer, or a firing pin of said portable weapon.
8. The safety lock mechanism as recited in claim 2, wherein said controller causes said locking means to block said firing sequence within 150 ms.
9. The safety lock mechanism as recited in claim 2, wherein said actuator comprising:
 - a. a motor; and
 - b. a gear, wherein said gear cooperates with said locking means, and said motor actuates said locking means through said gear.
10. The safety lock mechanism as recited in claim 2, wherein said actuator comprises a push-pull solenoid.
11. The safety lock mechanism as recited in claim 2, wherein said actuator comprises a self-holding solenoid.

12. The safety lock mechanism as recited in claim 2, wherein said actuator comprises a motor or rotating electromagnet.
13. The safety lock mechanism as recited in claim 12, wherein said motor comprises a servo motor.
14. The safety lock mechanism as recited in claim 11, wherein said locking means comprises:
- a. a bar member, a first distal end of said bar member is attached to a trigger of said portable weapon, said bar member is slidable along a moving path of the trigger, and a second distal end of said bar member comprises means for restricting a range of a sliding movement of said bar member;
 - b. said bar member further comprise a conical frustum that engages with an iron core of said self-holding solenoid to block said sliding movement of said bar member.
15. The safety lock mechanism as recited in claim 14, wherein said means for restricting said range of said sliding movement of said bar member comprising:
- a. a piston limiter on said bar member; and
 - b. a cavity plate that engages with said piston limiter for restricting said range of said sliding movement of said bar member.
16. The safety lock mechanism as recited in claim 11, wherein said locking means comprising:
- a. a retractable tapeline;
 - b. a string member movable between a first position and a second position along a moving path of a trigger of said portable weapon, a first distal end of said bar member is attached to said trigger, and a second distal end of said string member is attached to said retractable tapeline and said string member is biased to said first position;
- wherein said retractable tapeline defines a slot for receiving an iron core of said self-holding solenoid to lock said string member at said first position.
17. The safety lock mechanism as recited in claim 6, wherein said locking means comprises:
- a. a shell fastened over a trigger guard, said shell defining a finger hole;
 - b. a panel slidably engages with the shell defining a finger window, movable between a first position and a second position, and said permanent magnet is attached to said panel;

wherein said electromagnet cooperate with said permanent magnet, and when said panel slides in said second position, said finger hole and said finger window align to allow an access to a trigger of said portable weapon.

18. The safety lock mechanism as recited in claim 12, wherein said locking means comprising a rotary shaft that actuates a safety of said portable weapon, said motor actuates safety through said rotary shaft between said locked state and said unlocked state.

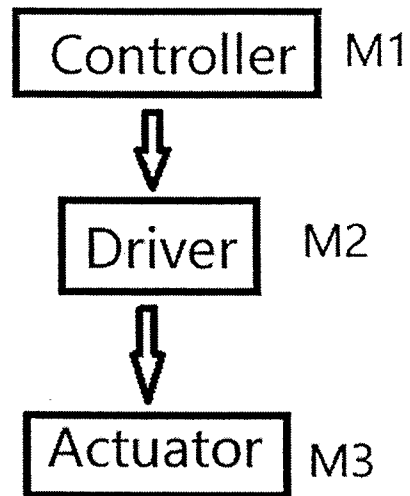


FIG 1.0

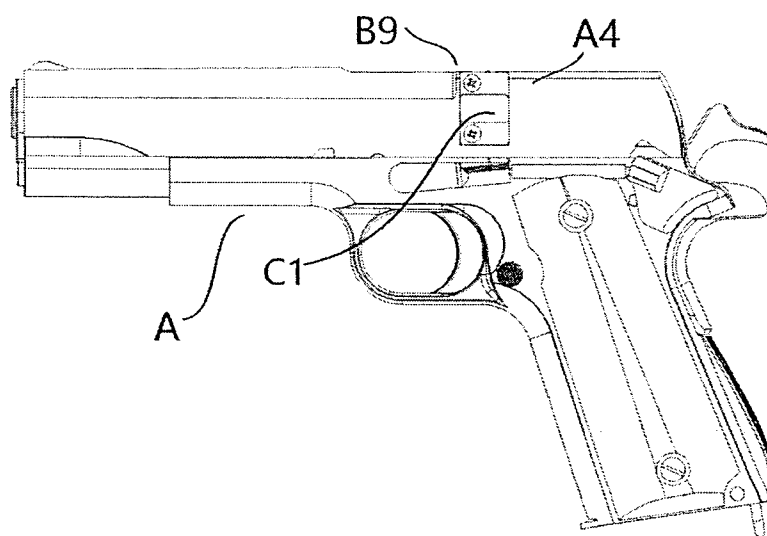


FIG 1.1

2/79

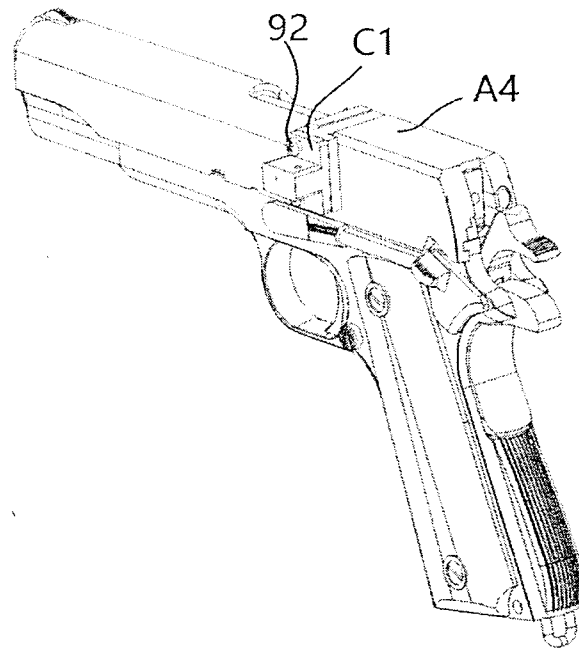


FIG 1.2

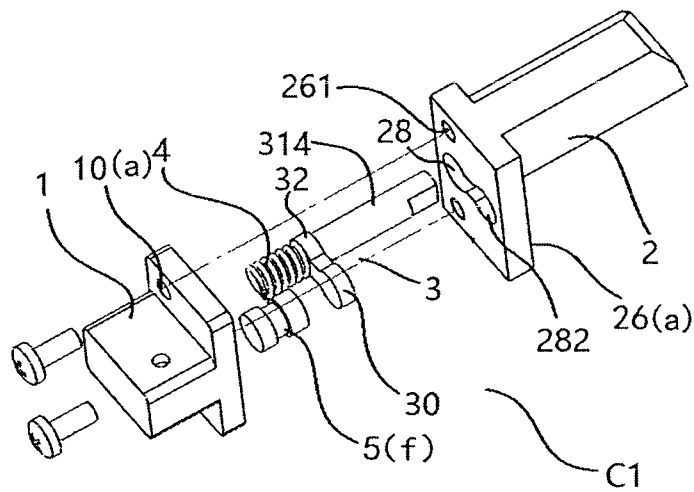


FIG 1.3

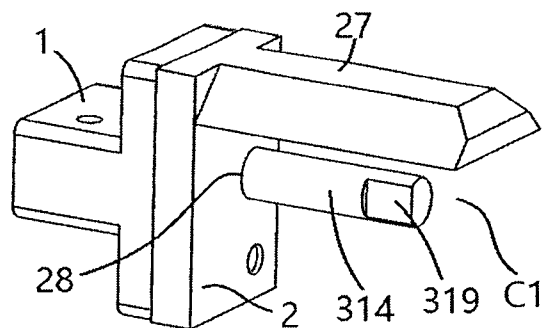


FIG 1.4

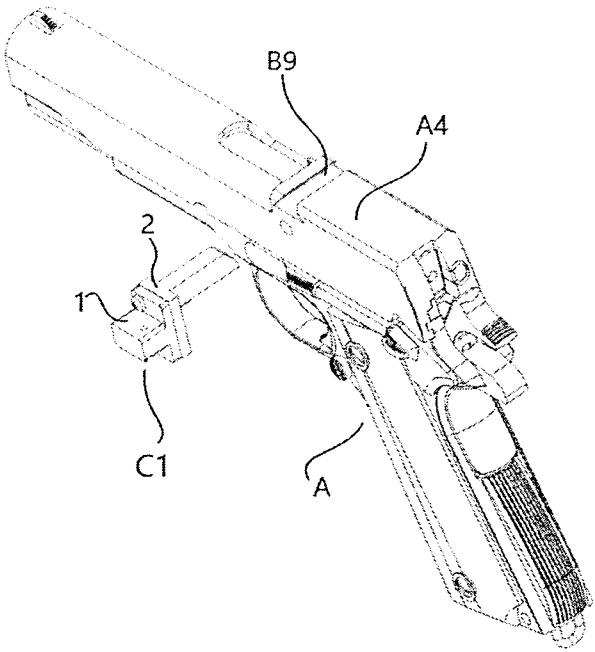


FIG 1.5

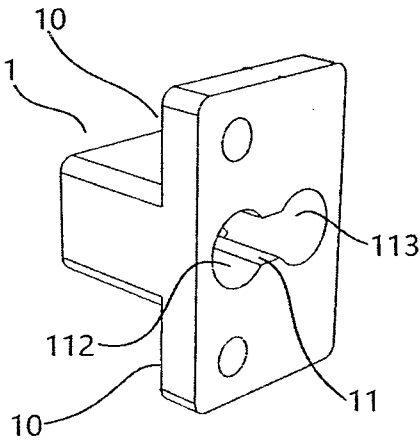


FIG 1.6

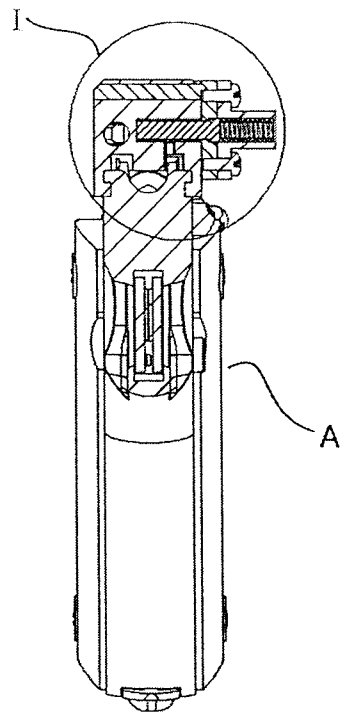


FIG 1.71

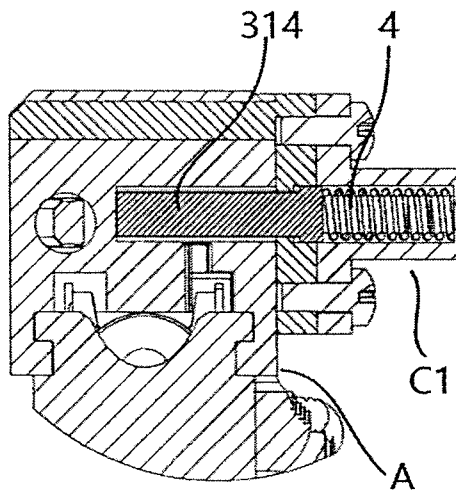


FIG 1.72

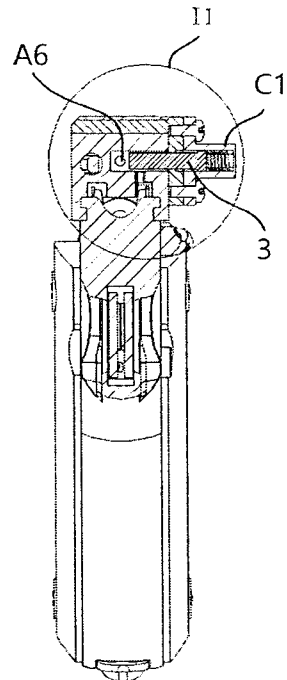


FIG 1.81

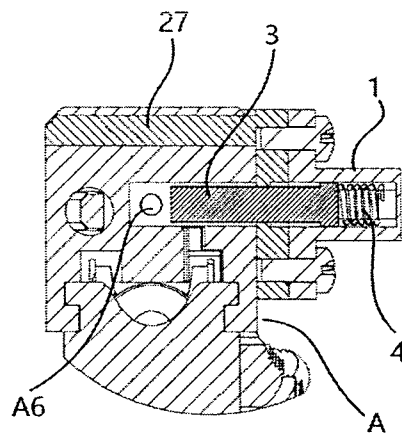


FIG 1.82

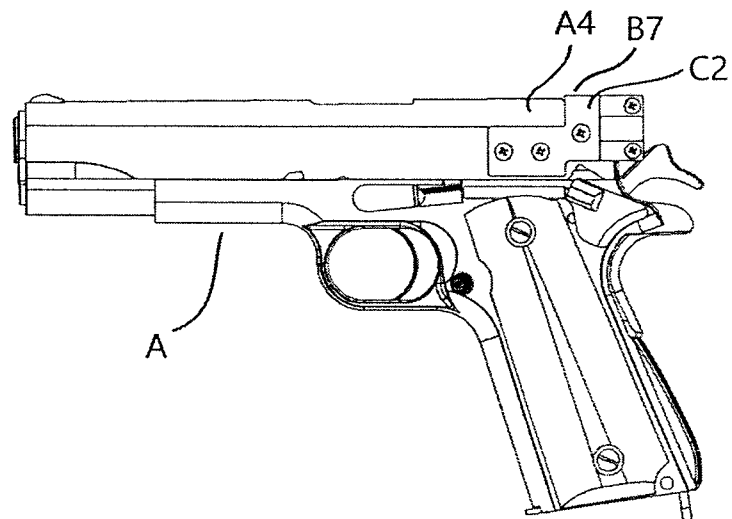


FIG 2.1

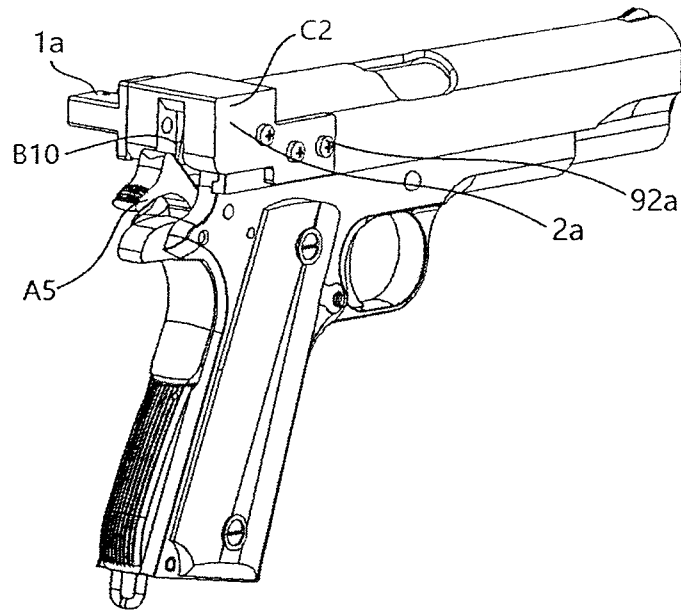


FIG 2.2

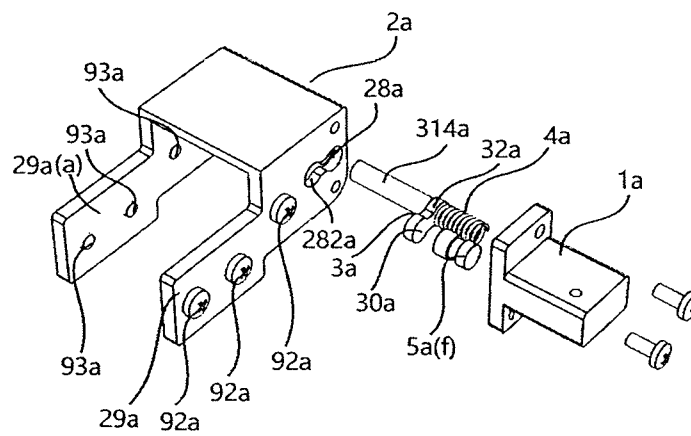


FIG 2.3

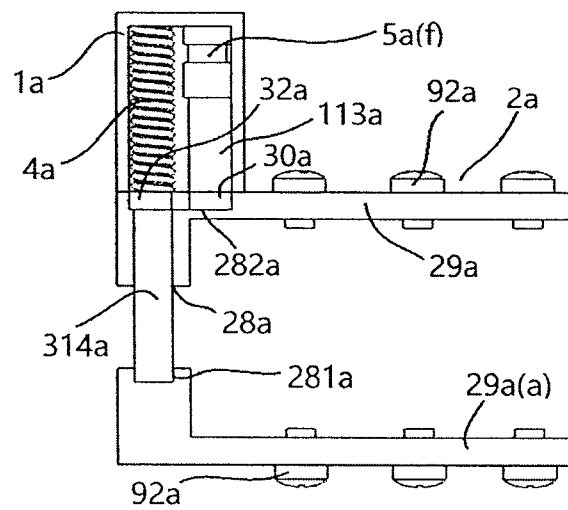


FIG 2.4

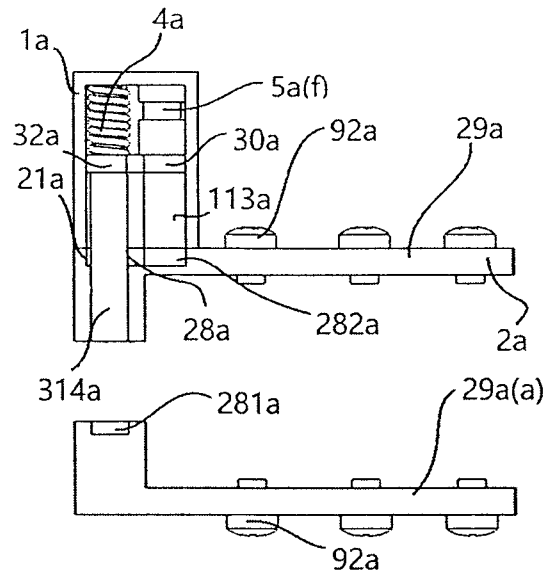


FIG 2.5

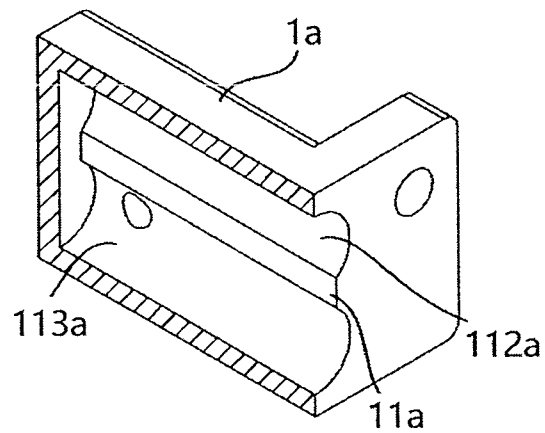


FIG 2.6

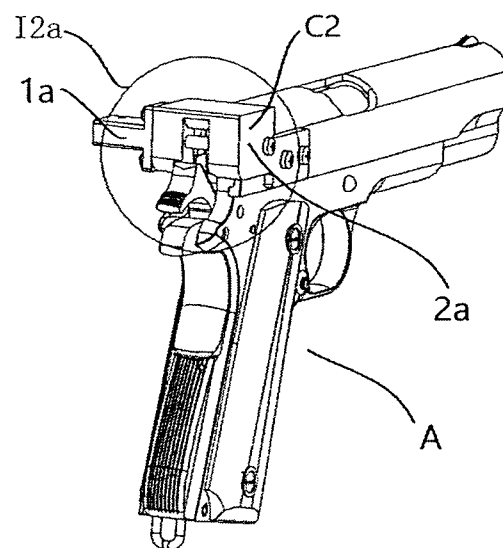


FIG 2.71

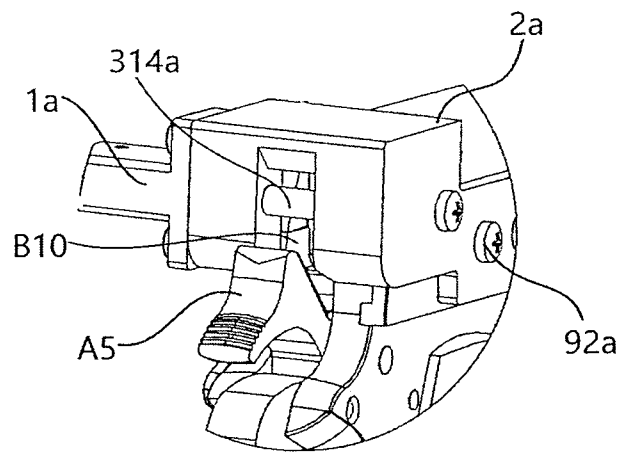


FIG 2.72

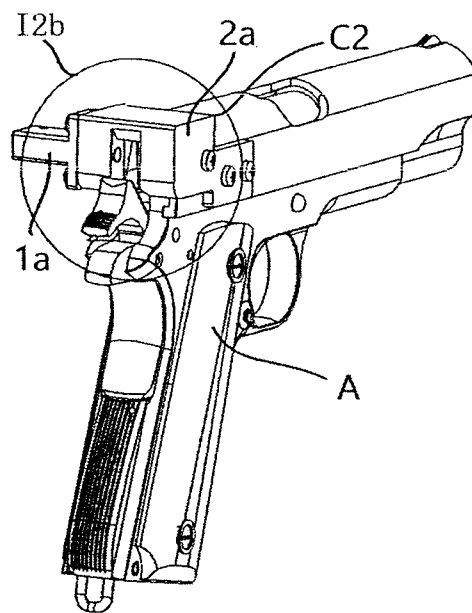


FIG 2.81

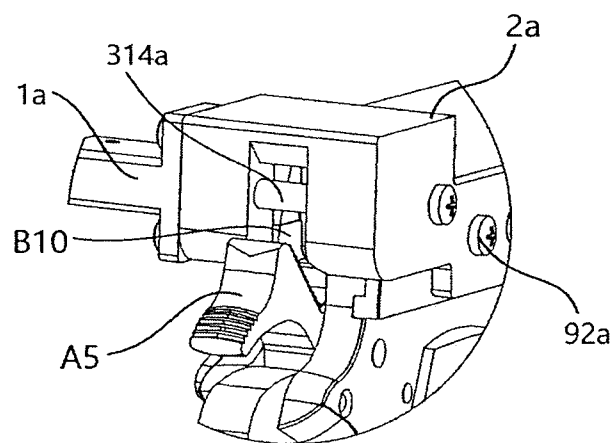


FIG 2.82

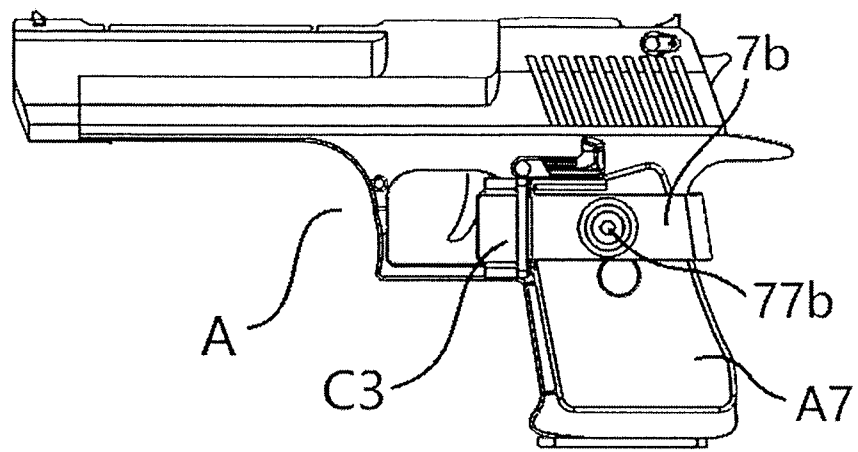


FIG 3.1

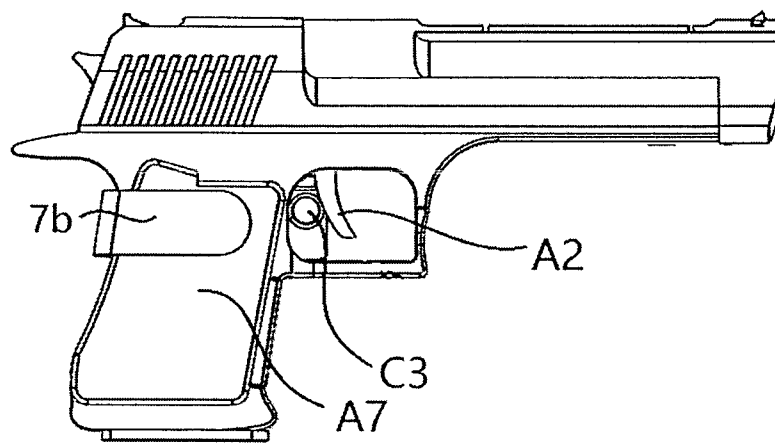


FIG 3.2

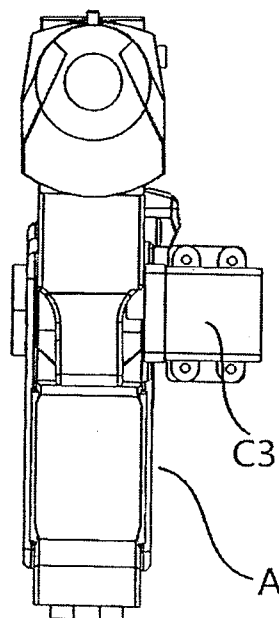


FIG 3.3

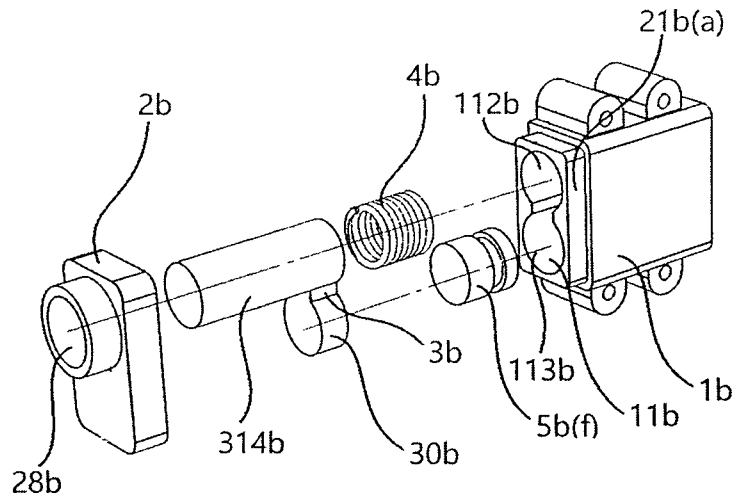


FIG 3.4

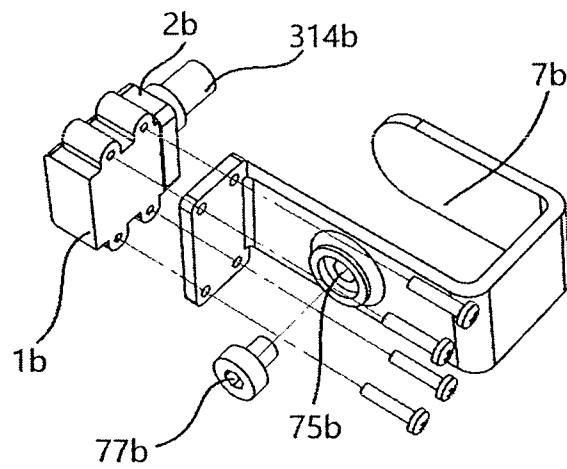


FIG 3.5

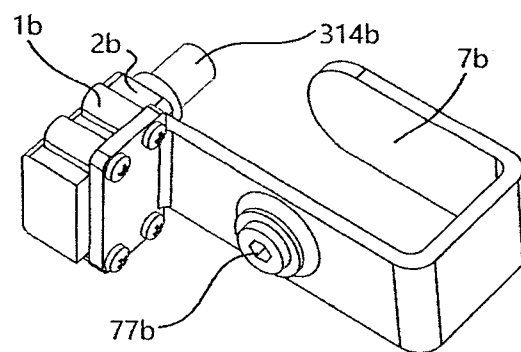


FIG 3.6

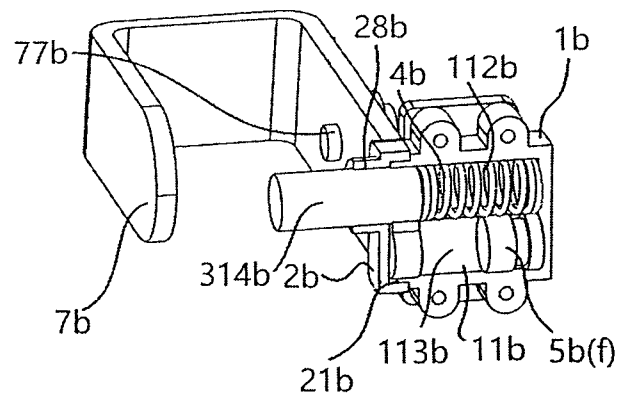


FIG 3.7

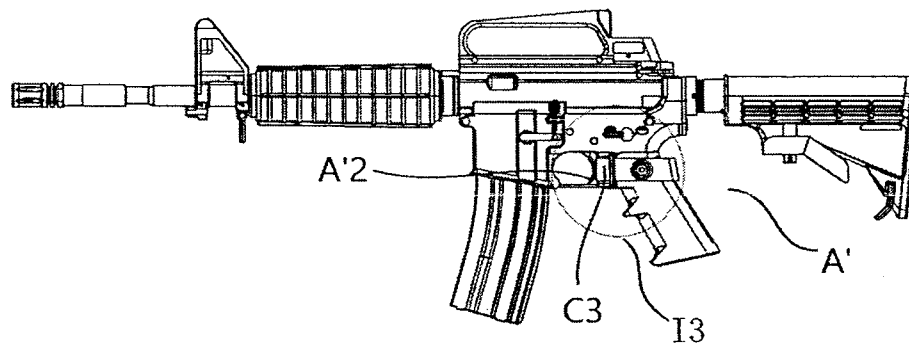


FIG 3.81

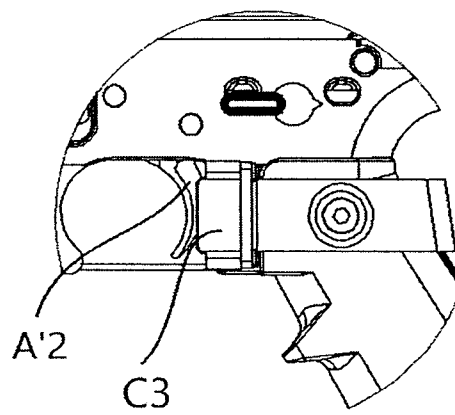


FIG 3.82

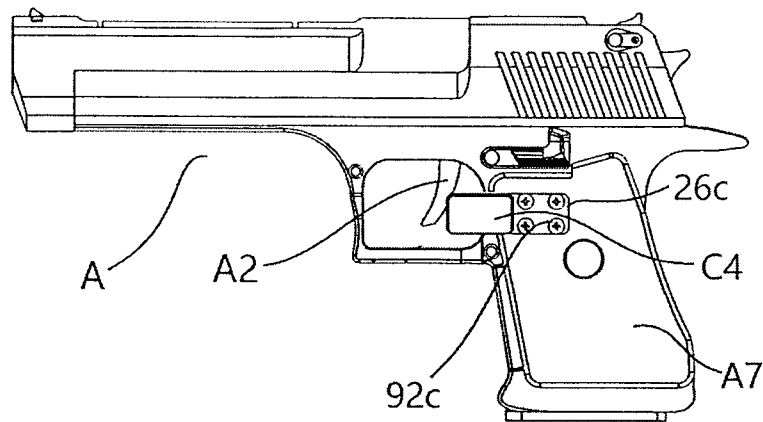


FIG 4.1

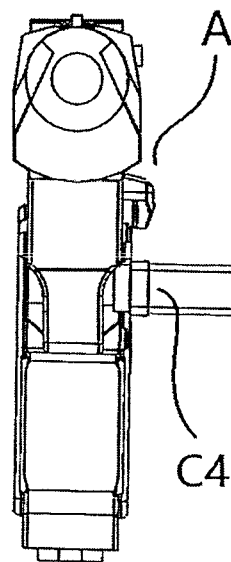


FIG 4.2

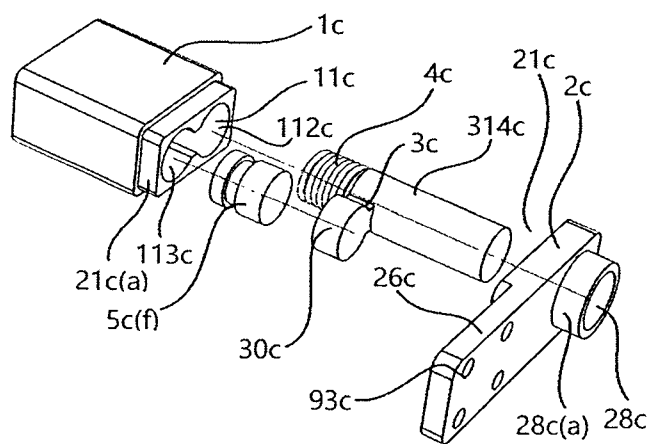


FIG 4.3

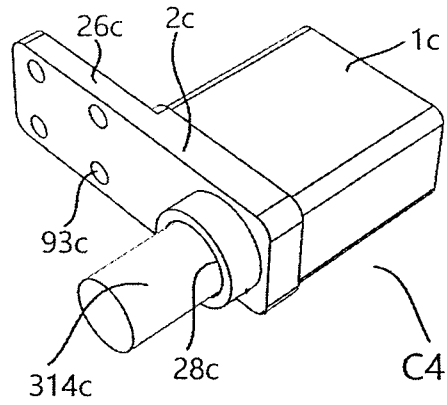


FIG 4.4

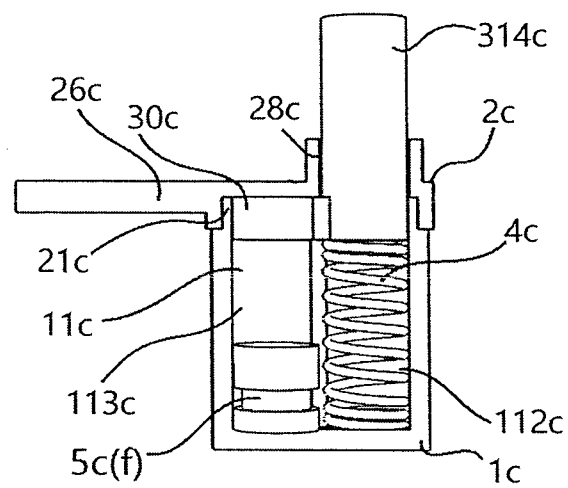


FIG 4.5

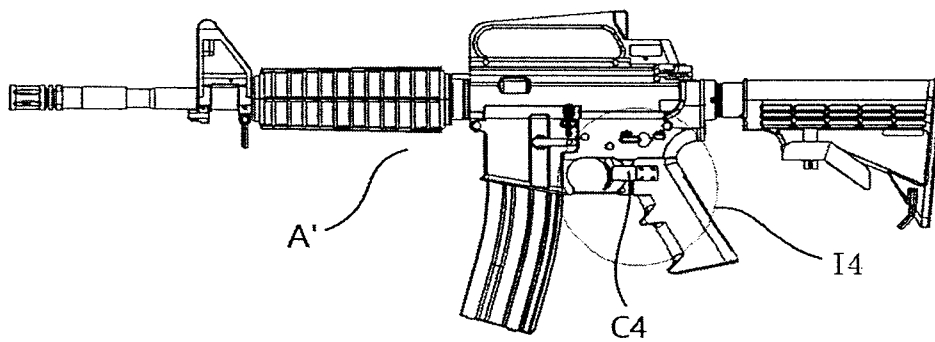


FIG 4.61

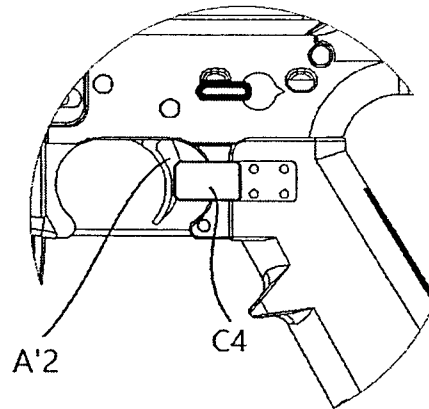


FIG 4.62

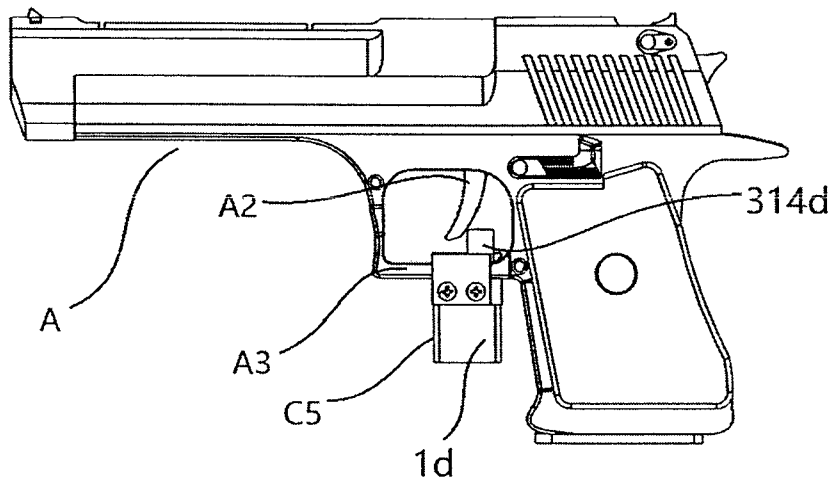


FIG 5.1

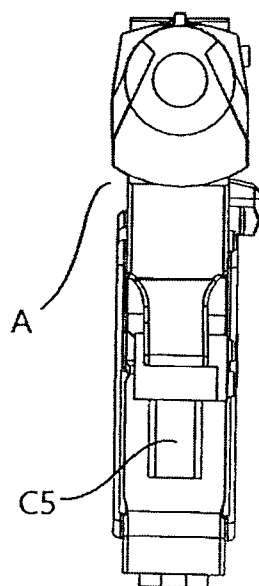


FIG 5.2

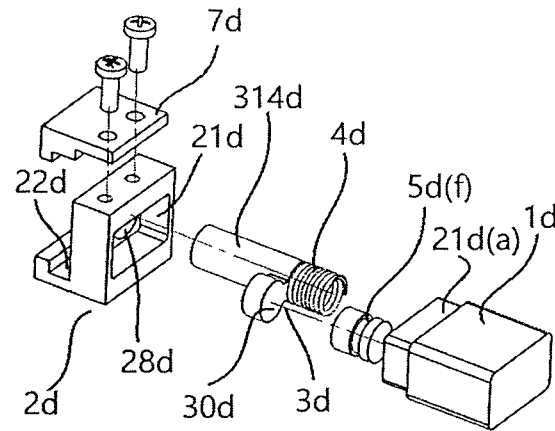


FIG 5.3

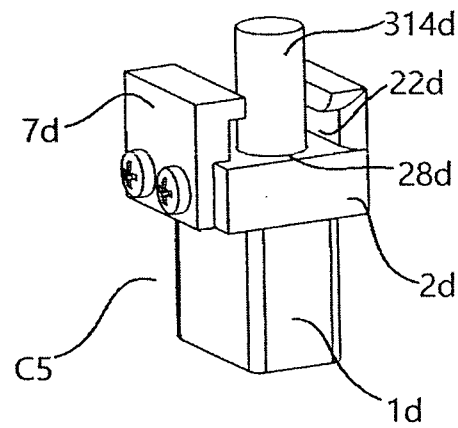


FIG 5.4

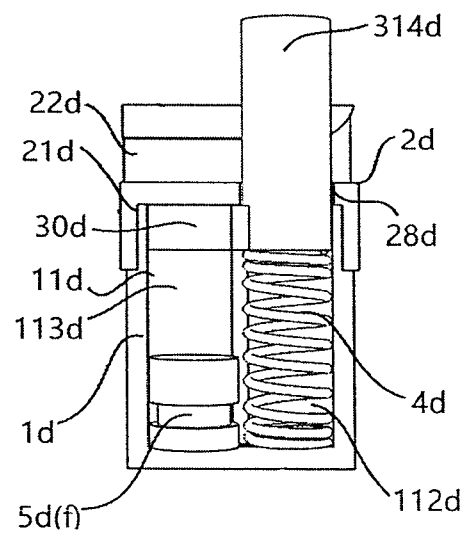


FIG 5.5

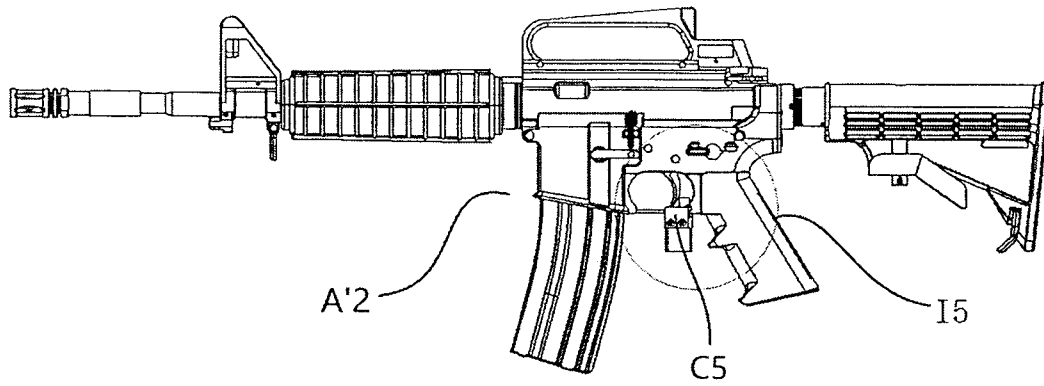


FIG 5.61

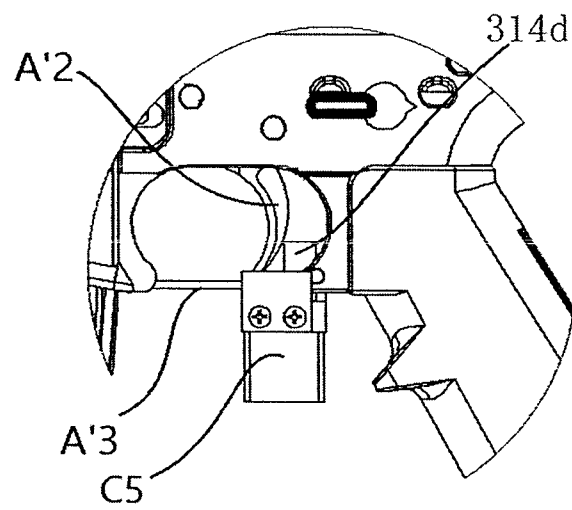


FIG 5.62

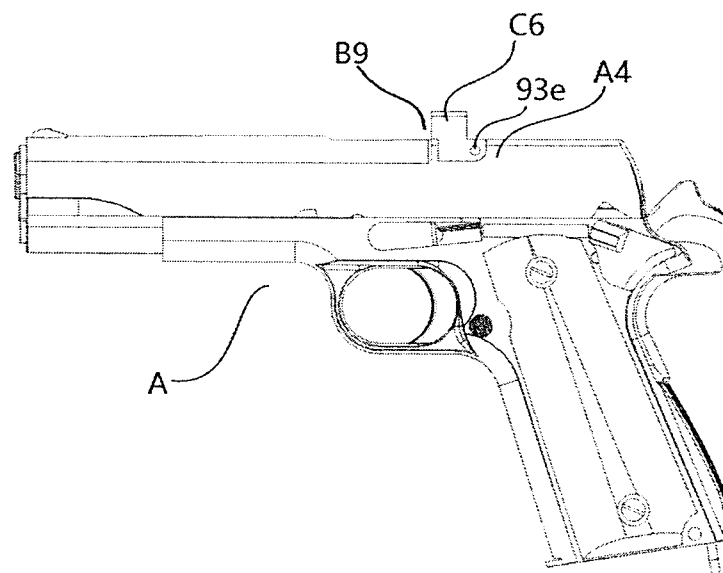


FIG 6.1

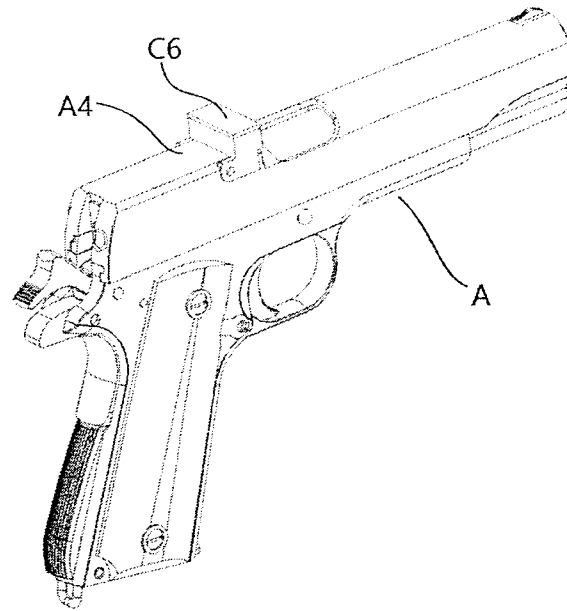


FIG 6.2

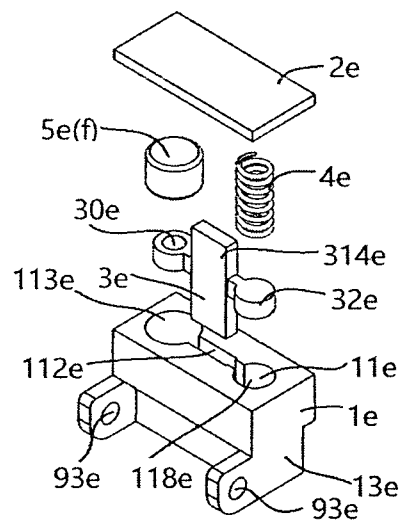


FIG 6.3

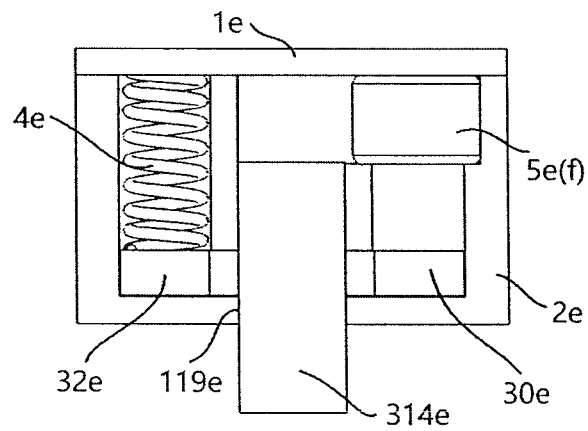


FIG 6.4

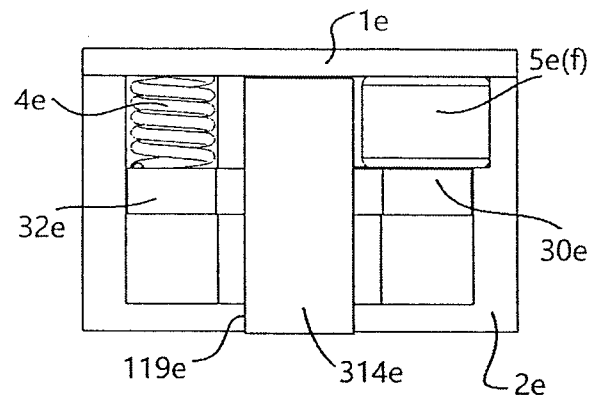


FIG 6.5

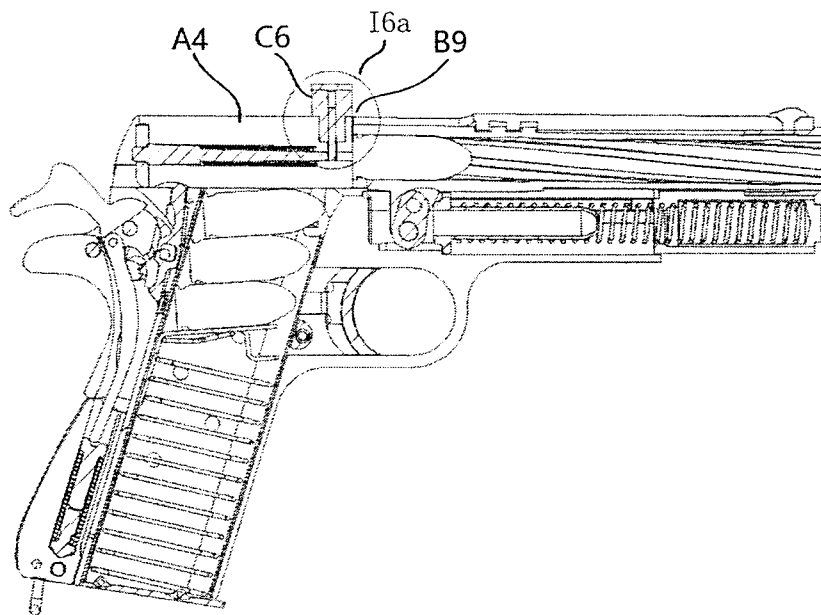


FIG 6.61

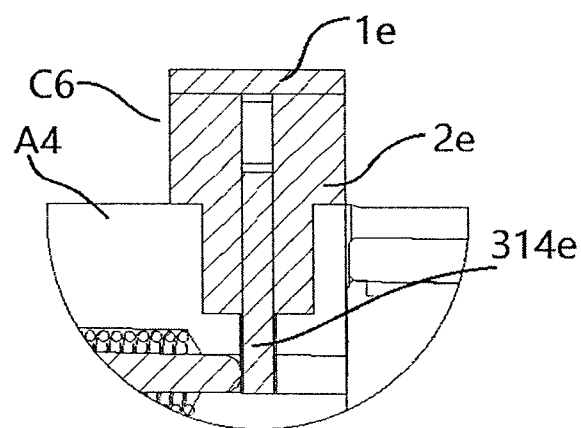


FIG 6.62

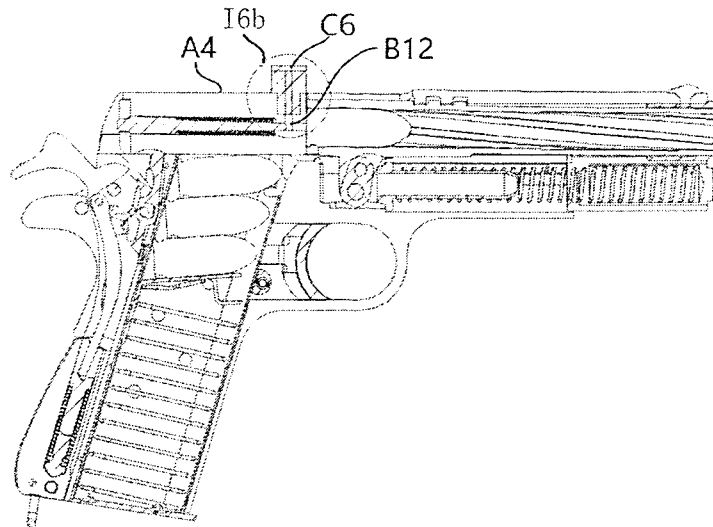


FIG 6.71

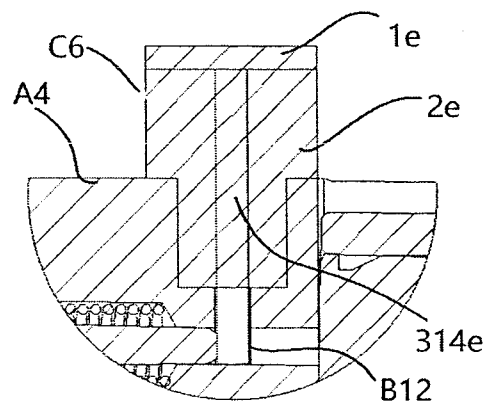


FIG 6.72

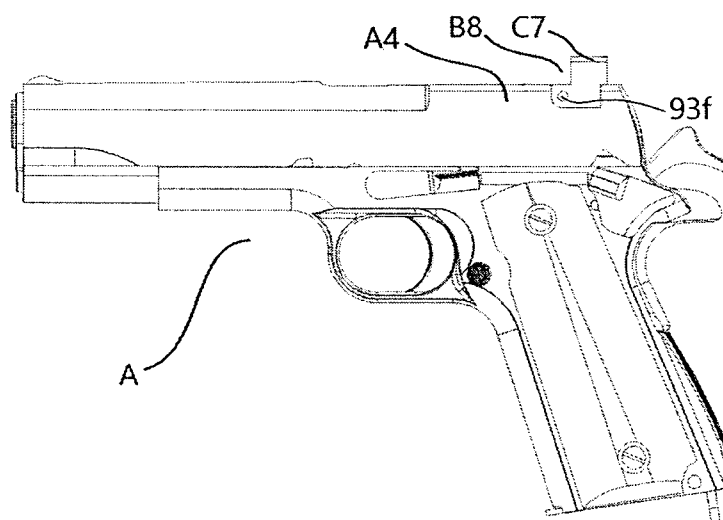


FIG 7.1

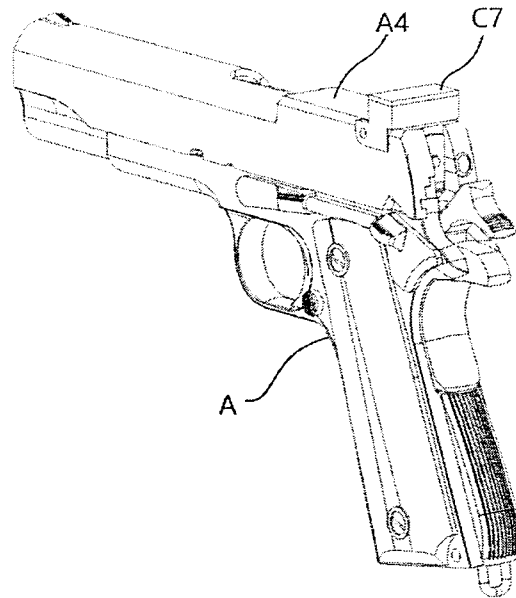


FIG 7.2

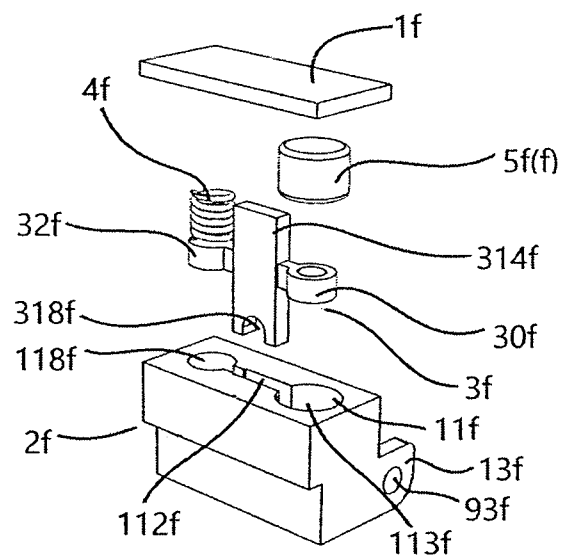


FIG 7.3

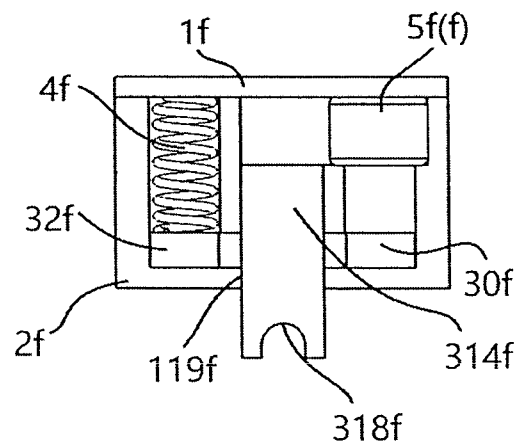


FIG 7.4

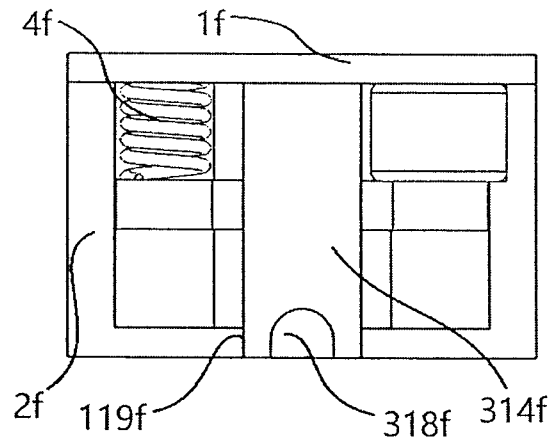


FIG 7.5

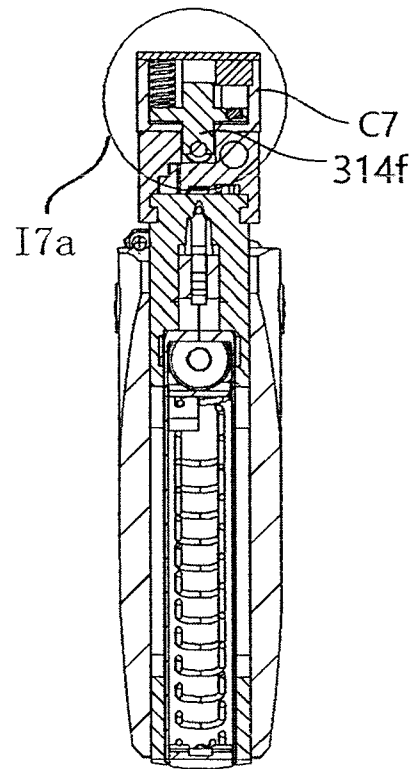


FIG 7.61

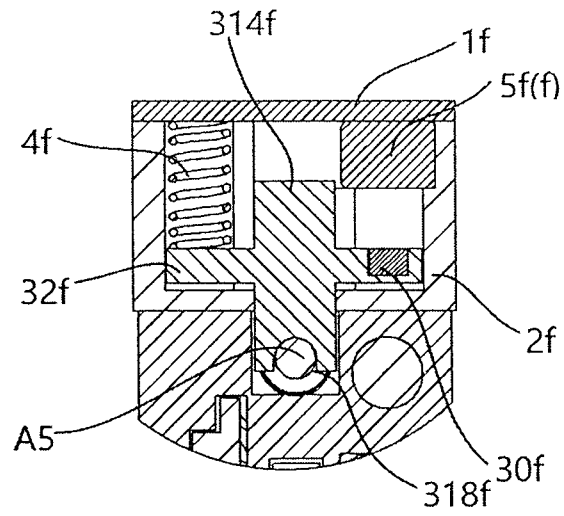


FIG 7.62

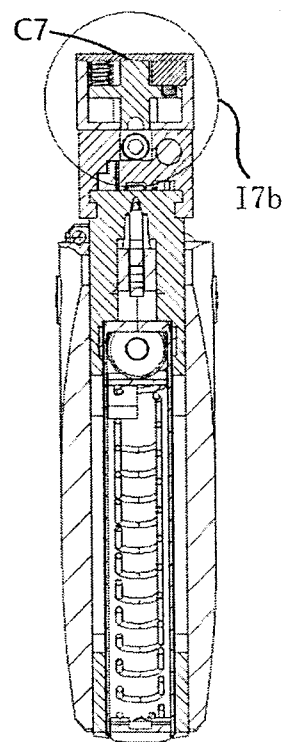


FIG 7.71

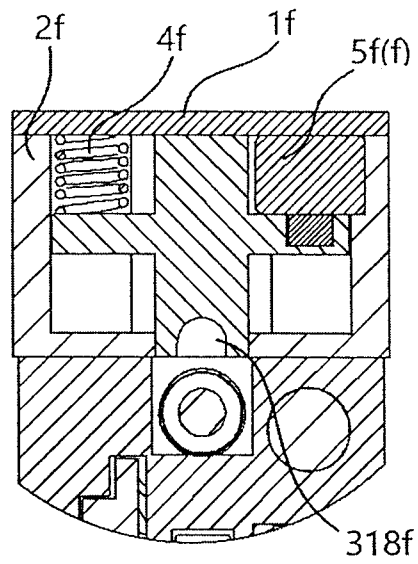


FIG 7.72

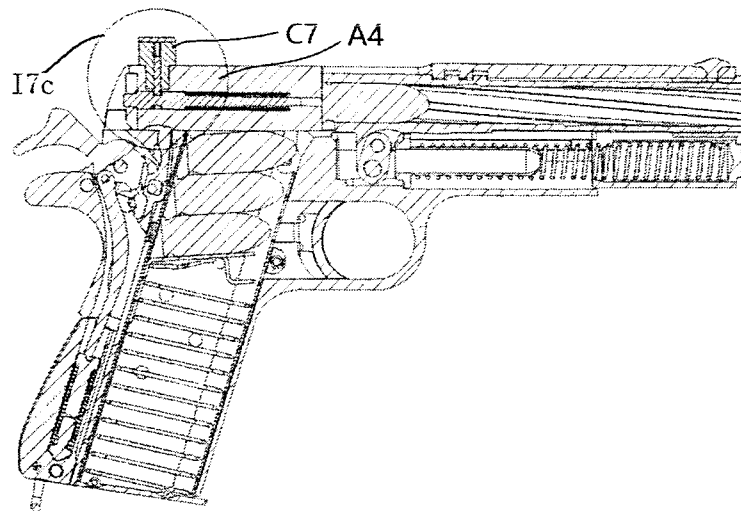


FIG 7.81

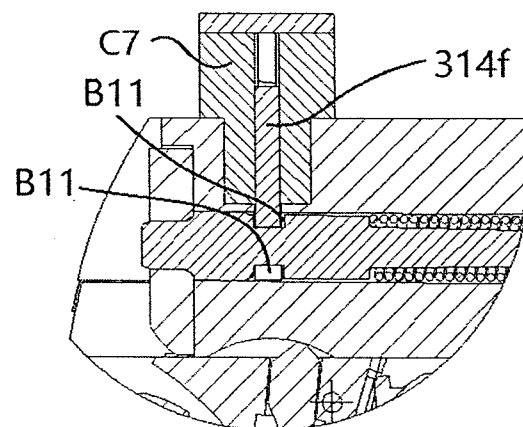


FIG 7.82

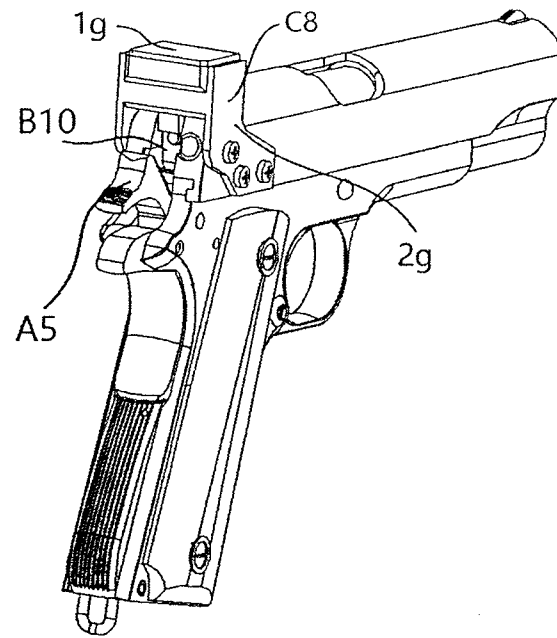


FIG 8.1

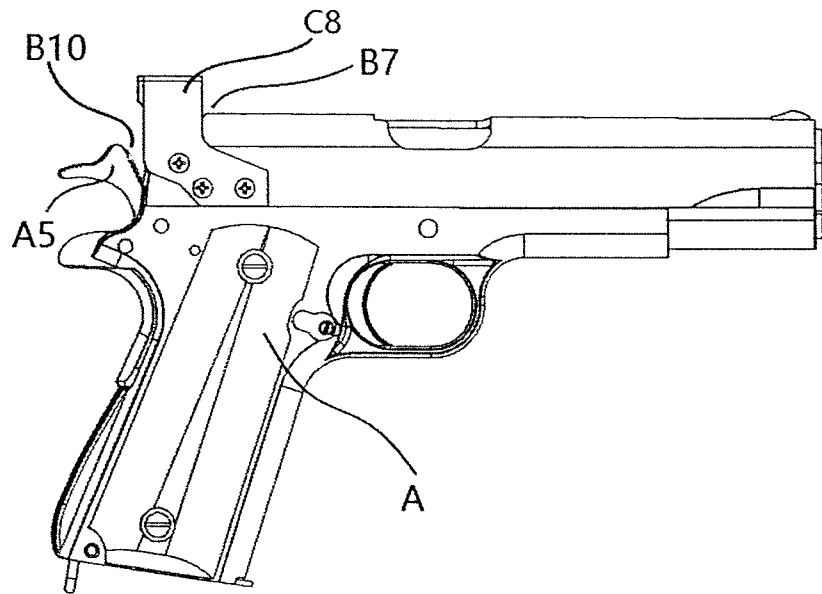


FIG 8.2

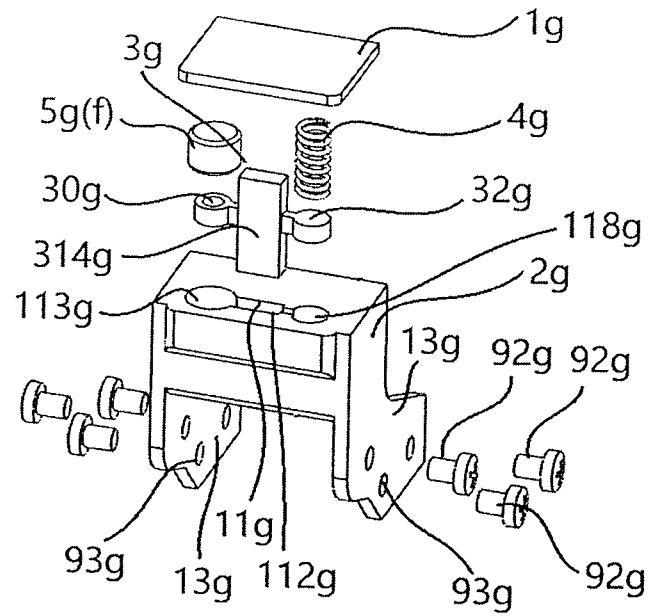


FIG 8.3

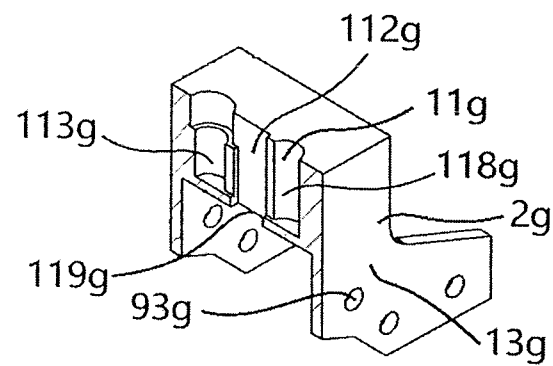


FIG 8.4

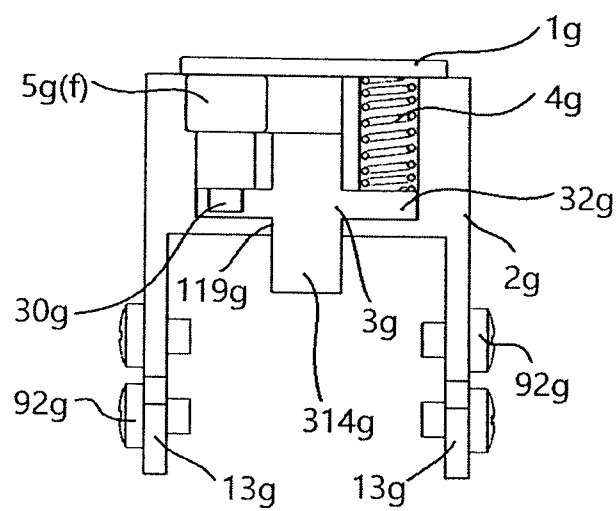


FIG 8.5

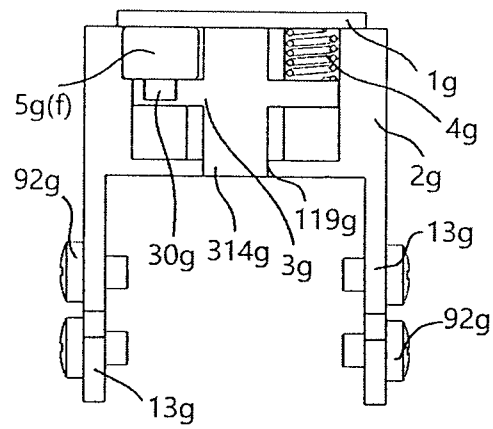


FIG 8.6

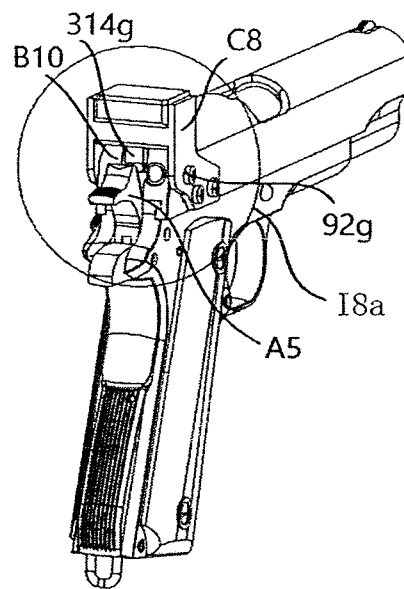


FIG 8.71

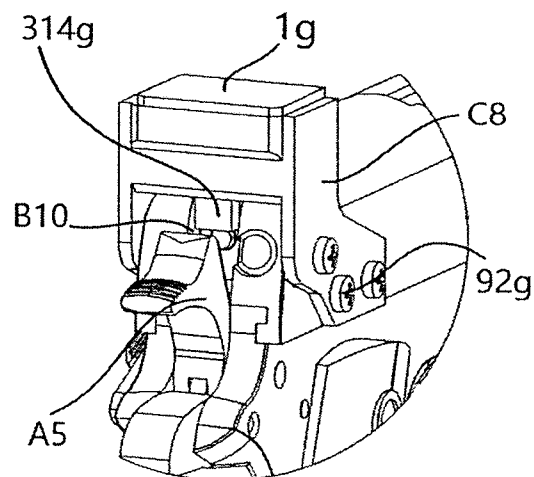


FIG 8.72

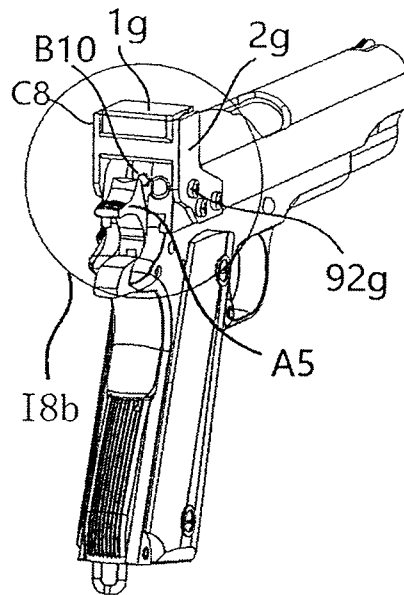


FIG 8.81

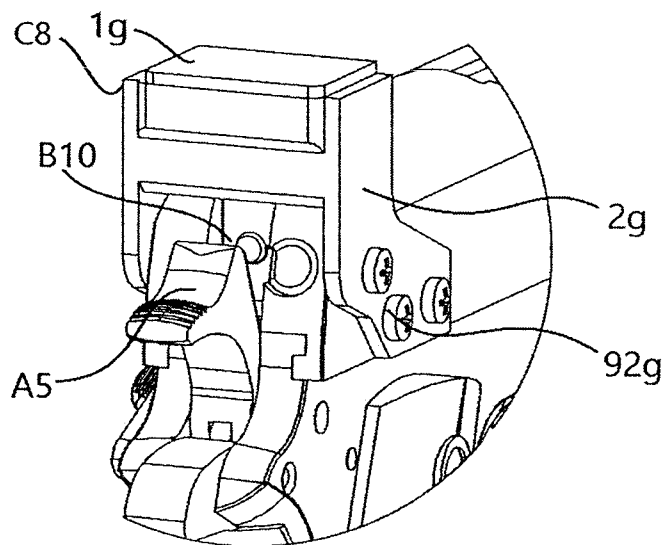


FIG 8.82

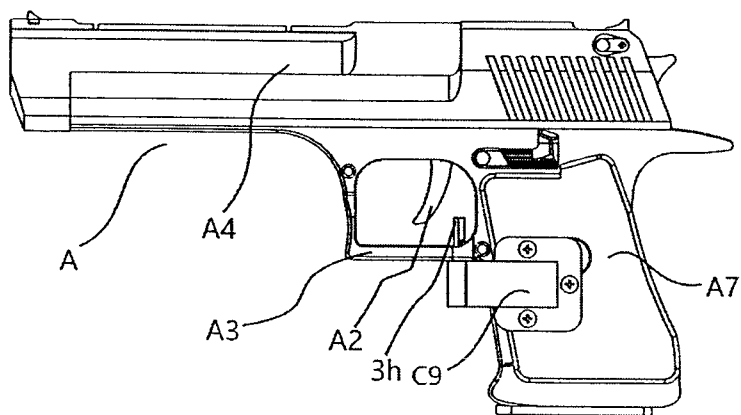


FIG 9.1

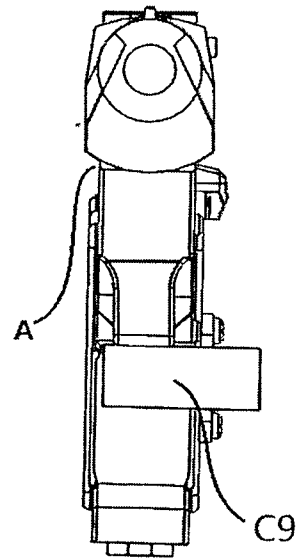


FIG 9.2

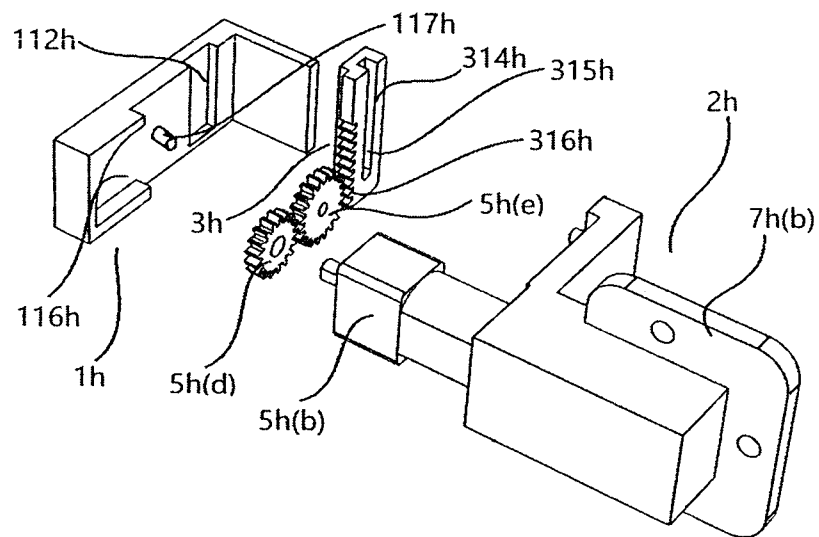


FIG 9.3

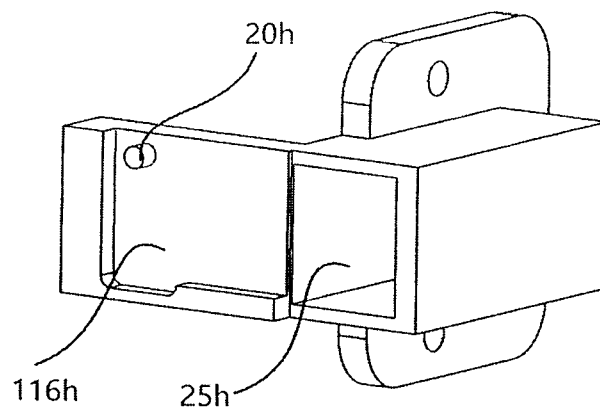


FIG 9.4

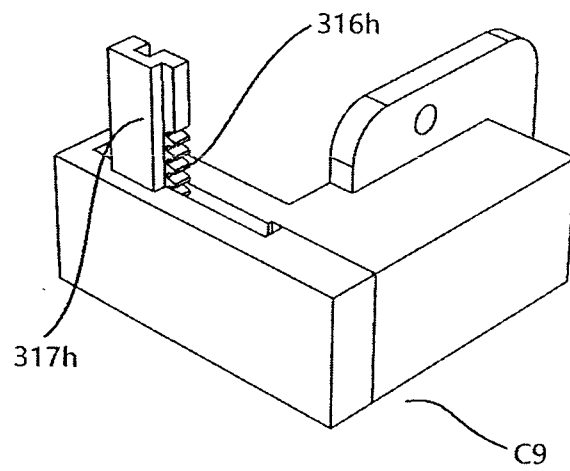


FIG 9.5

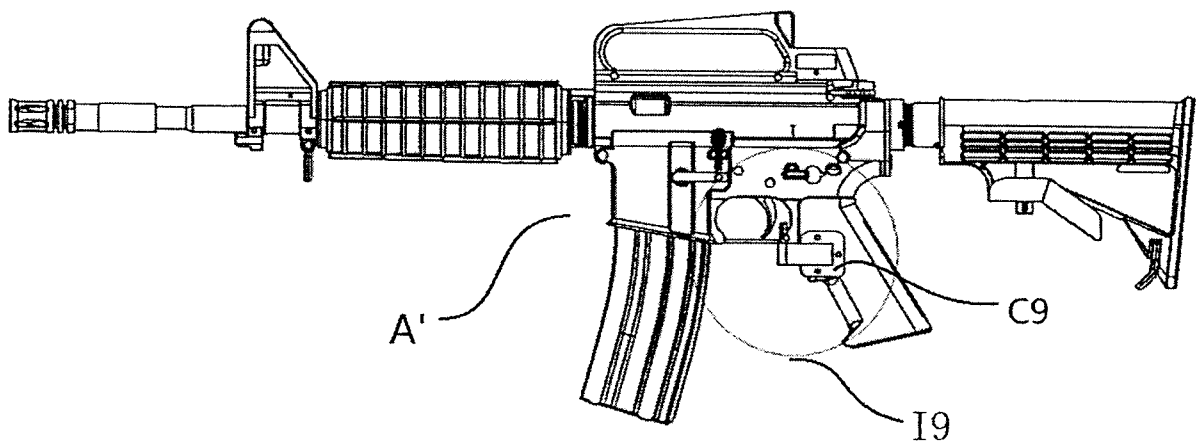


FIG 9.61

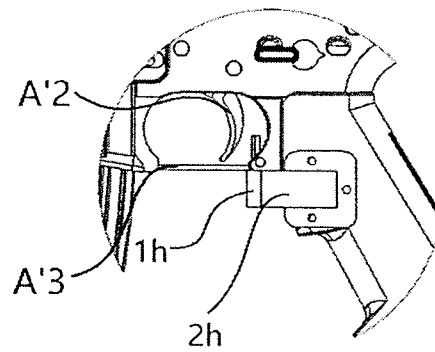


FIG 9.62

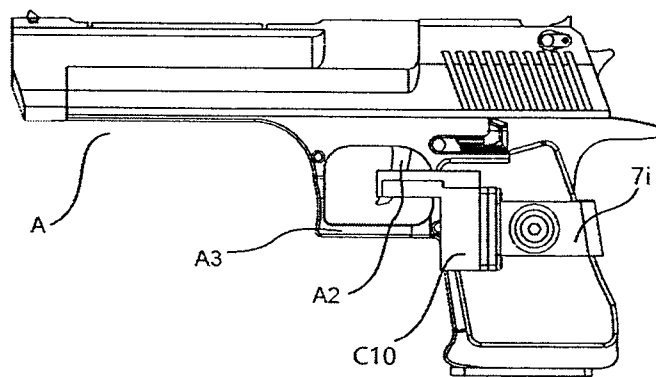


FIG 10.1

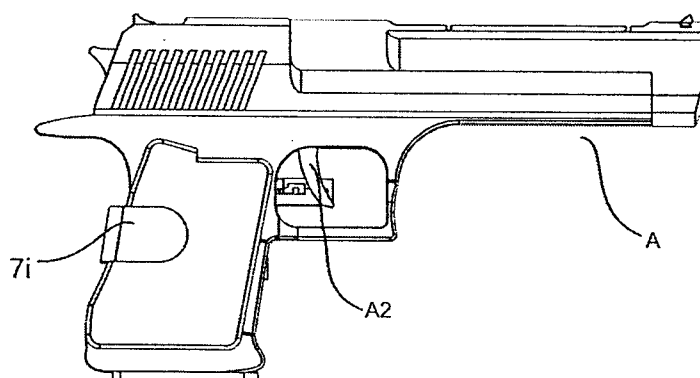


FIG 10.2

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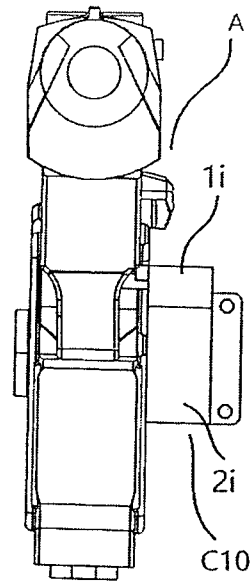


FIG 10.3

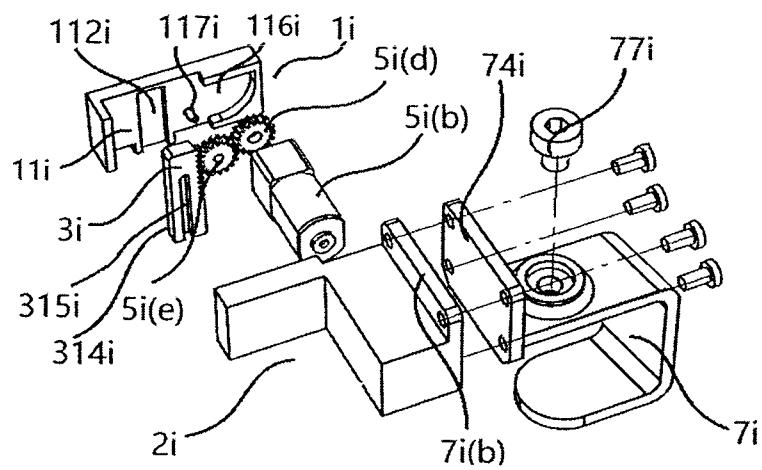


FIG 10.4

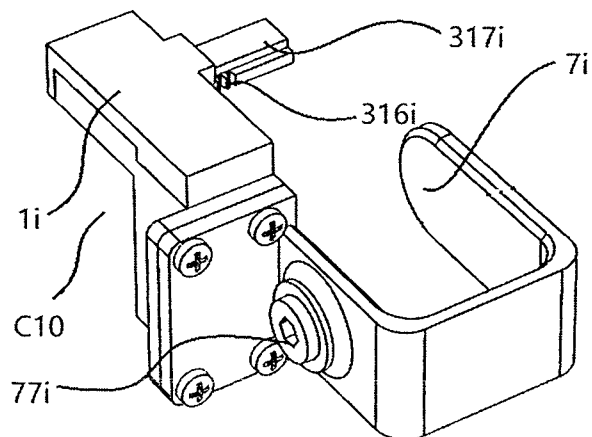


FIG 10.5

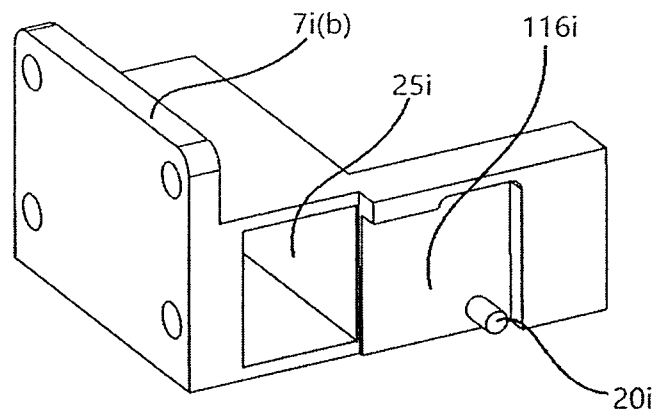


FIG 10.6

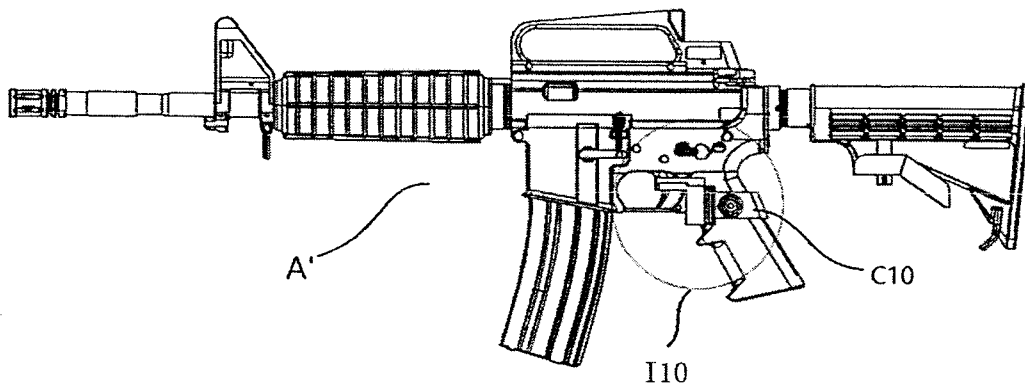


FIG 10.71

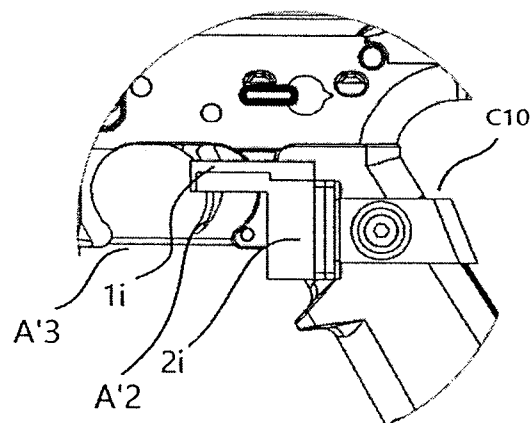


FIG 10.72

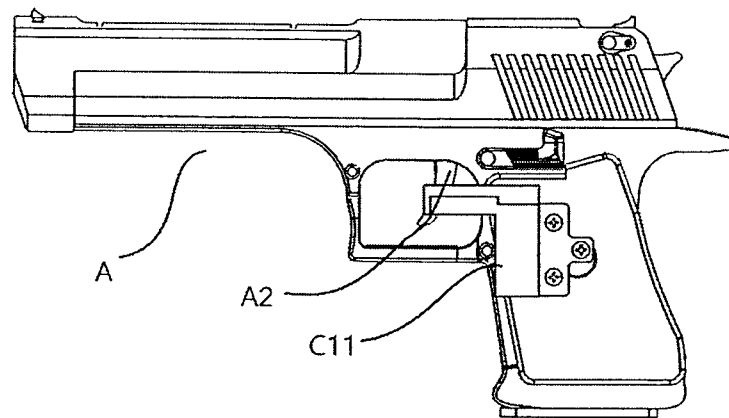


FIG 11.1

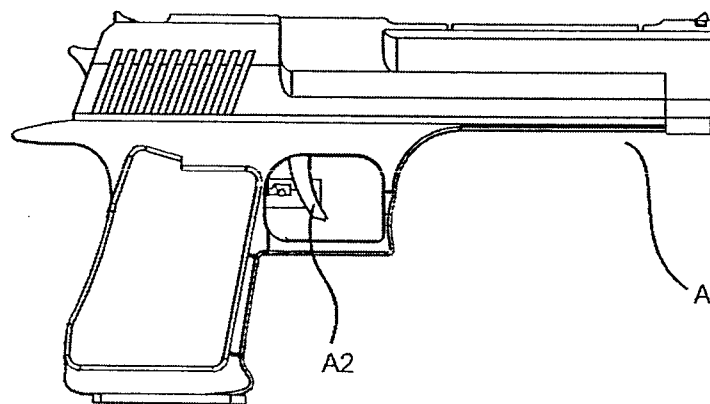


FIG 11.2

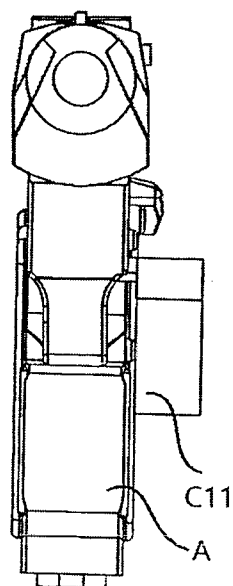


FIG 11.3

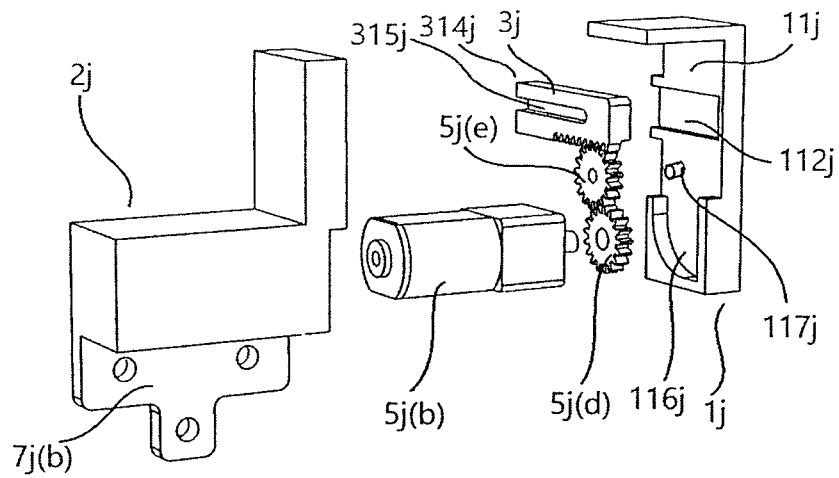


FIG 11.4

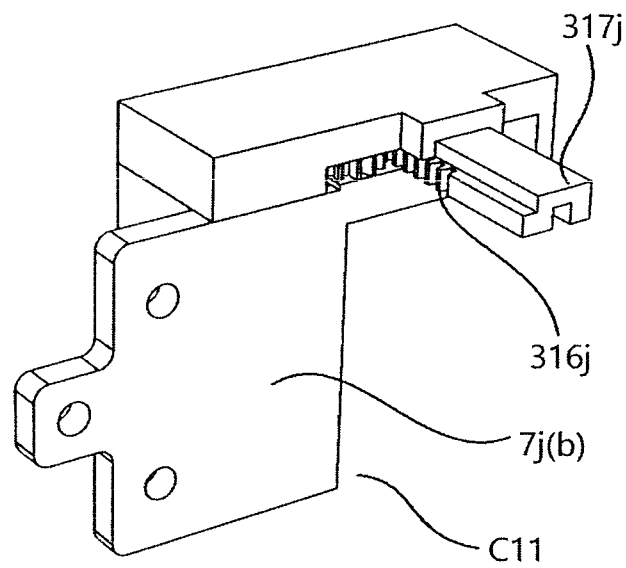


FIG 11.5

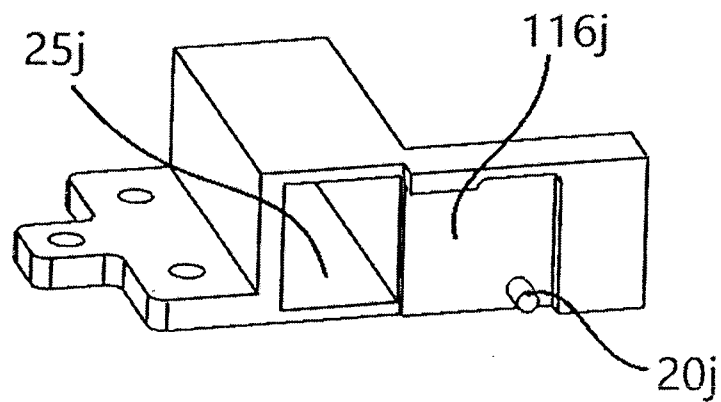


FIG 11.6

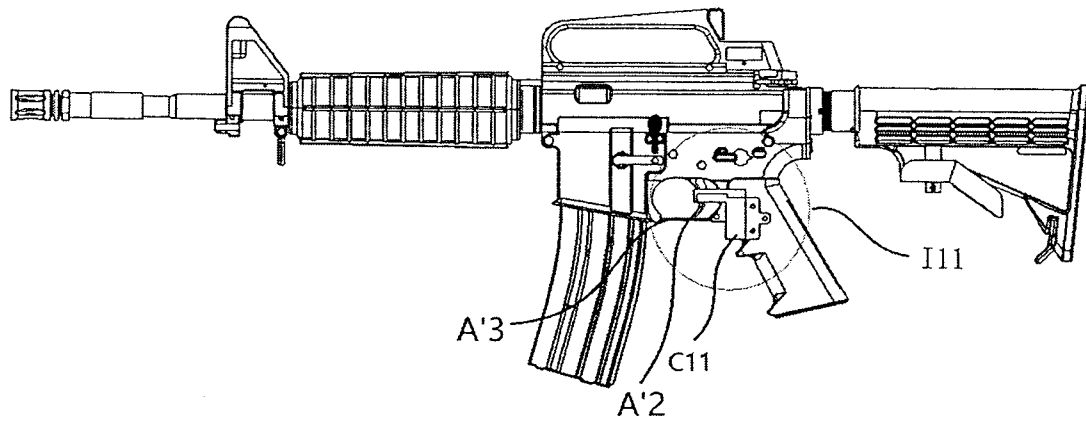


FIG 11.71

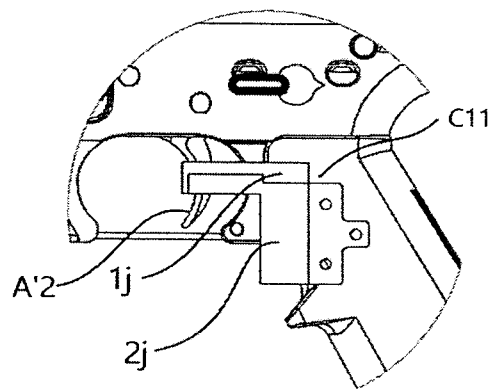


FIG 11.72

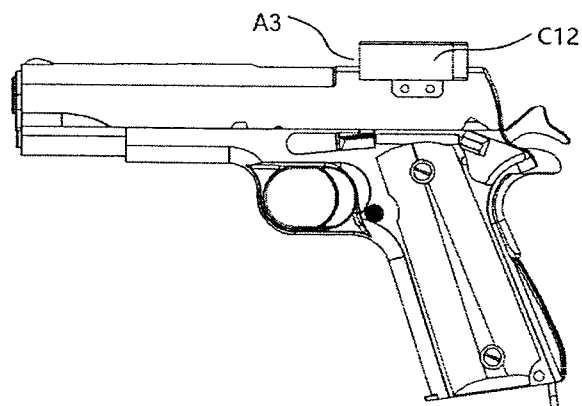


FIG 12.1

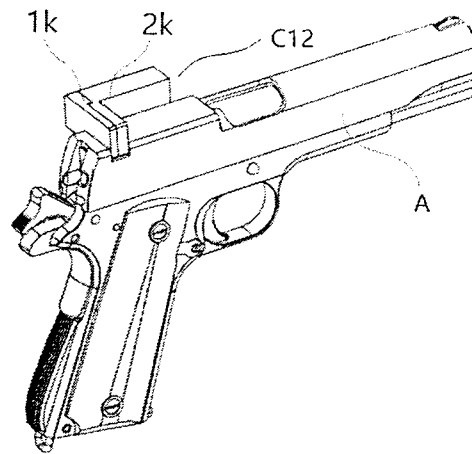


FIG 12.2

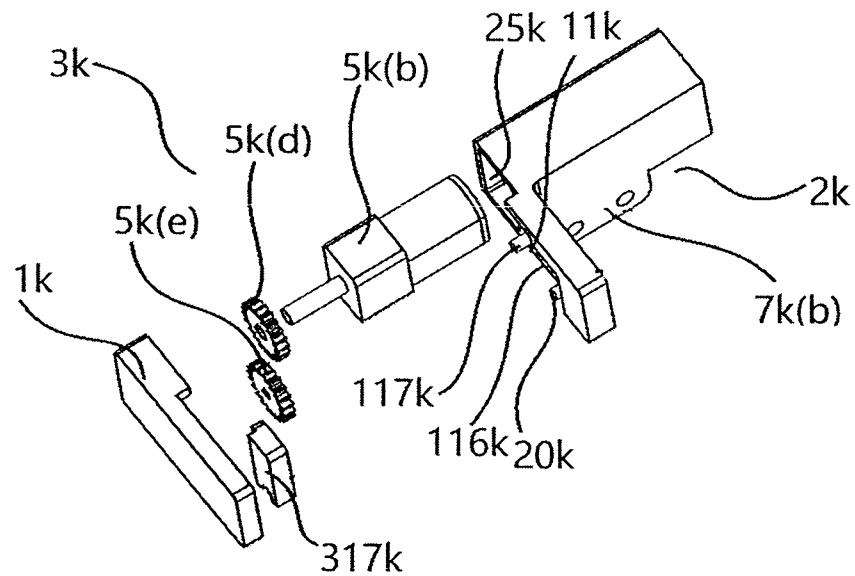


FIG 12.3

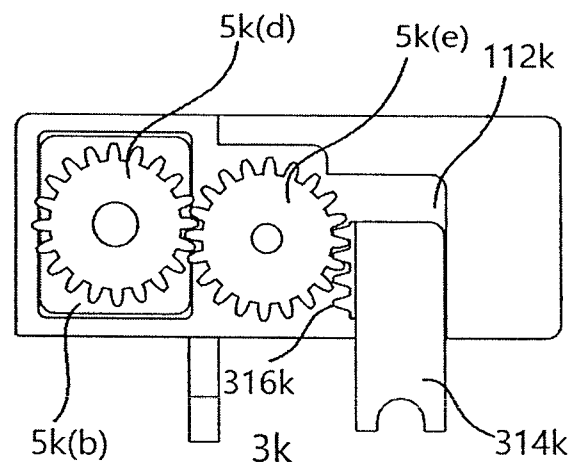


FIG 12.4

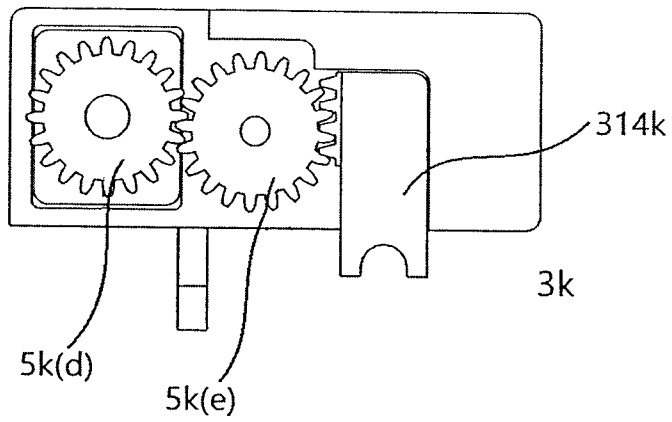


FIG 12.5

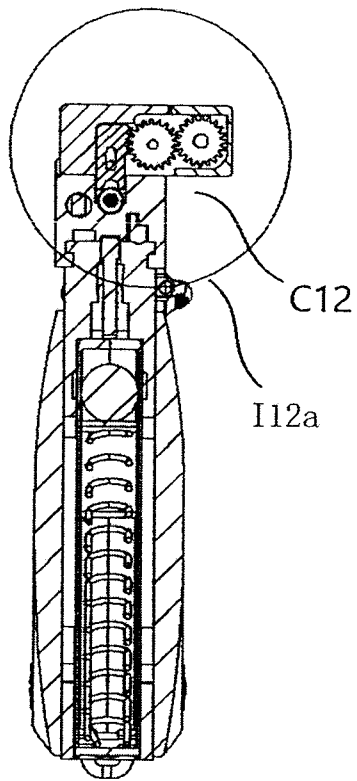


FIG 12.61

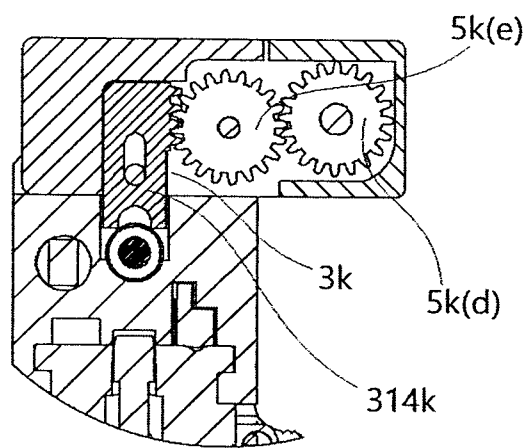


FIG 12.62

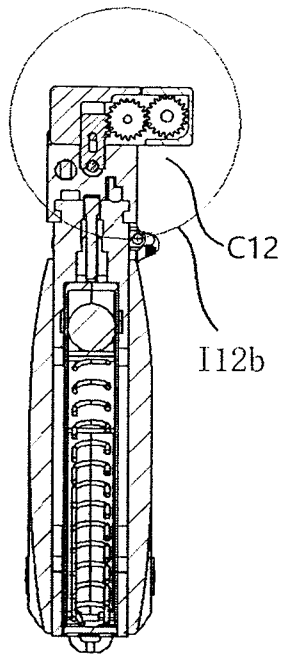


FIG 12.71

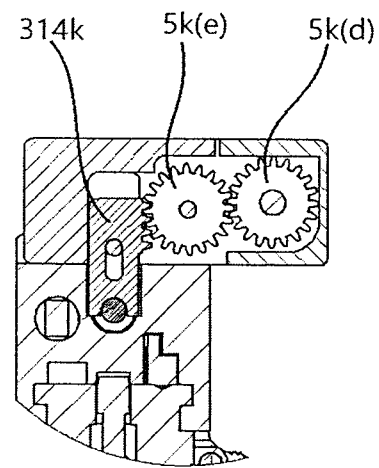


FIG 12.72

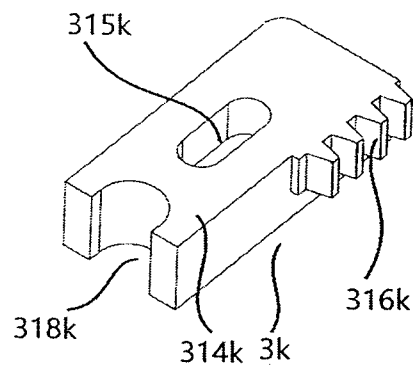


FIG 12.8

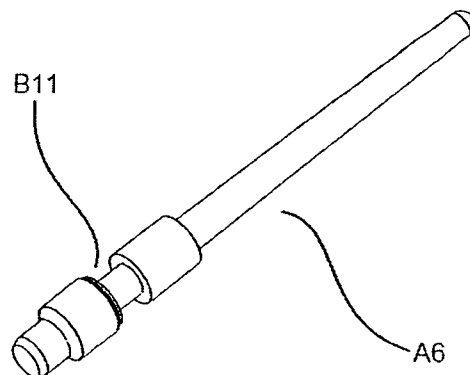


FIG 12.9

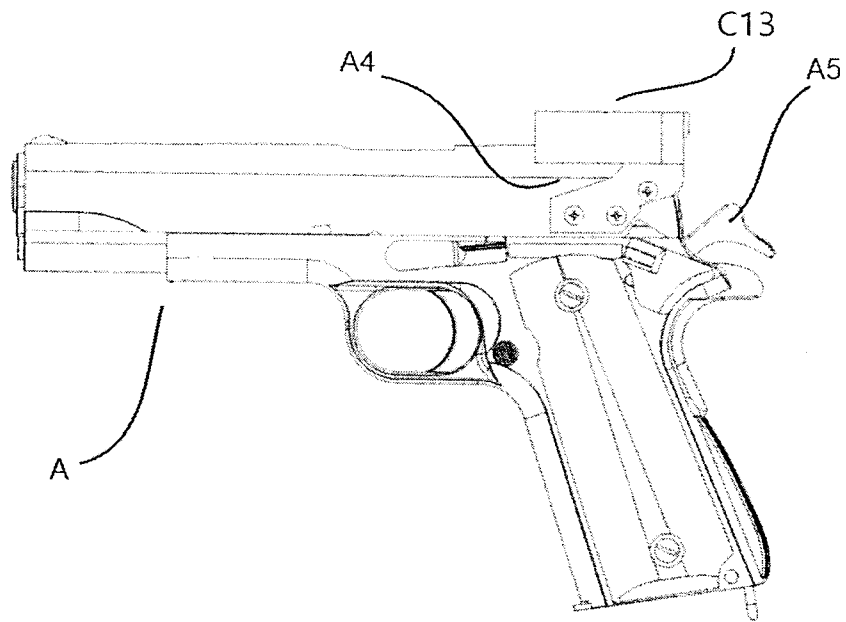


FIG 13.1

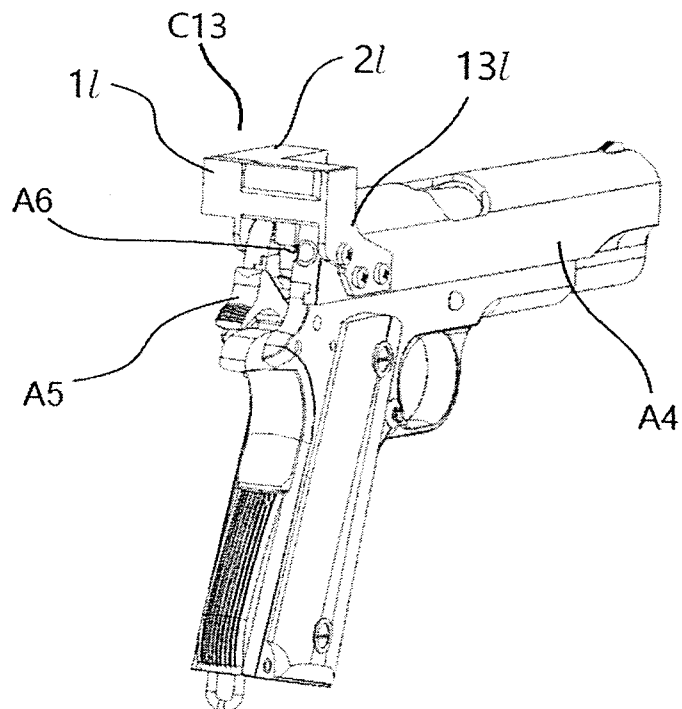


FIG 13.2

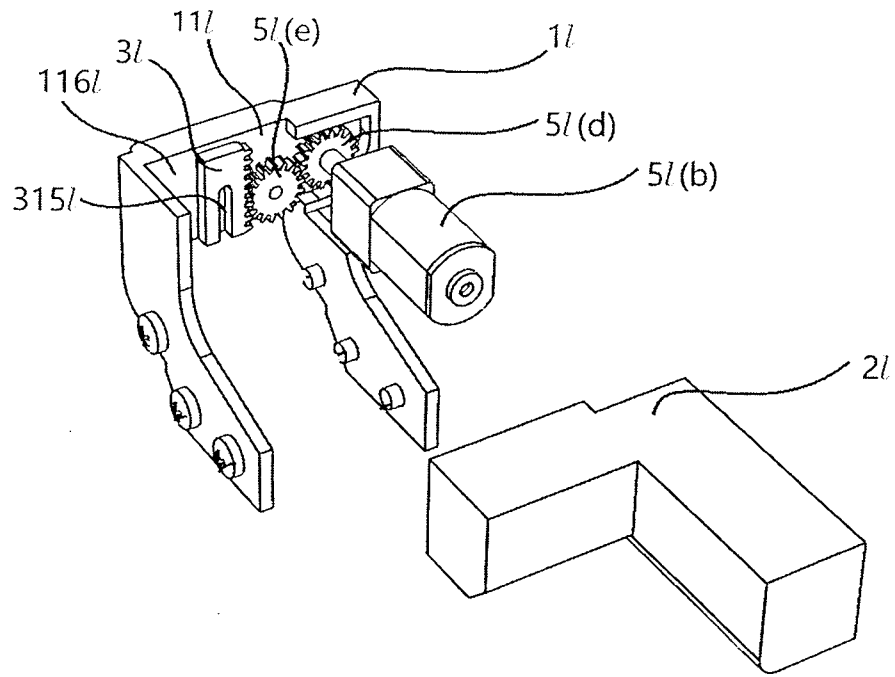


FIG 13.31

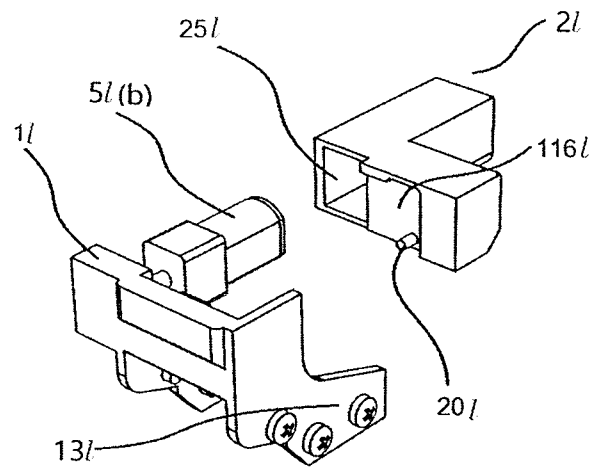


FIG 13.32

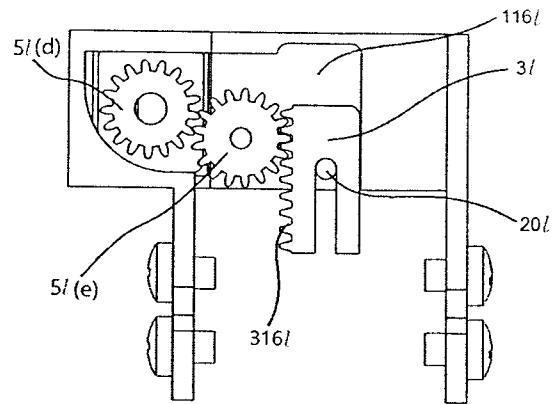


FIG 13.41

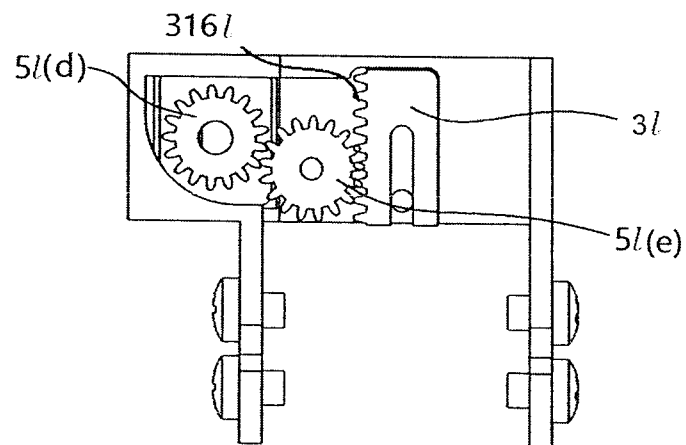


FIG 13.42

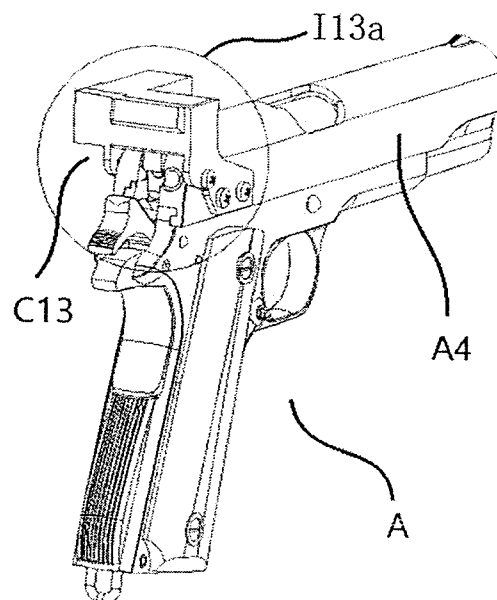


FIG 13.51

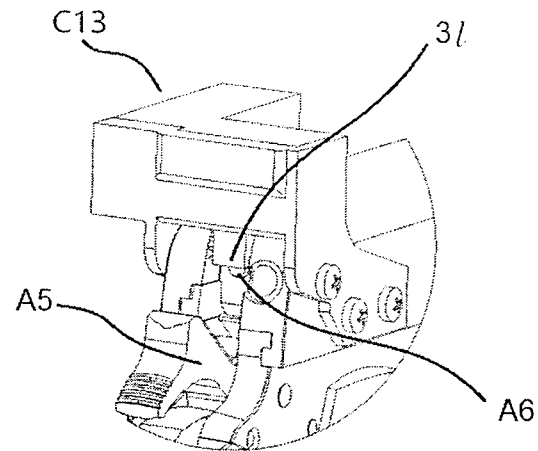


FIG 13.52

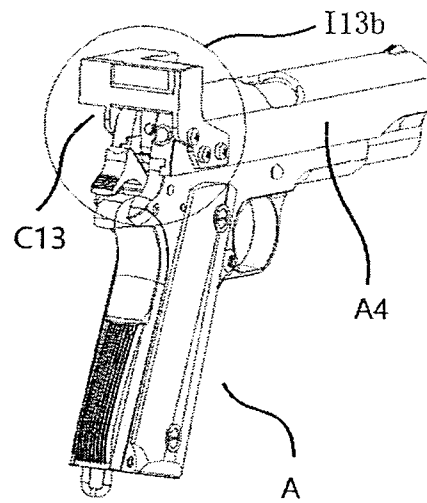


FIG 13.61

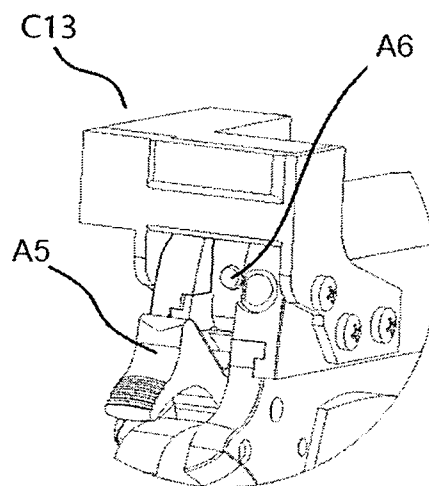


FIG 13.62

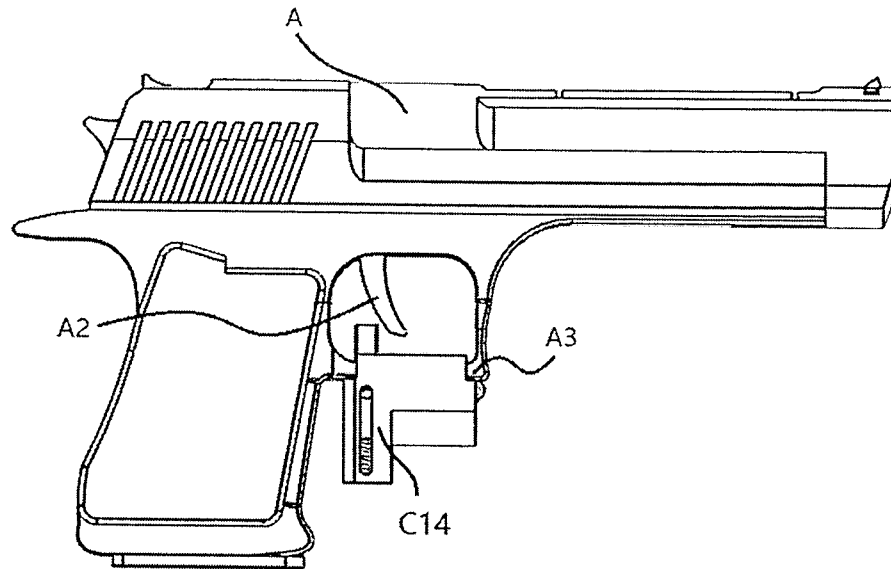


FIG 14.1

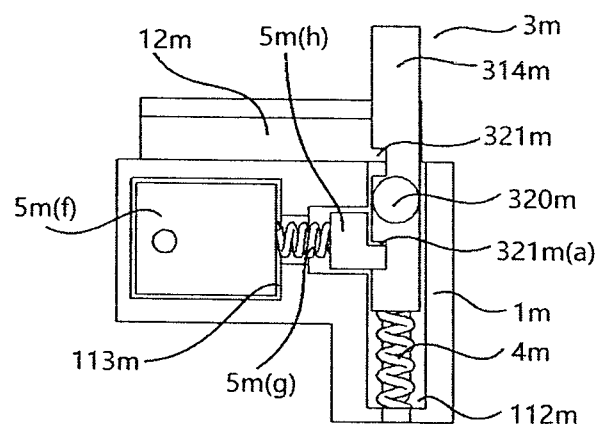


FIG 14.21

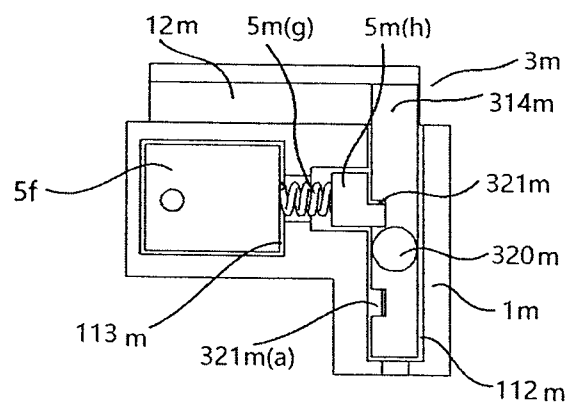


FIG 14.22

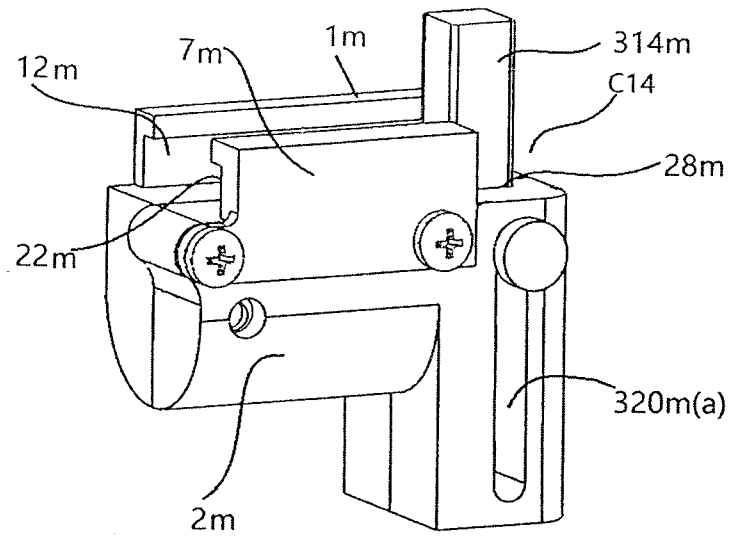


FIG 14.3

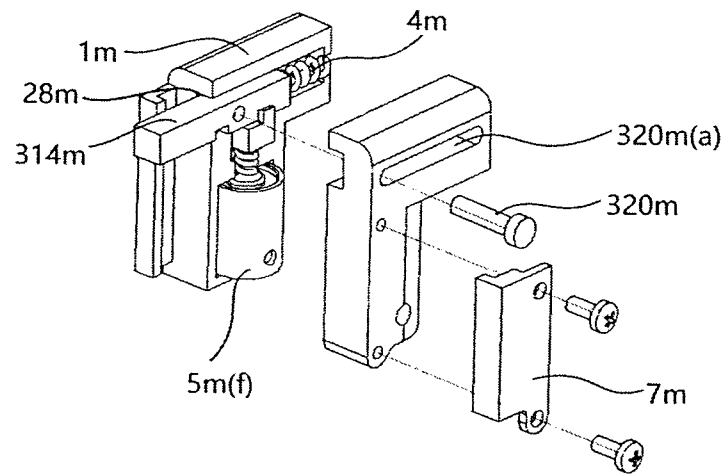


FIG 14.4

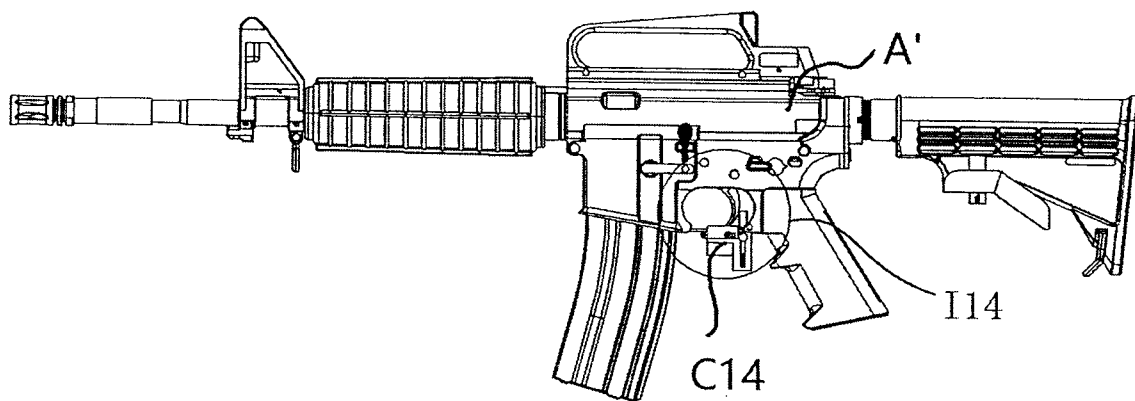


FIG 14.51

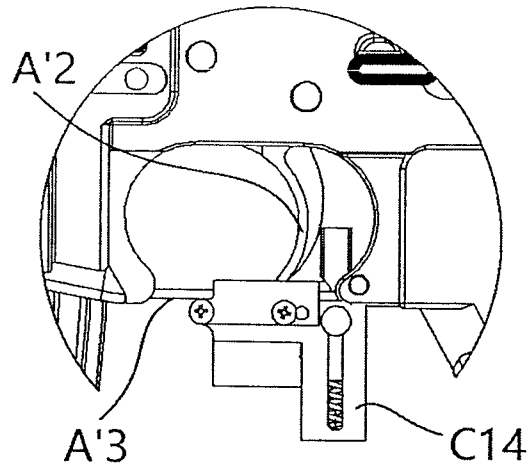


FIG 14.52

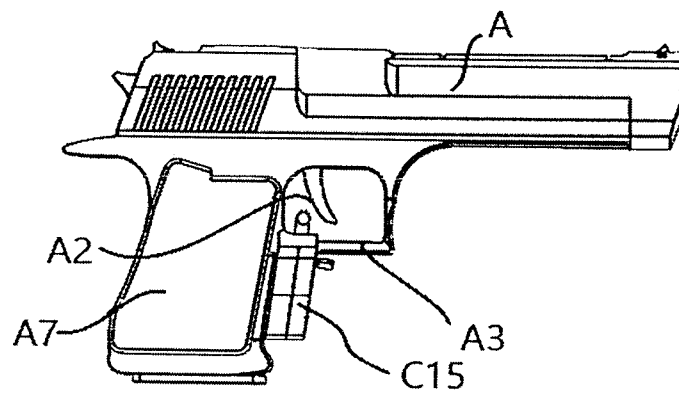


FIG 15.1

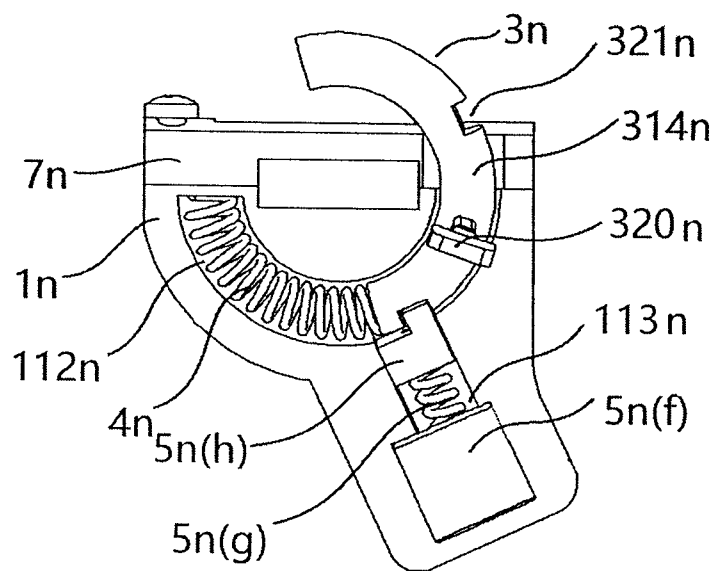


FIG 15.21

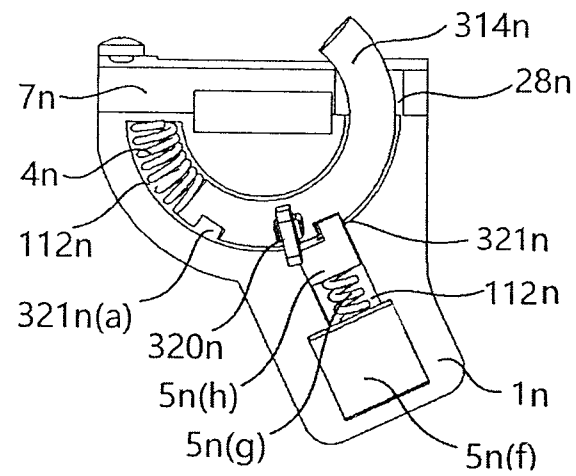


FIG 15.22

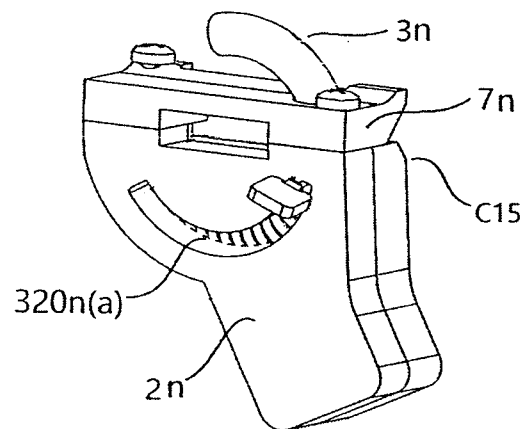


FIG 15.3

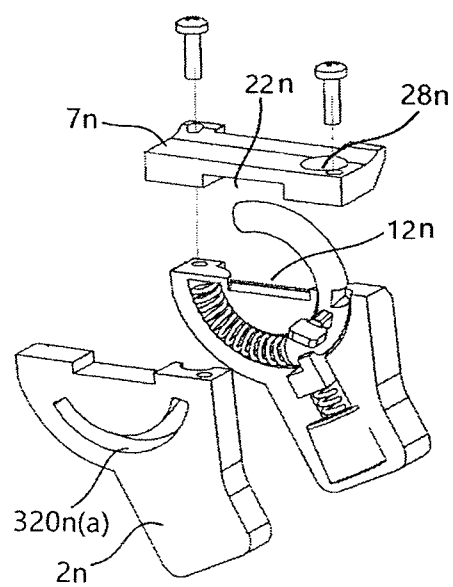


FIG 15.4

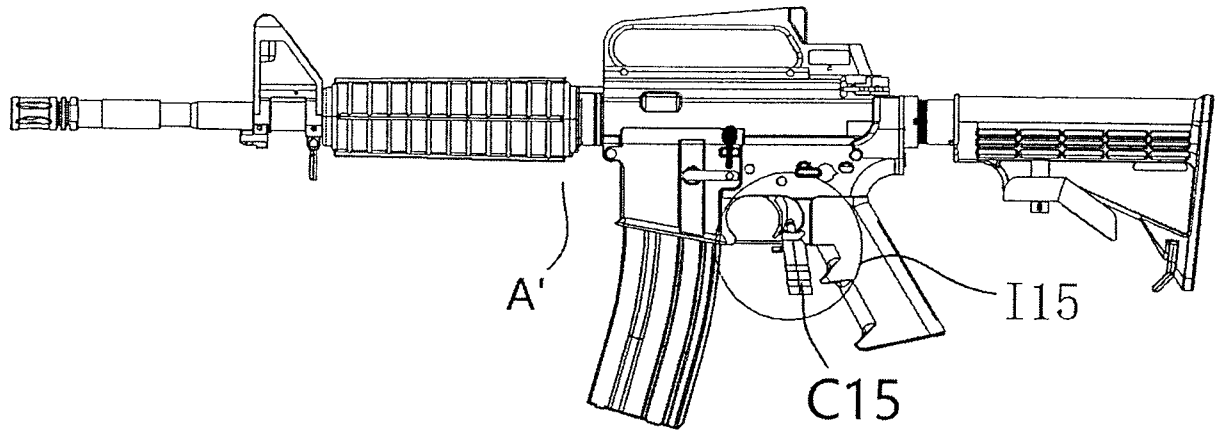


FIG 15.51

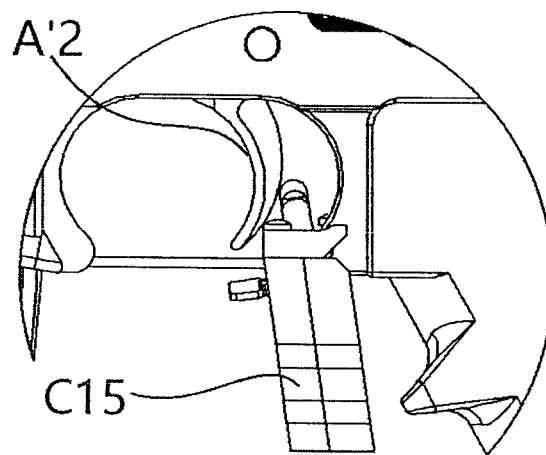


FIG 15.52

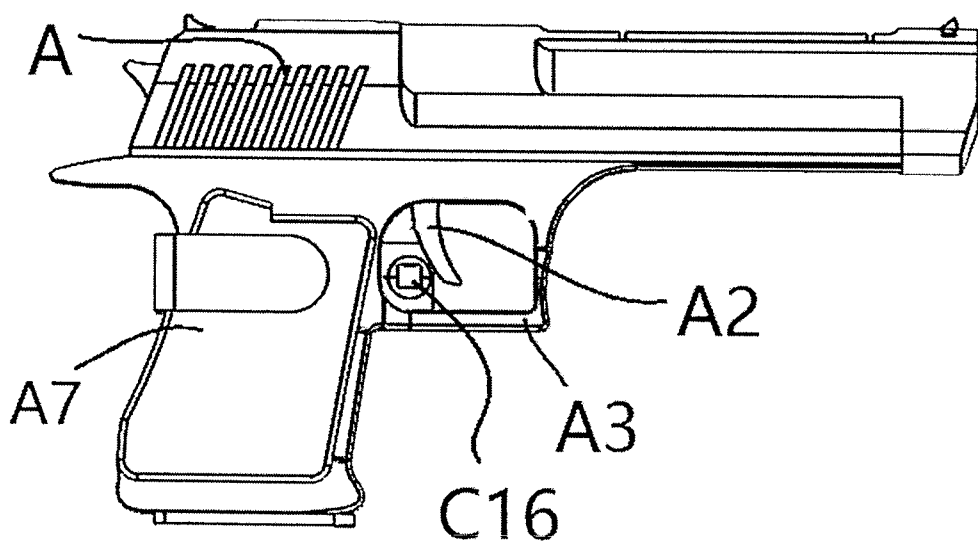


FIG 16.1

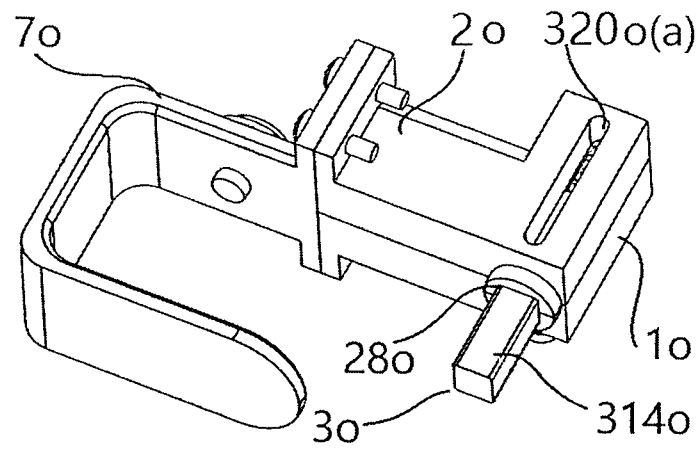


FIG 16.2

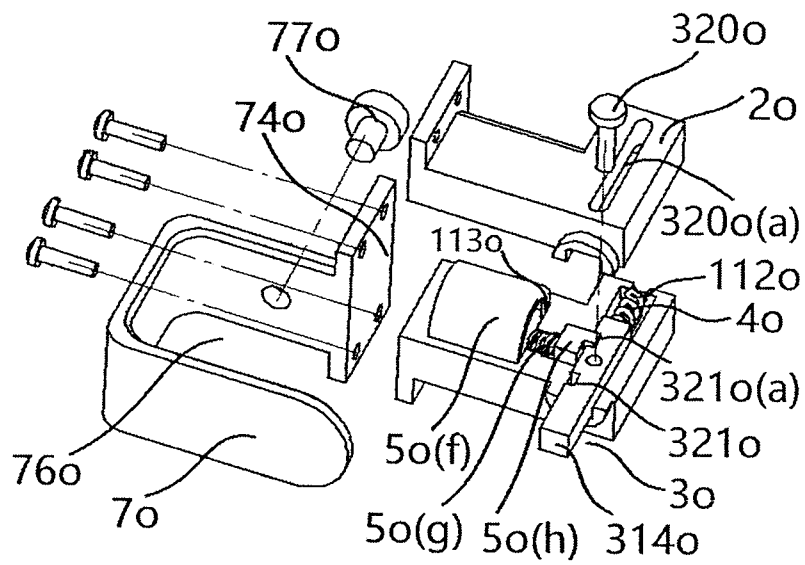


FIG 16.3

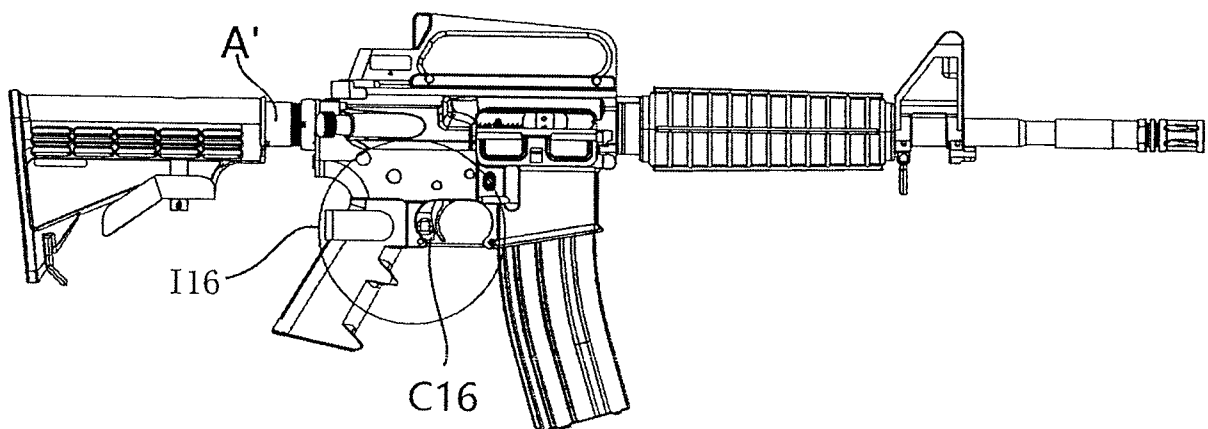


FIG 16.41

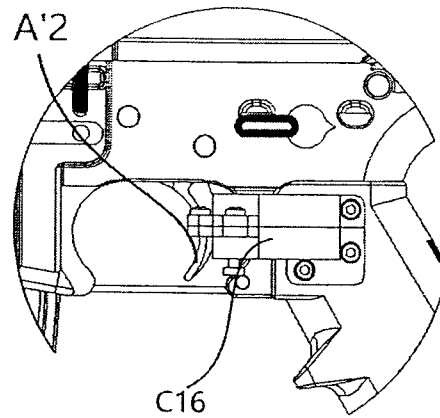


FIG 16.42

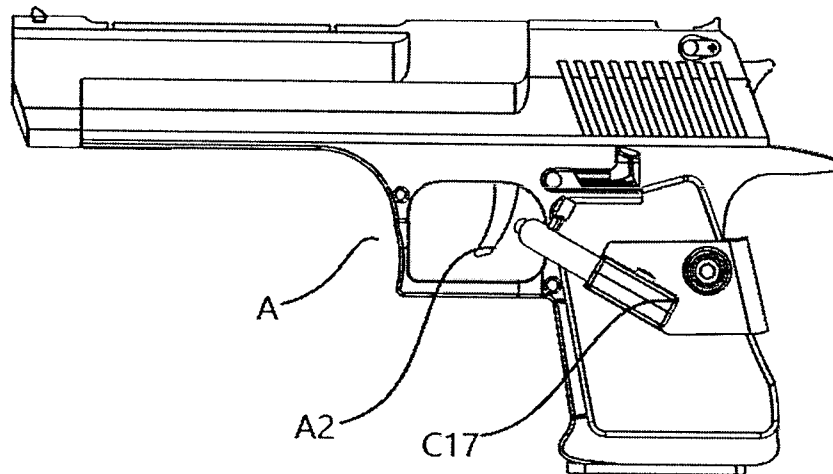


FIG 17.1

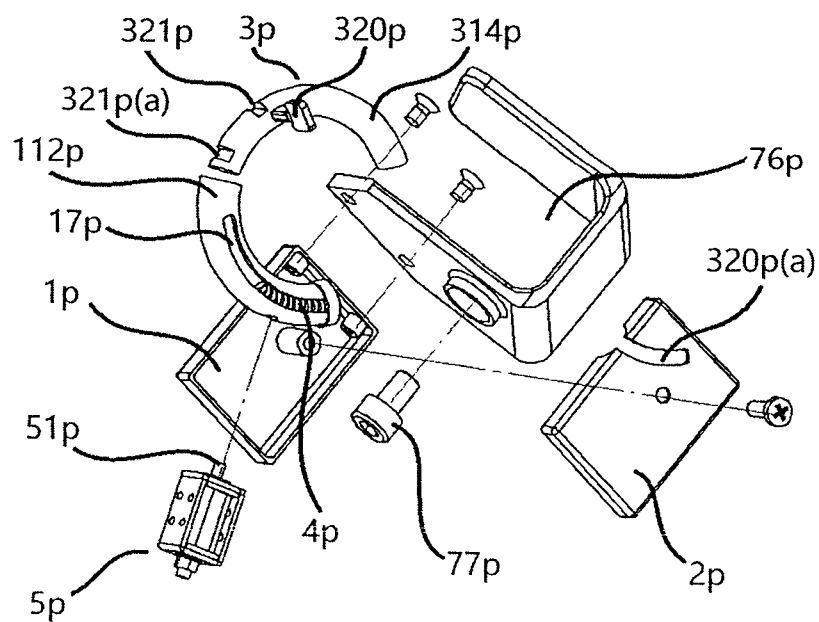


FIG 17.2

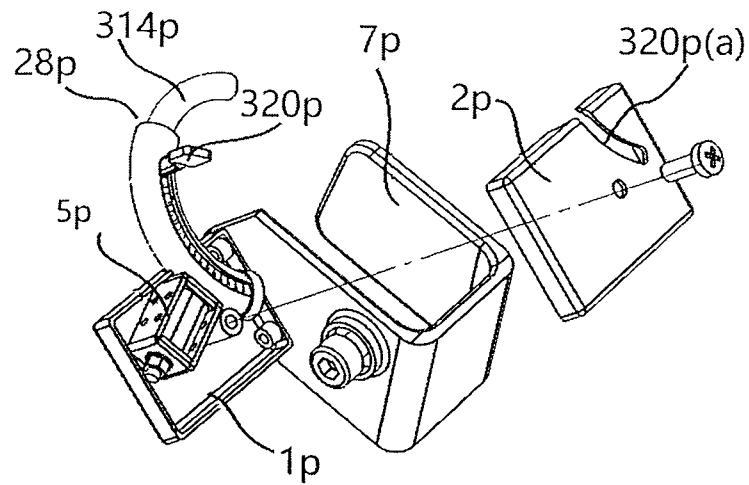


FIG 17.3

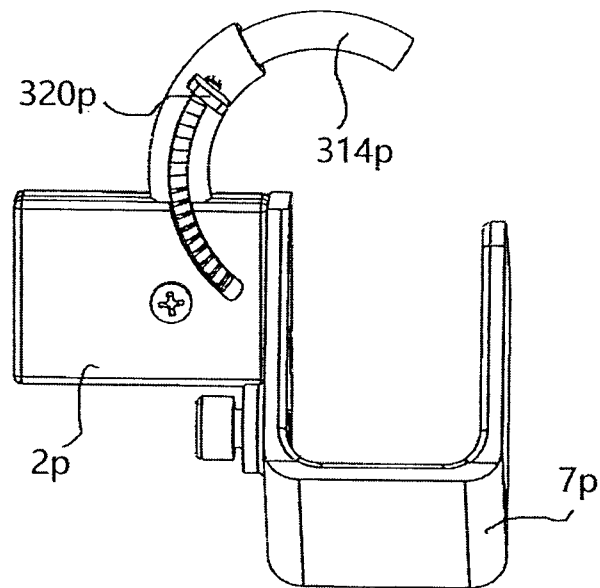


FIG 17.4

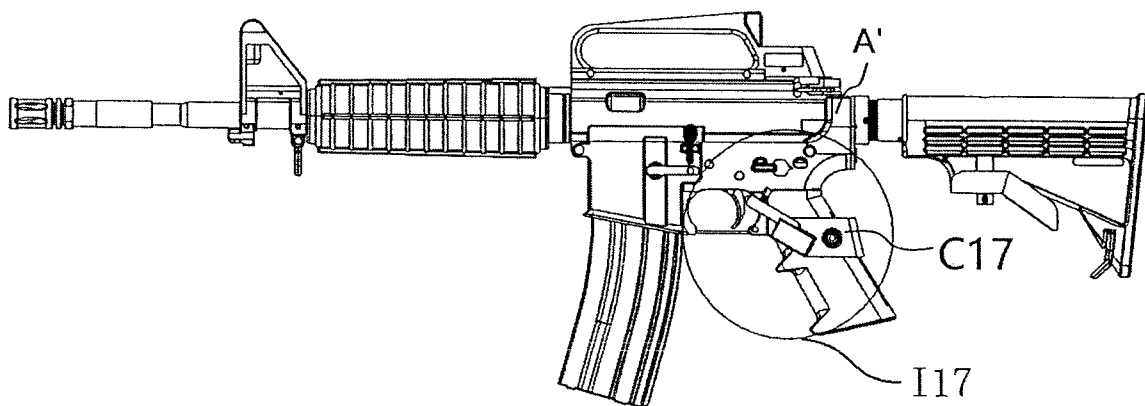


FIG 17.51

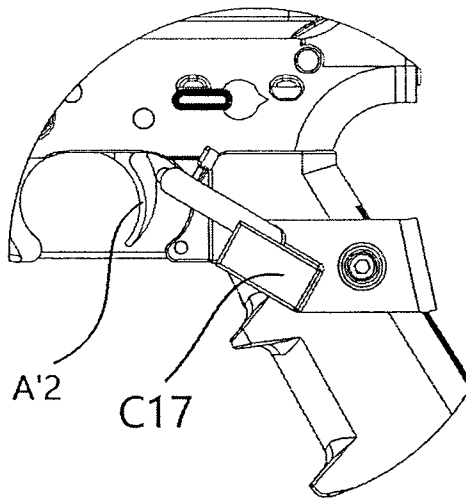


FIG 17.52

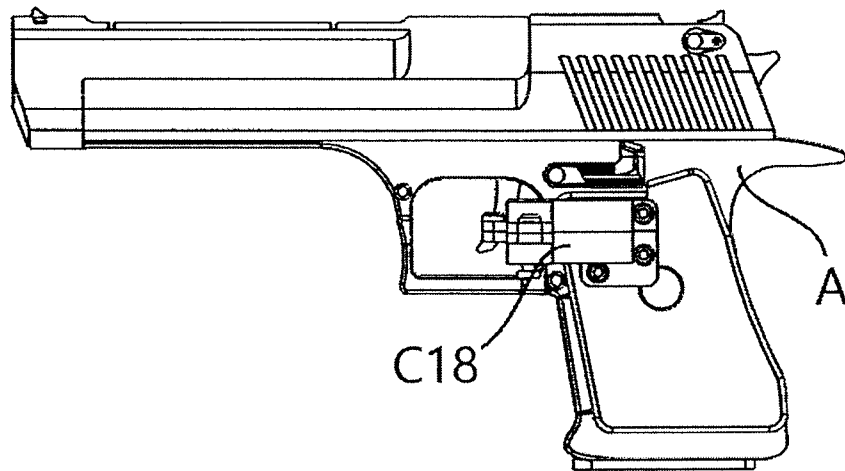


FIG 18.1

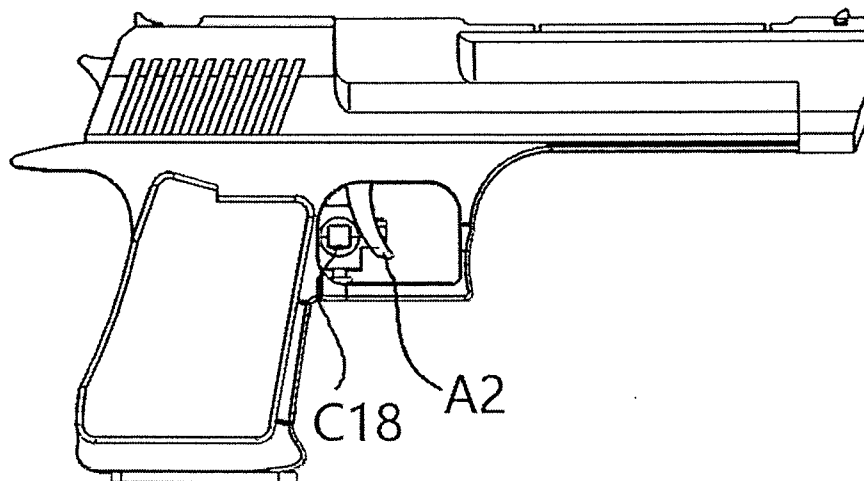


FIG 18.2

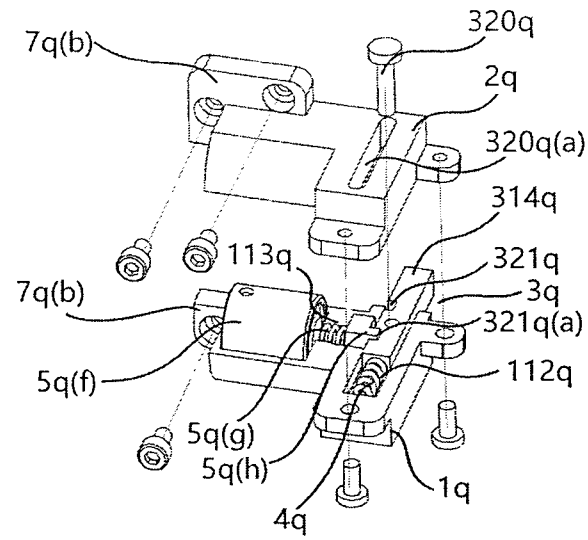


FIG 18.3

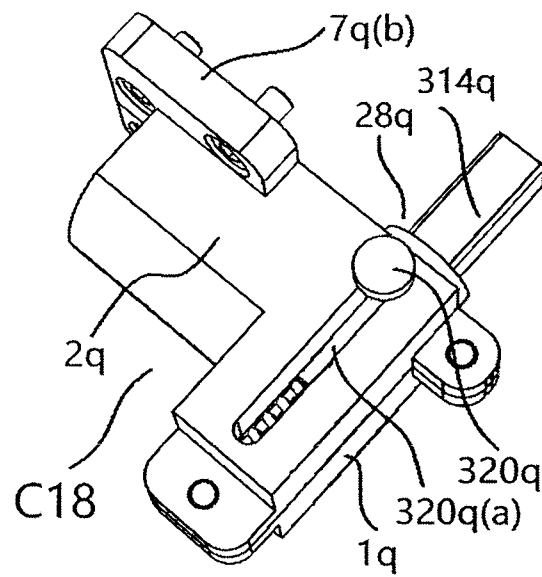


FIG 18.4

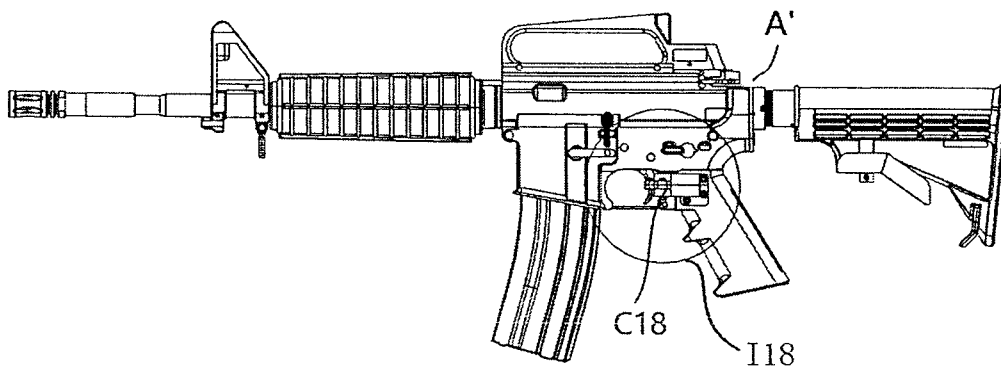


FIG 18.51

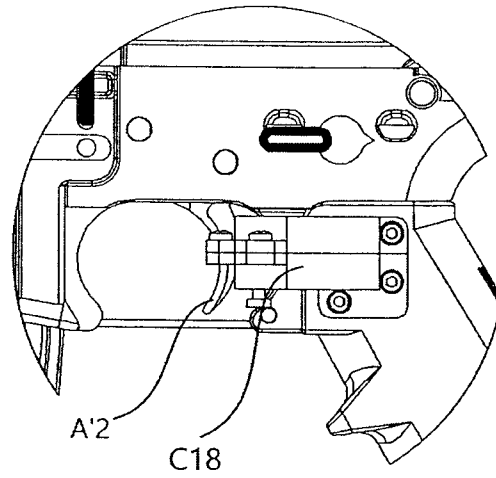


FIG 18.52

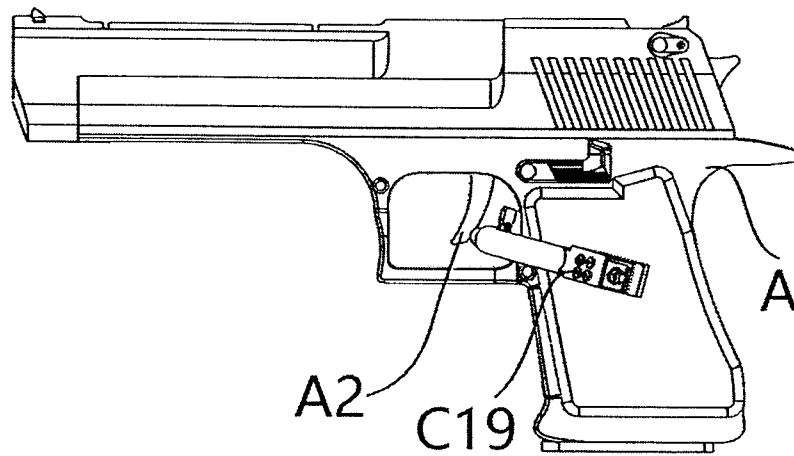


FIG 19.1

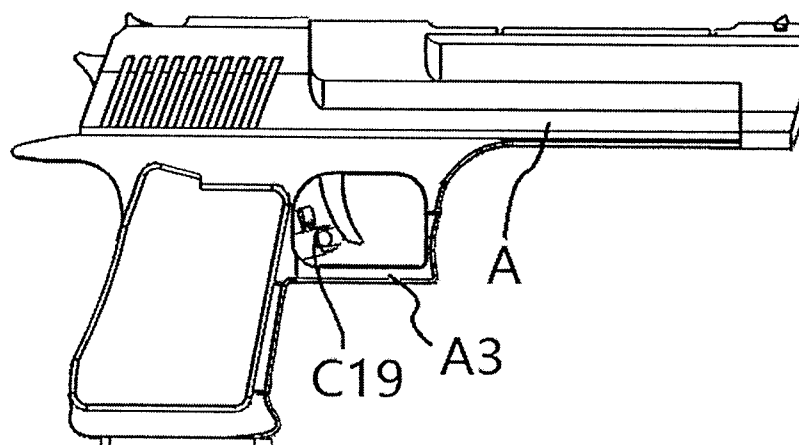


FIG 19.2

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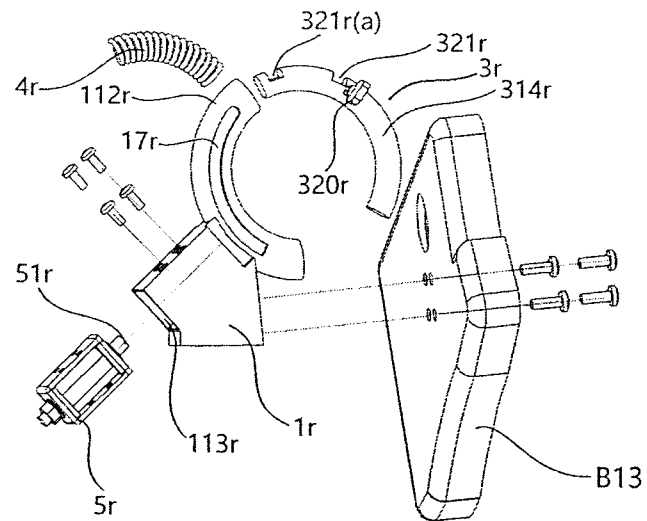


FIG 19.3

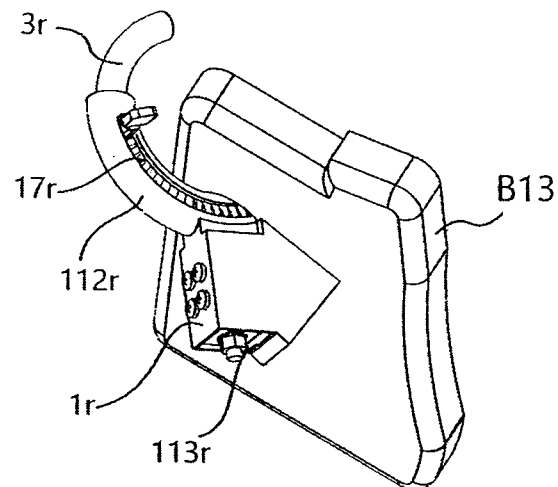


FIG 19.4

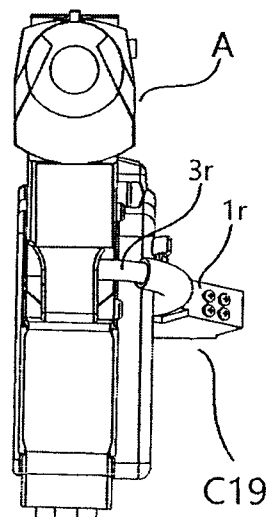


FIG 19.5

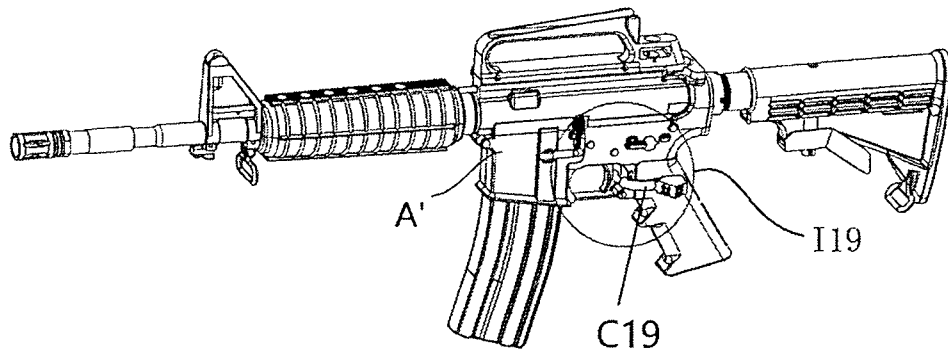


FIG 19.61

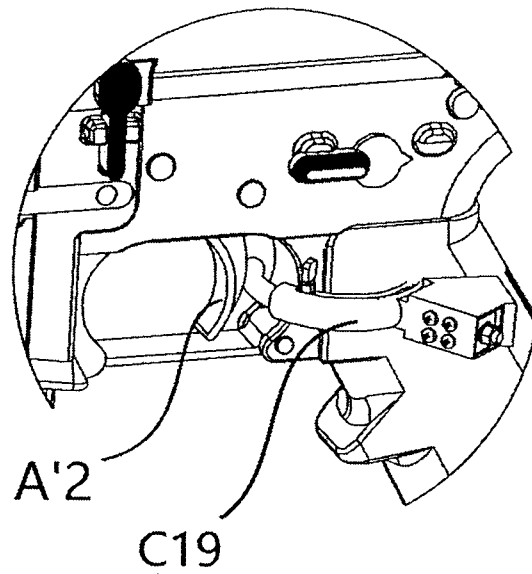


FIG 19.62

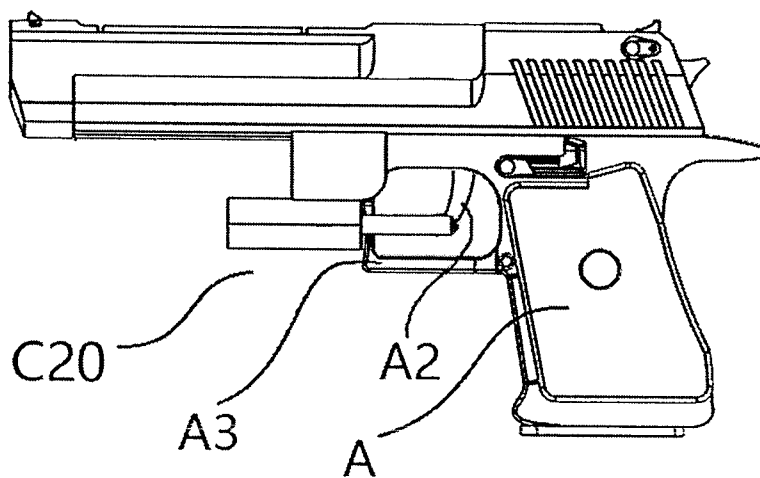


FIG 20.1

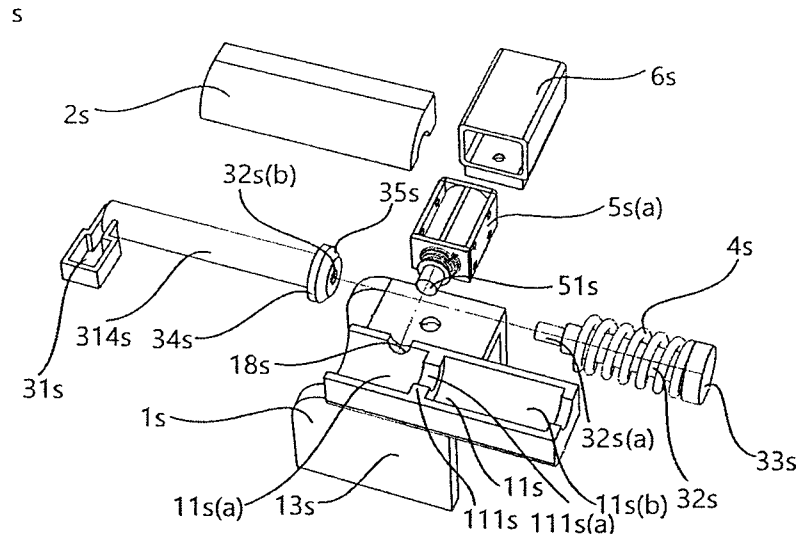


FIG 20.2

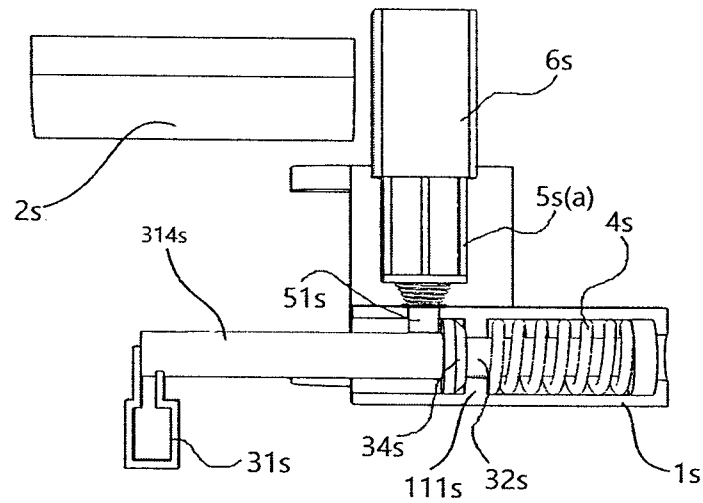


FIG 20.3

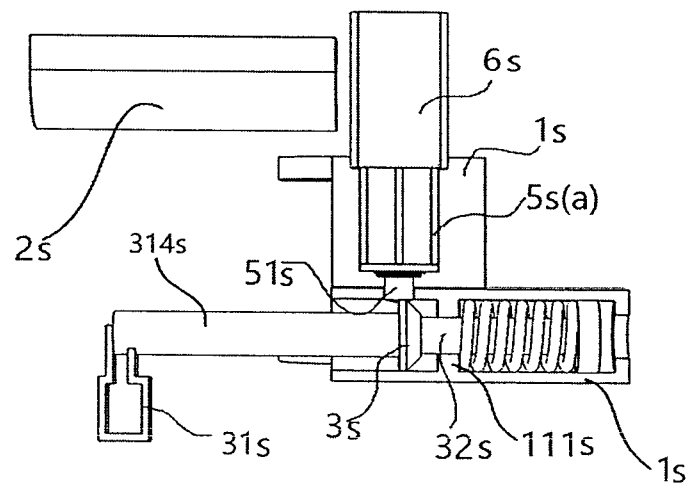


FIG 20.4

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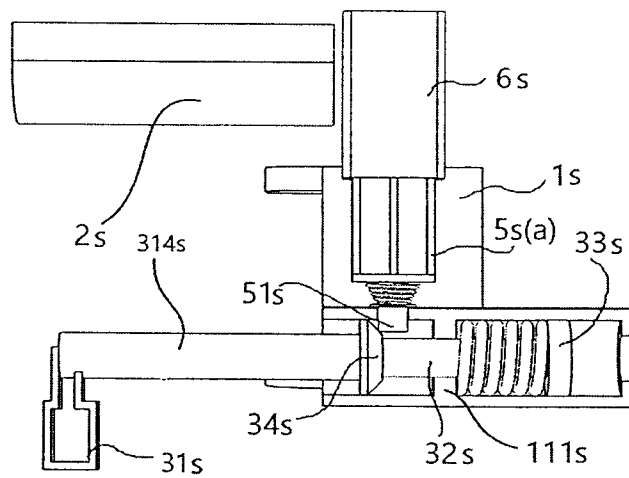


FIG 20.5

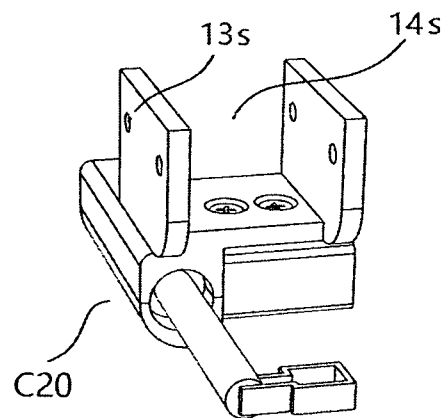


FIG 20.6

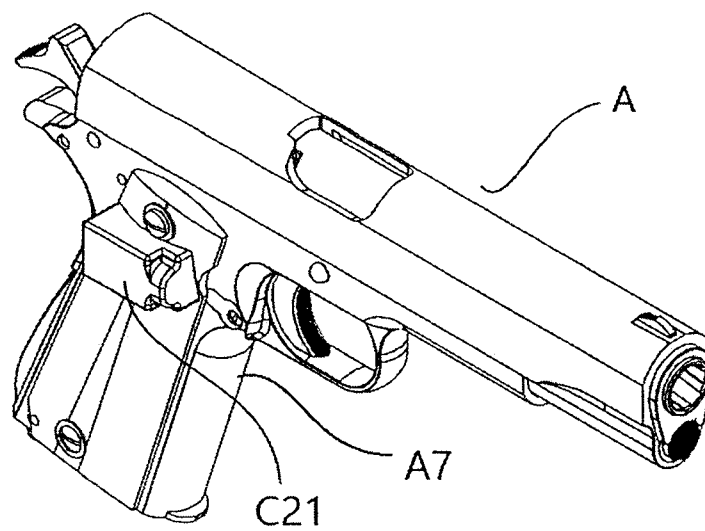


FIG 21.1

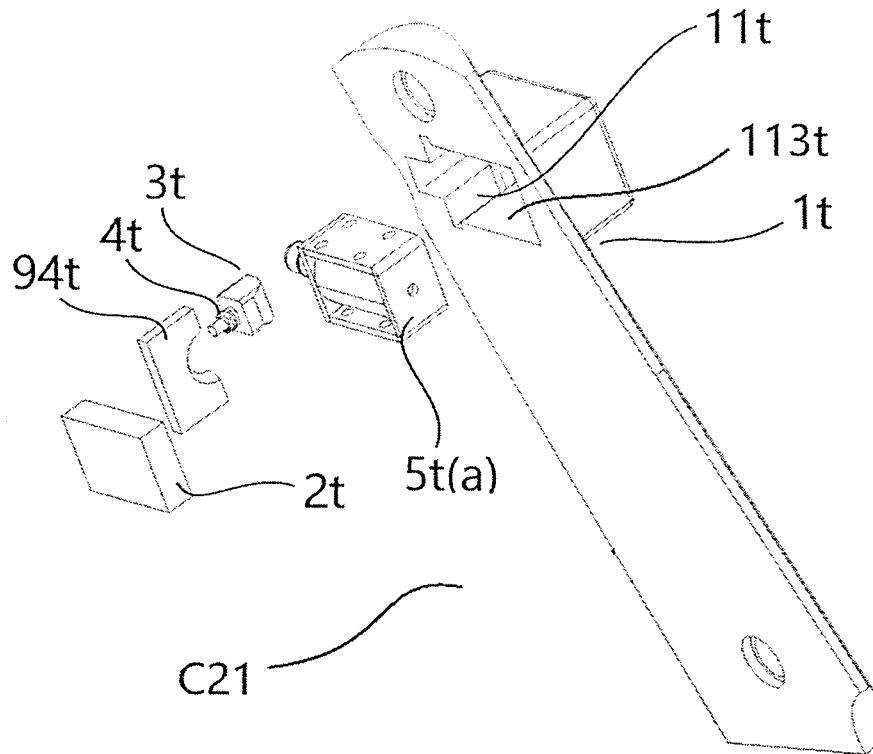


FIG 21.2

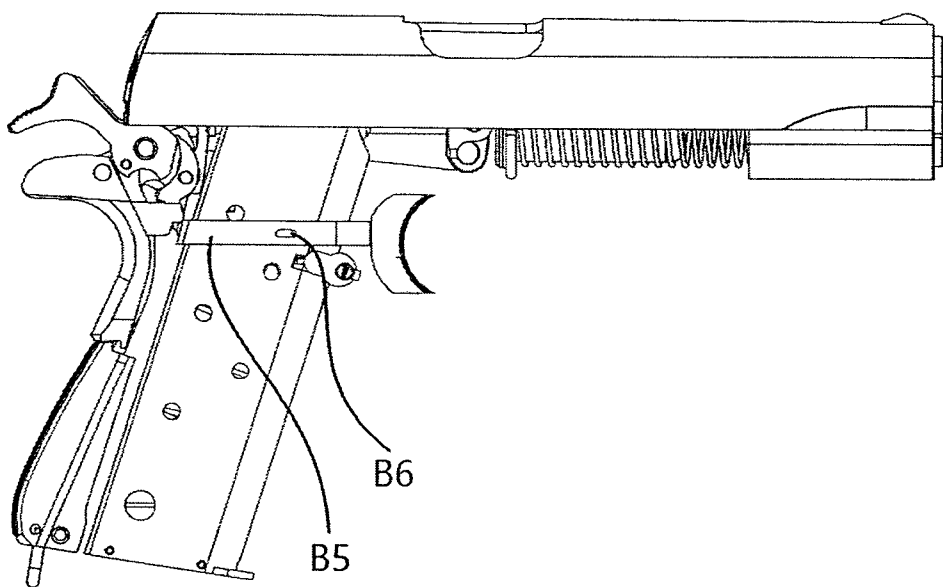


FIG 21.3

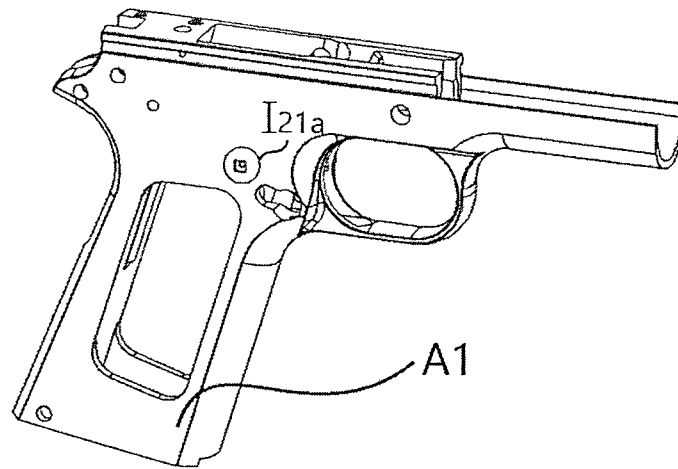


FIG 21.4

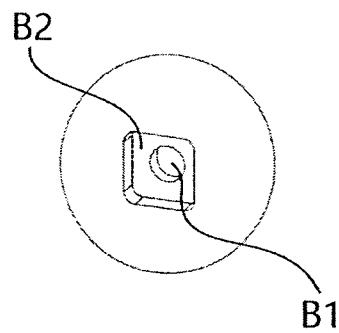


FIG 21.41

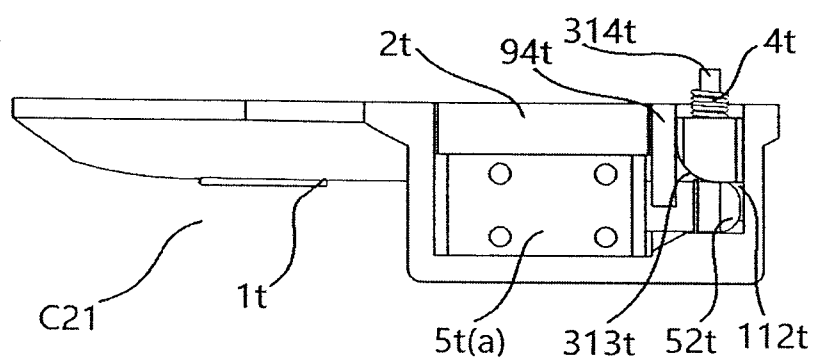


FIG 21.5

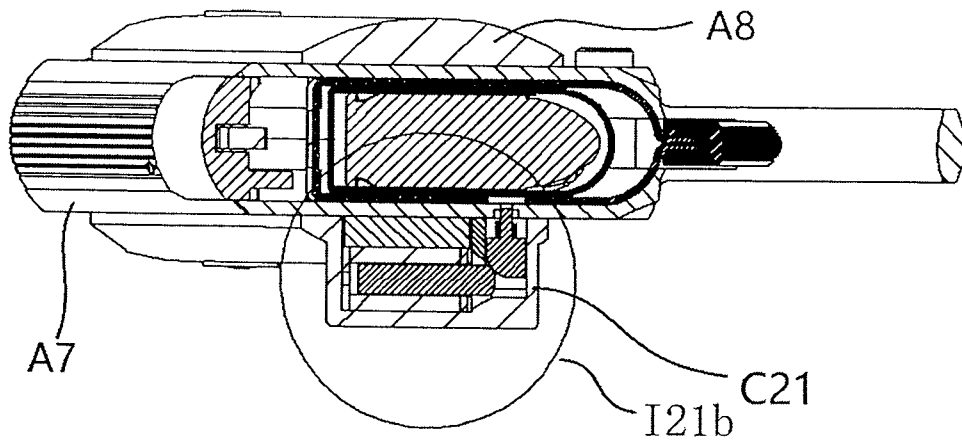


FIG 21.6

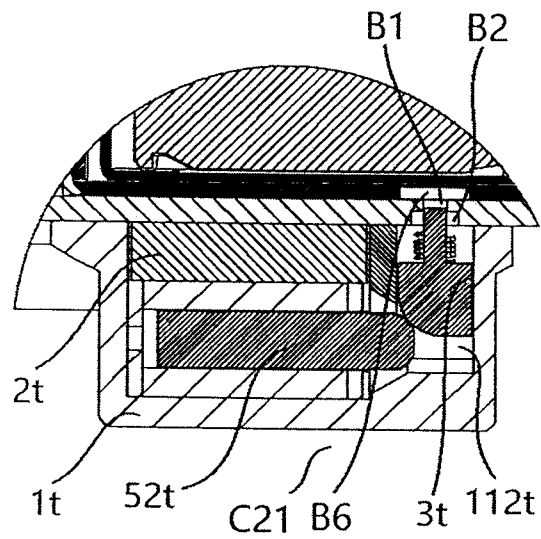


FIG 21.61

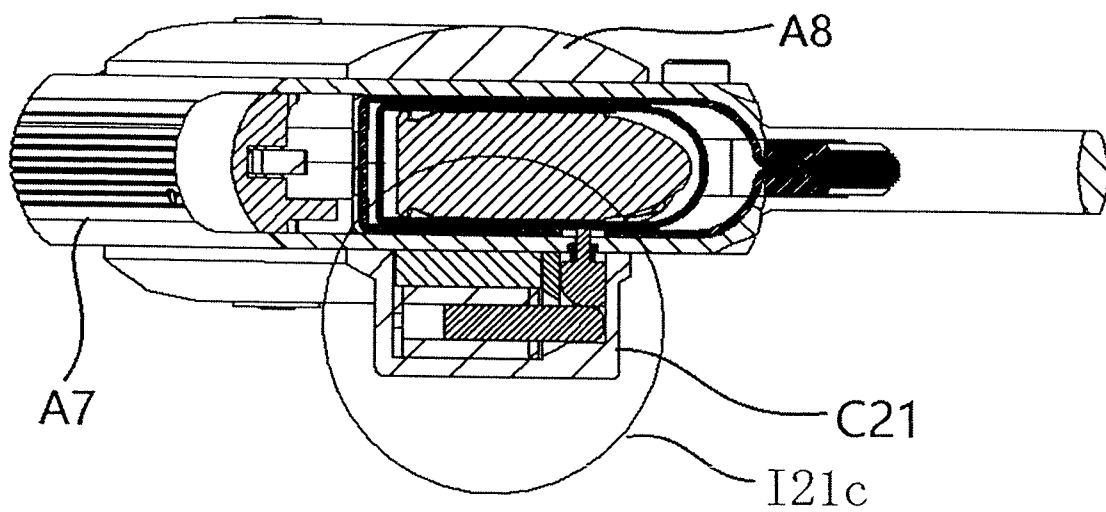


FIG 21.7

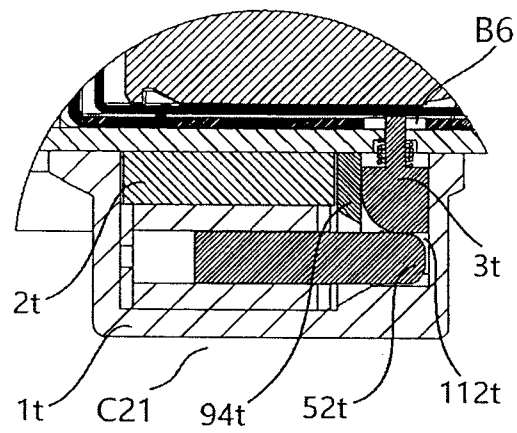


FIG 21.71

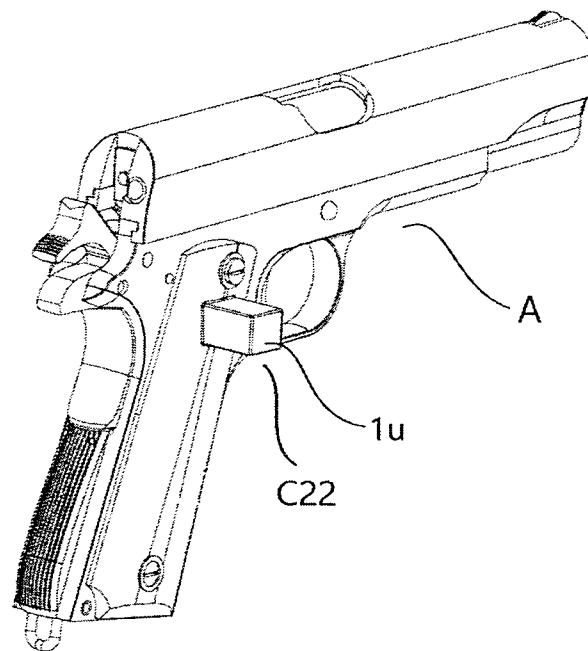


FIG 22.1

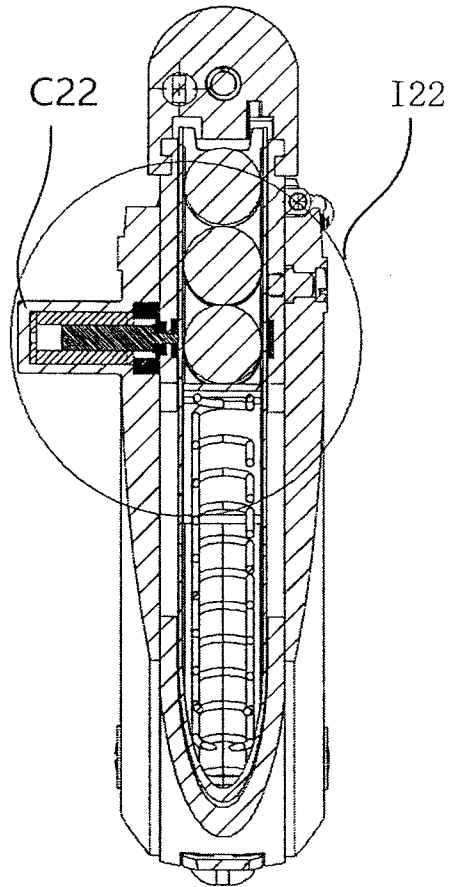


FIG 22.2

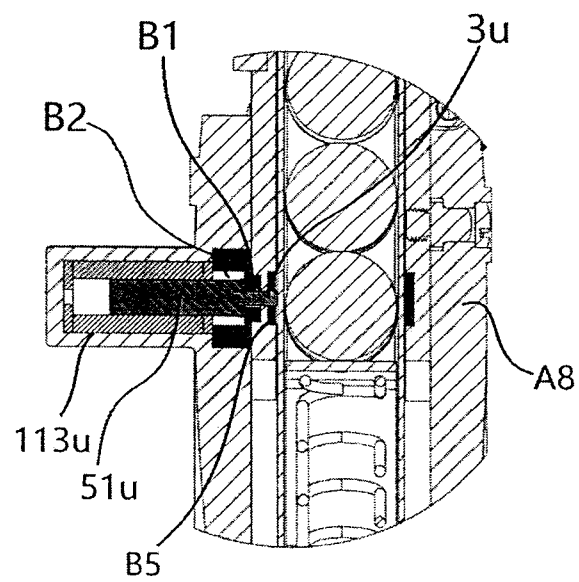


FIG 22.21

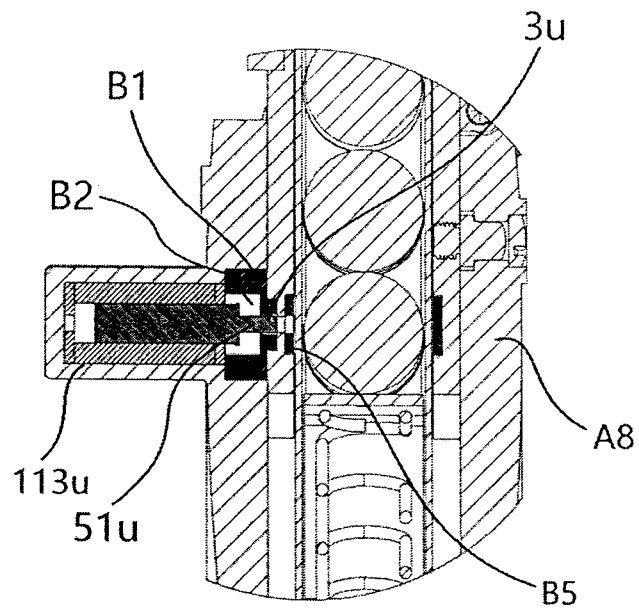


FIG 22.22

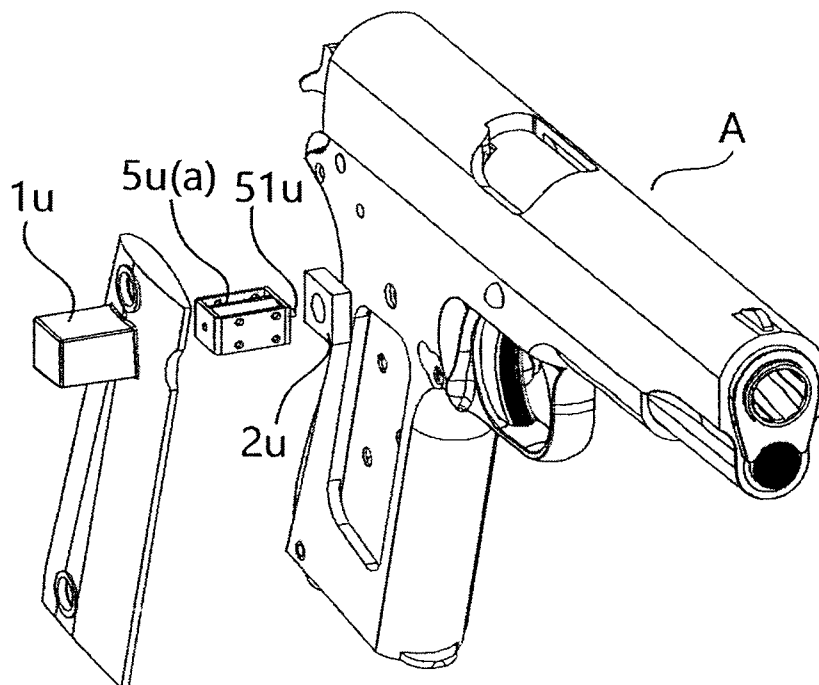


FIG 22.3

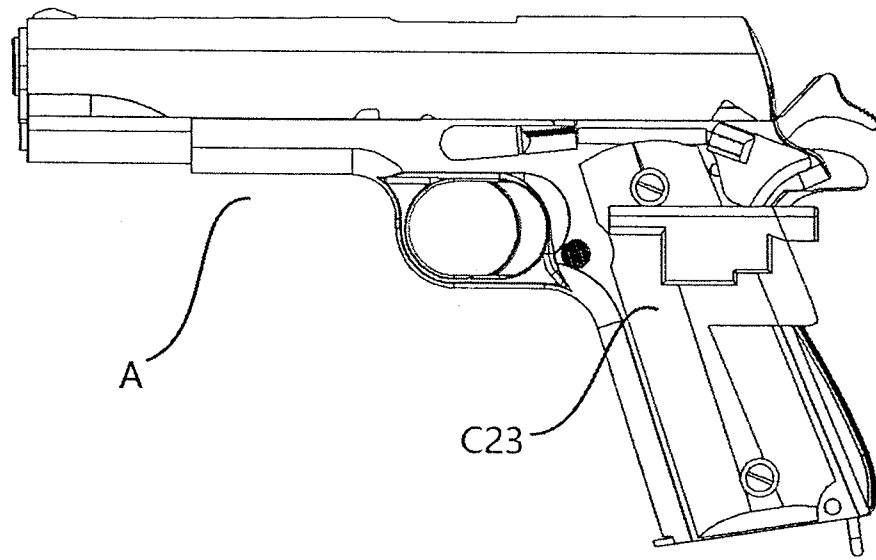


FIG 23.1

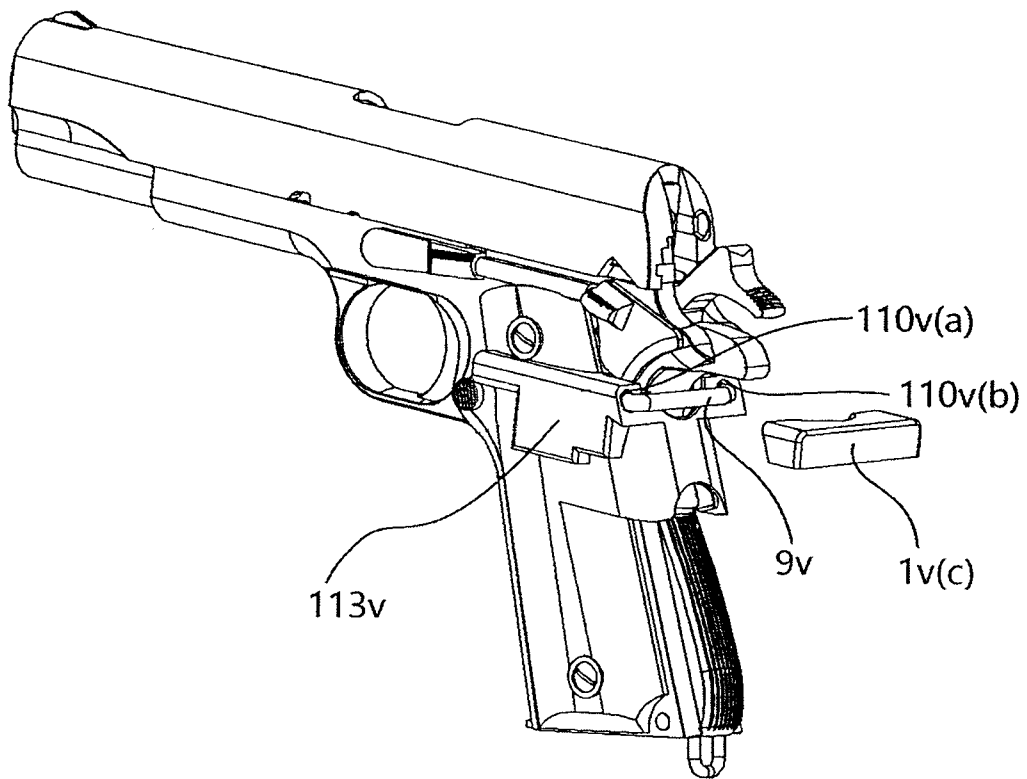


FIG 23.2

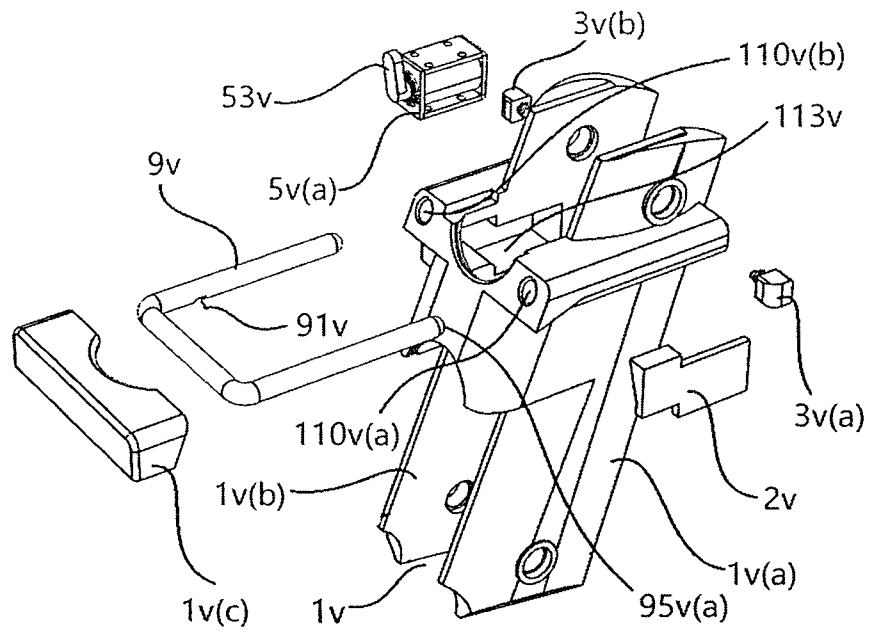


FIG 23.3

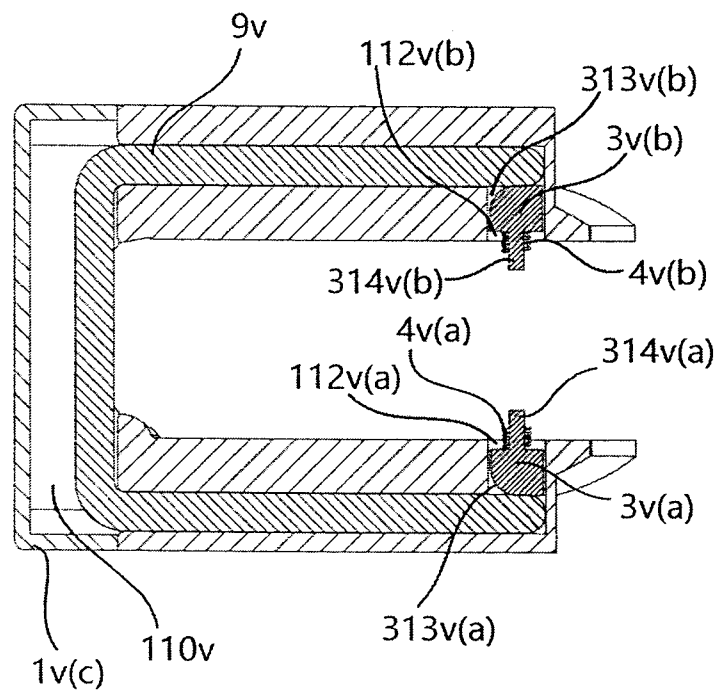


FIG 23.4

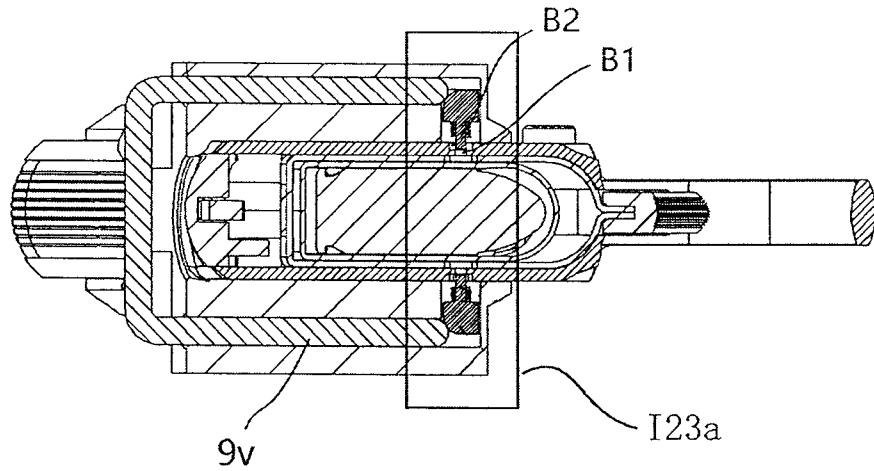


FIG 23.5

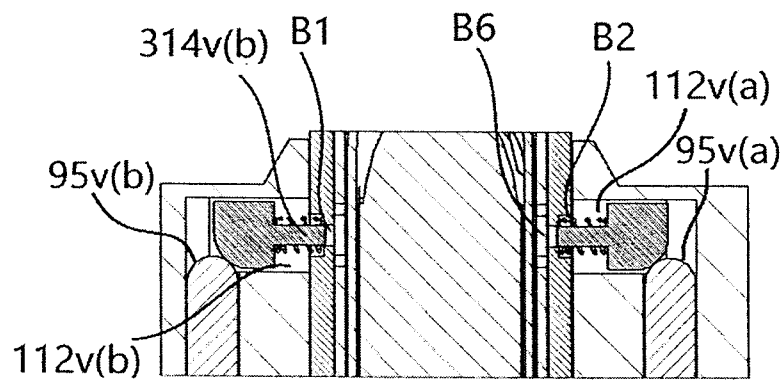


FIG 23.51

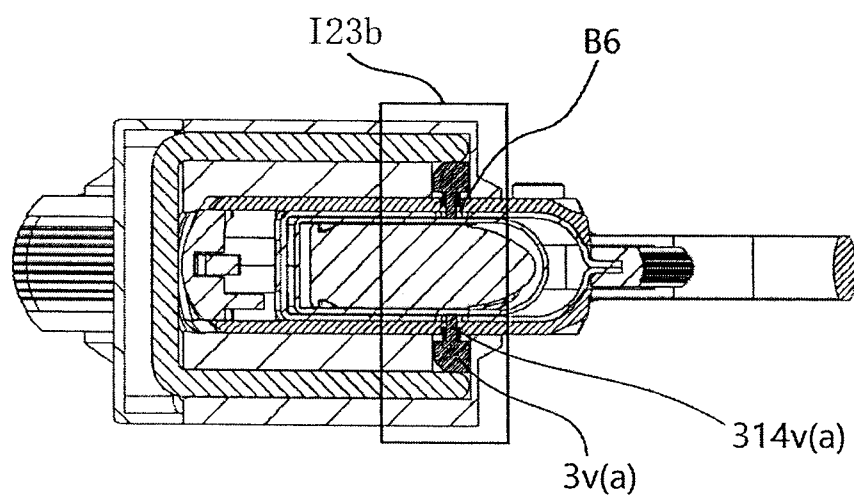


FIG 23.6

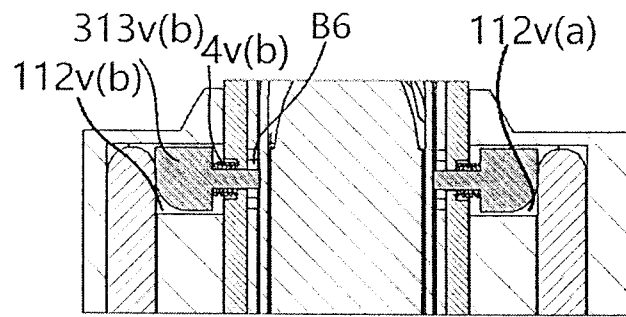


FIG 23.61

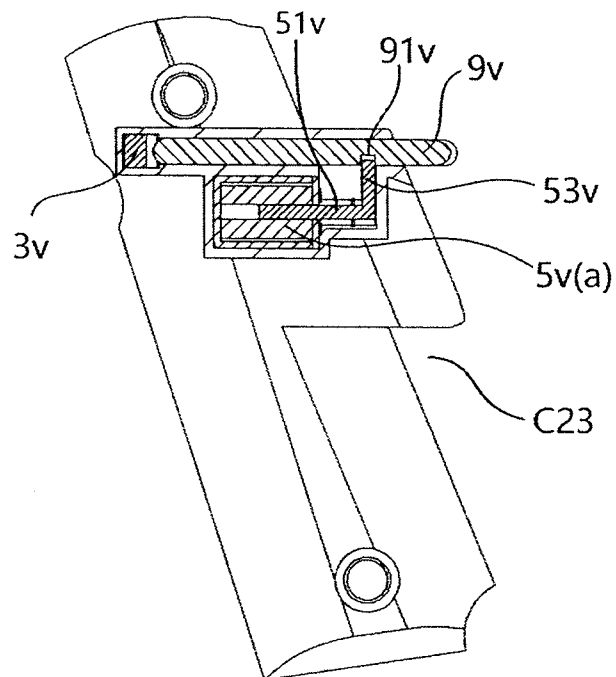


FIG 23.7

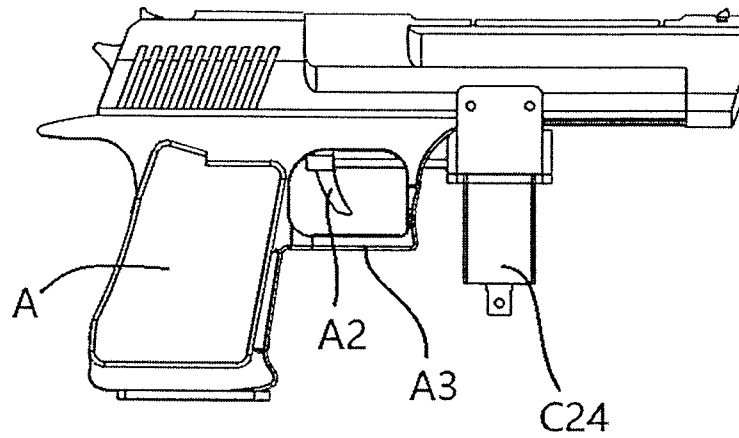


FIG 24.1

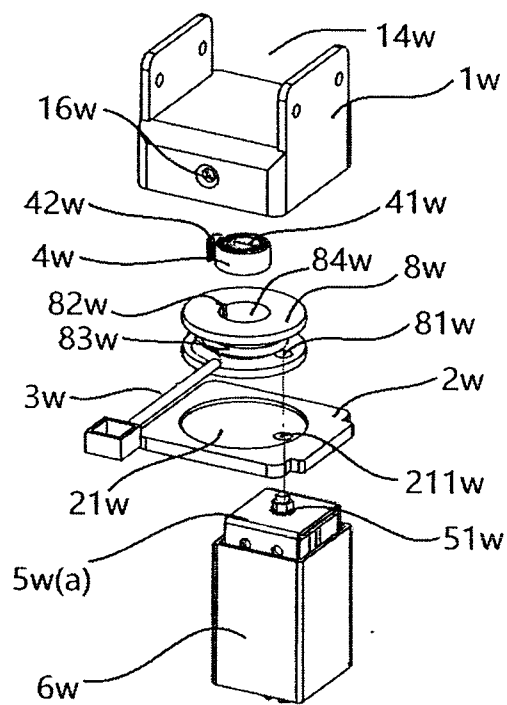


FIG 24.2

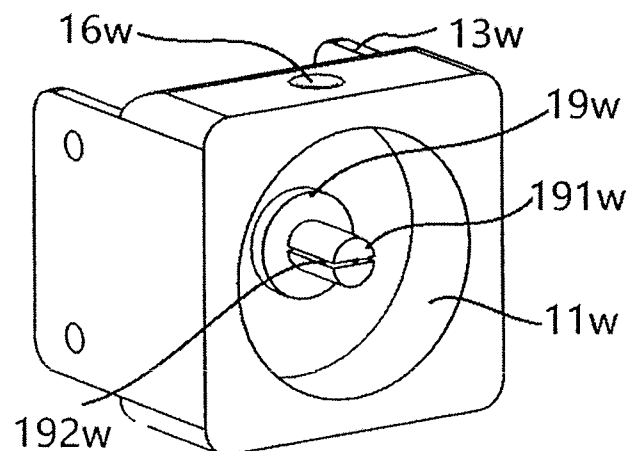


FIG 24.3

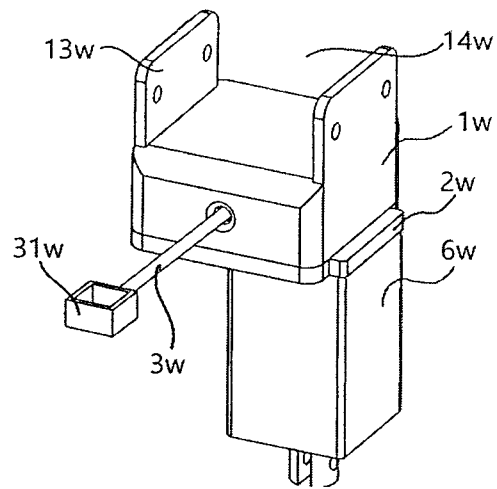


FIG 24.4

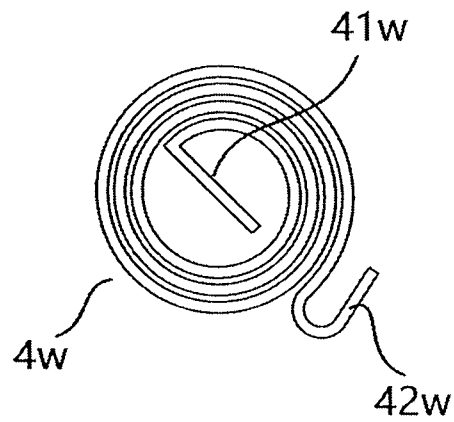


FIG 24.5

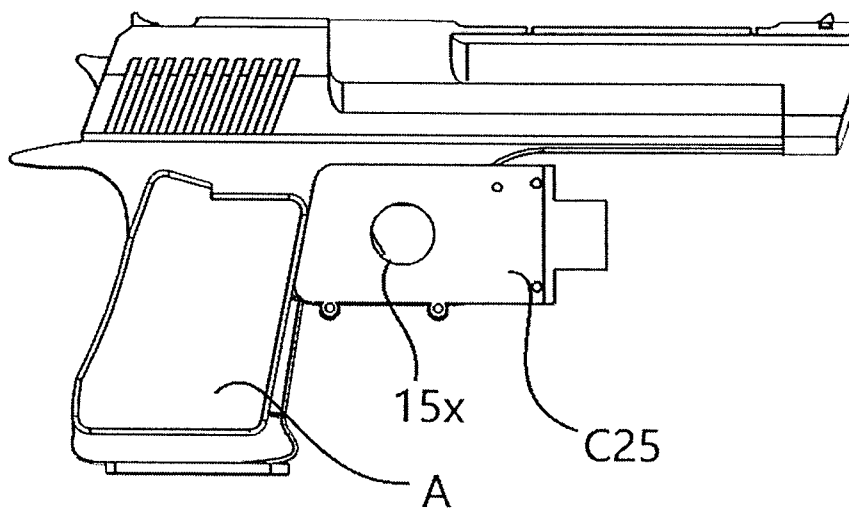


FIG 25.1

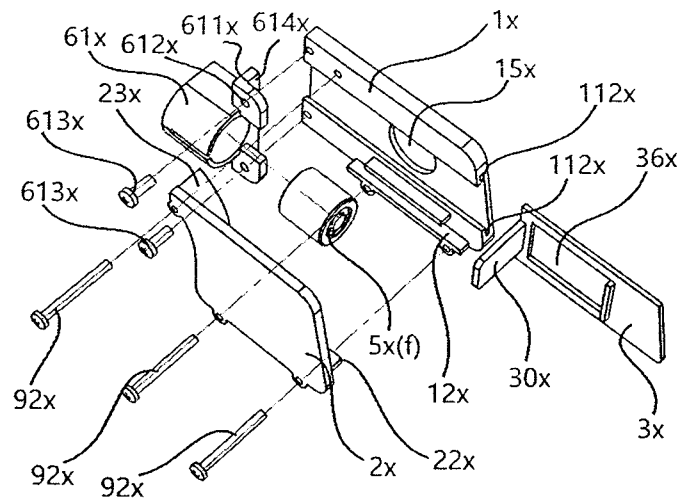


FIG 25.2

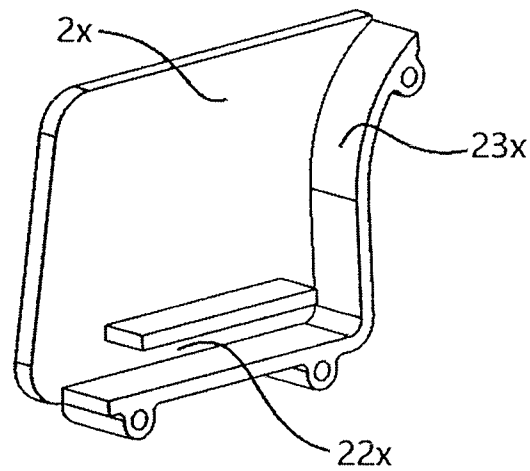


FIG 25.3

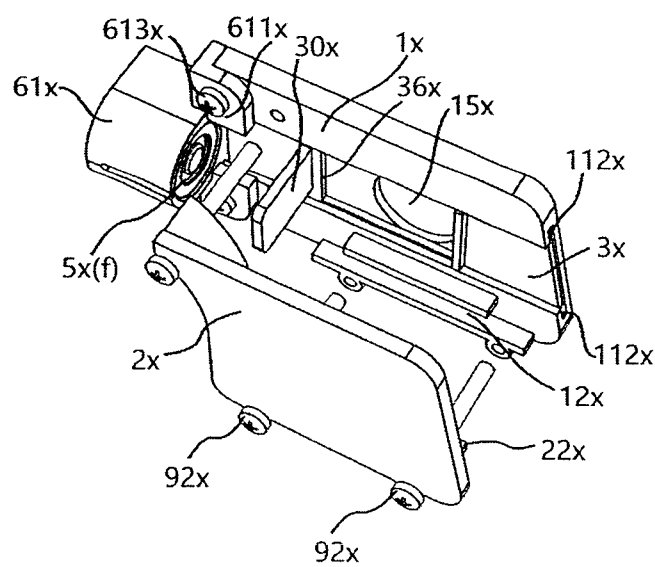


FIG 25.4

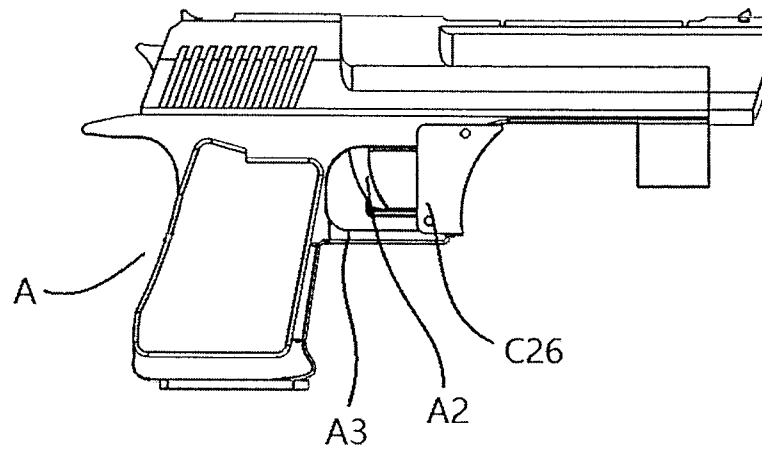


FIG 26.1

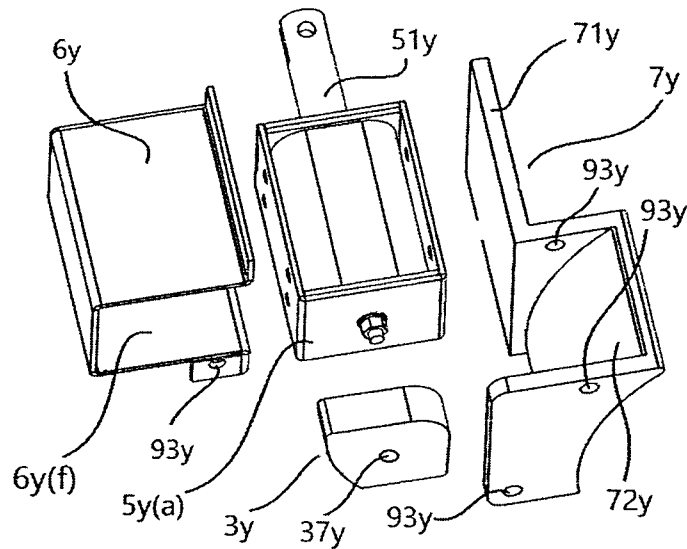


FIG 26.2

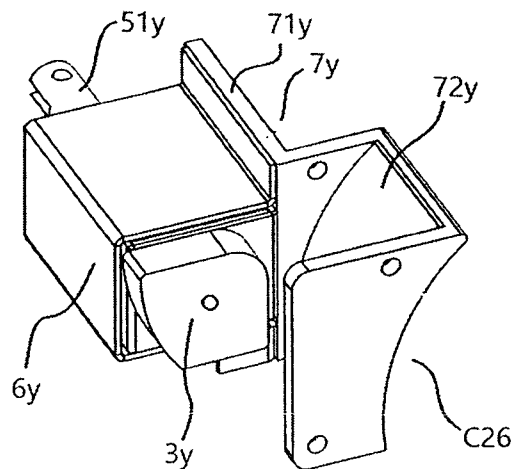


FIG 26.3

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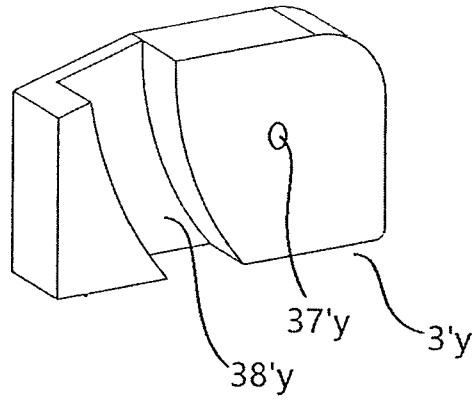


FIG 26.4

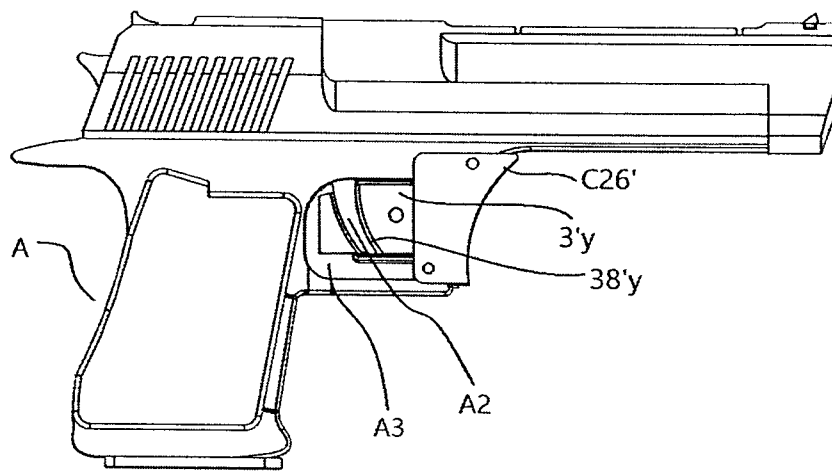


FIG 26.5

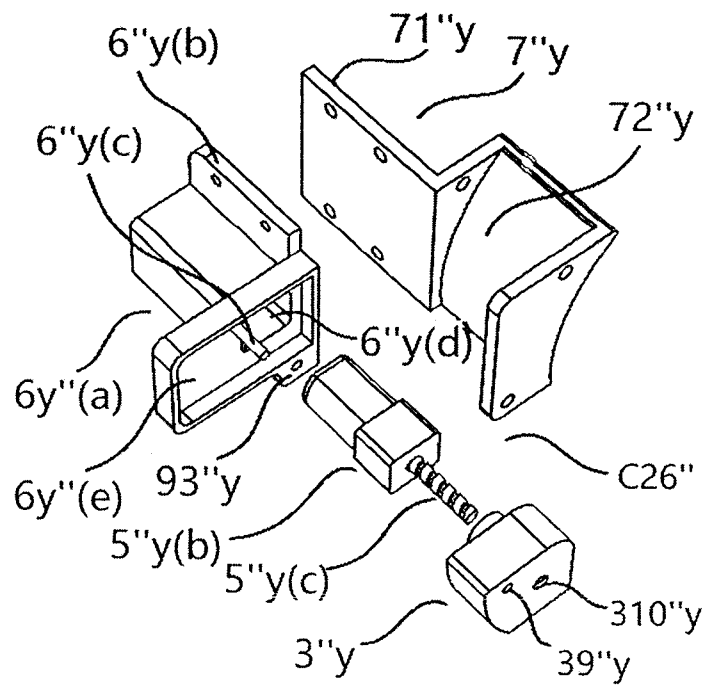


FIG 26.6

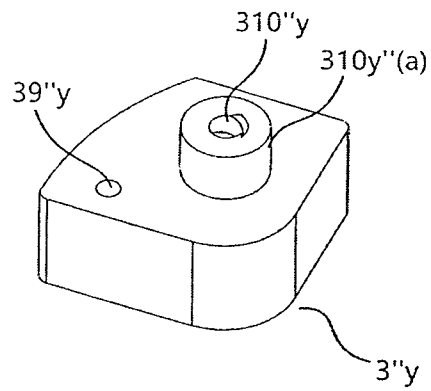


FIG 26.7

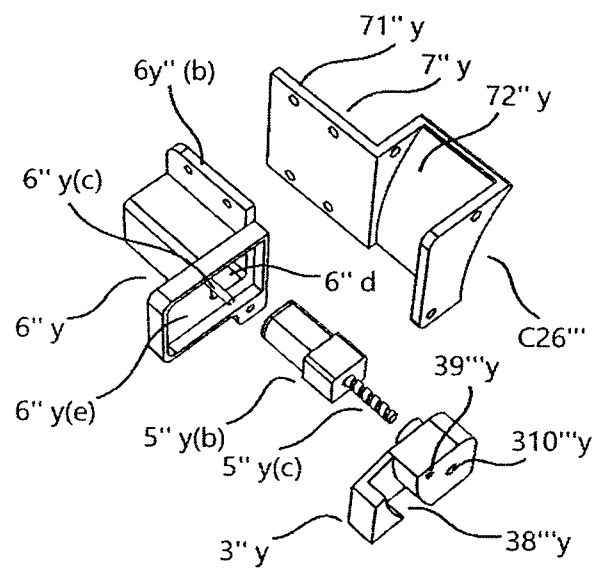


FIG 26.8

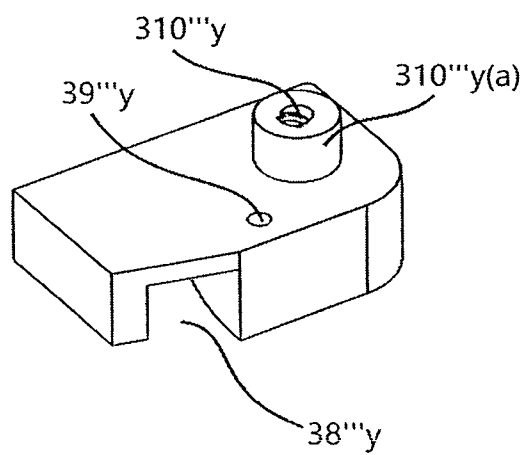


FIG 26.9

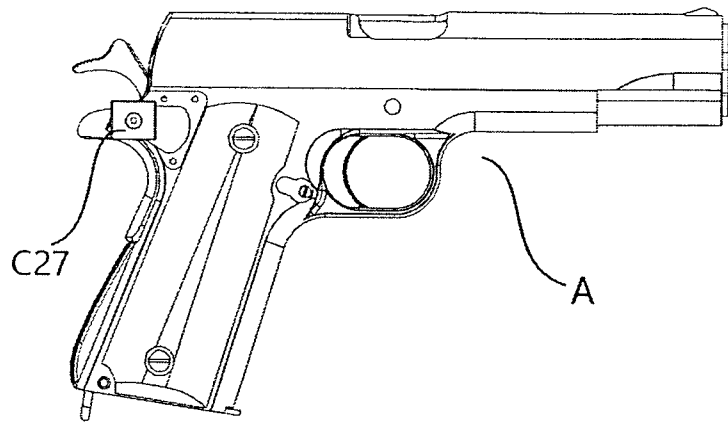


FIG 27.1

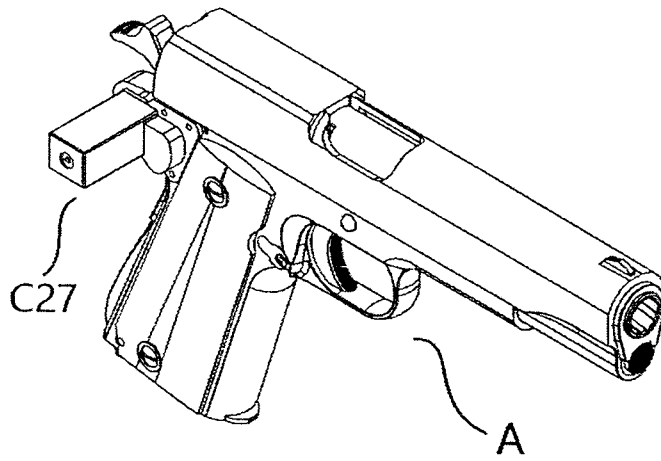


FIG 27.2

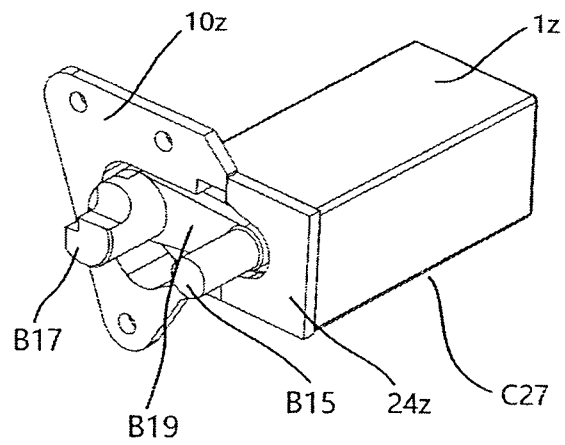


FIG 27.3

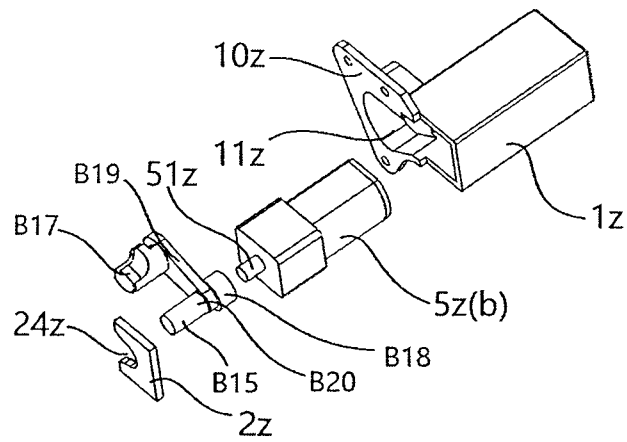


FIG 27.4

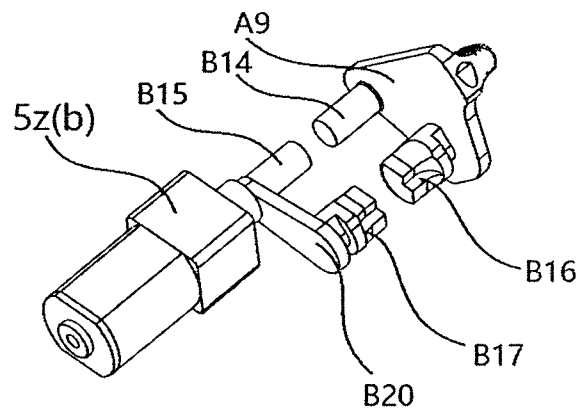


FIG 27.5

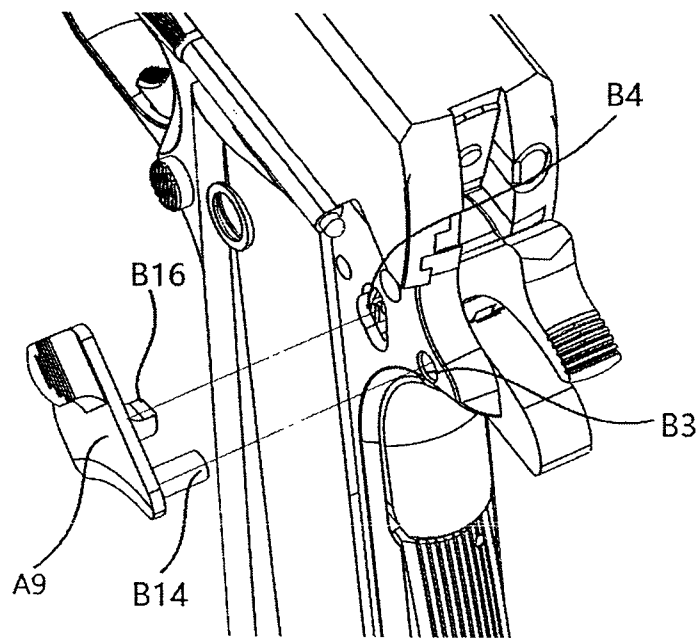


FIG 27.6

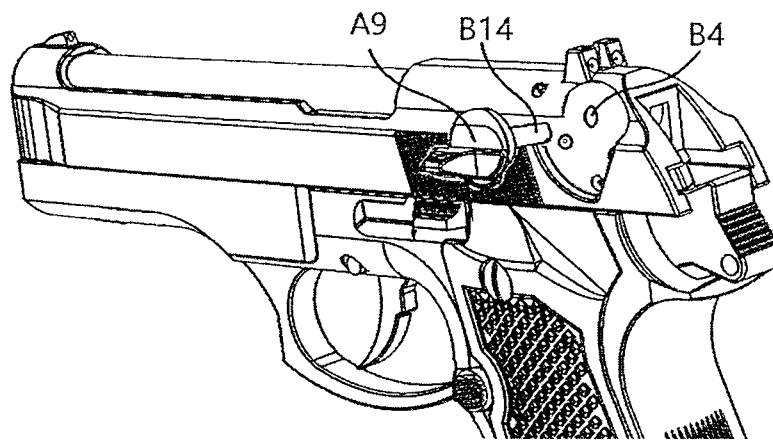


FIG 27.7

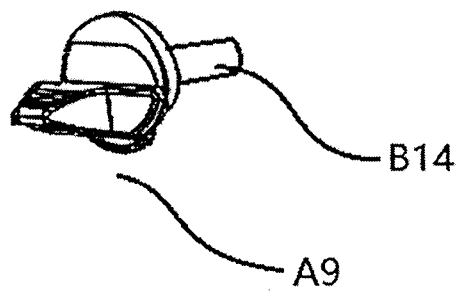


FIG 27.8

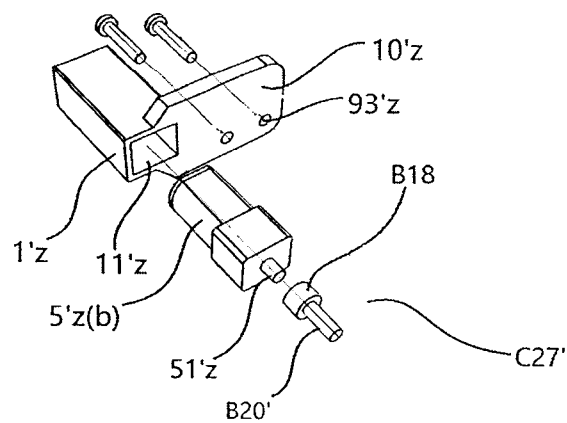


FIG 27.9

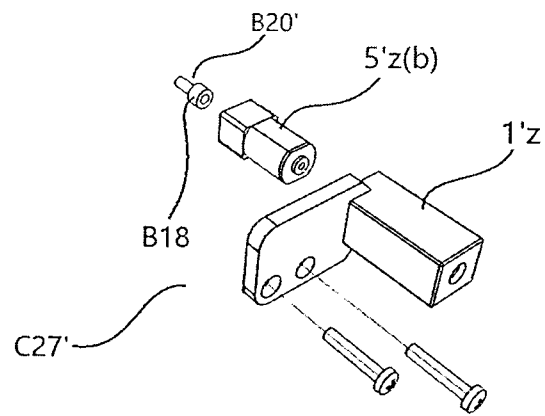


FIG 27.10

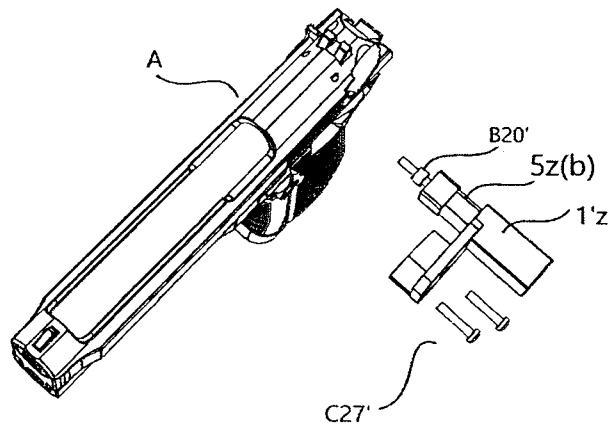


FIG 27.11

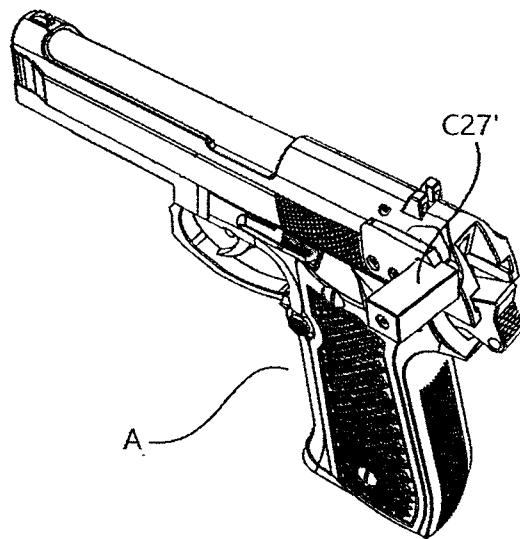


FIG 27.12

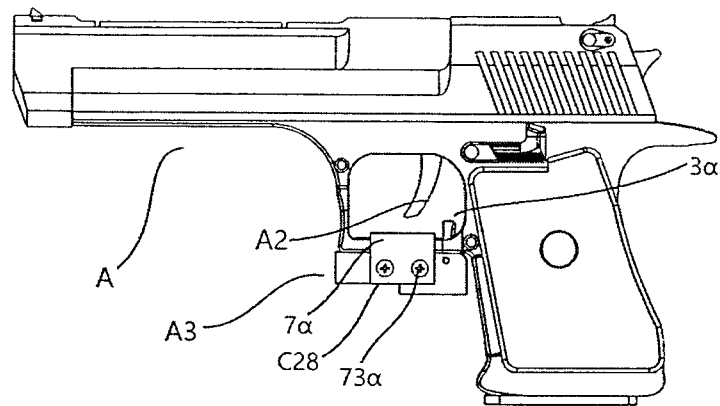


FIG 28.1

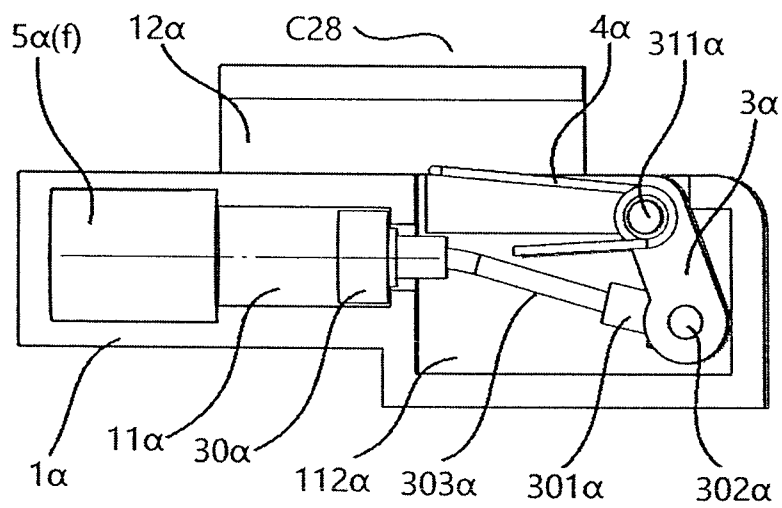


FIG 28.2

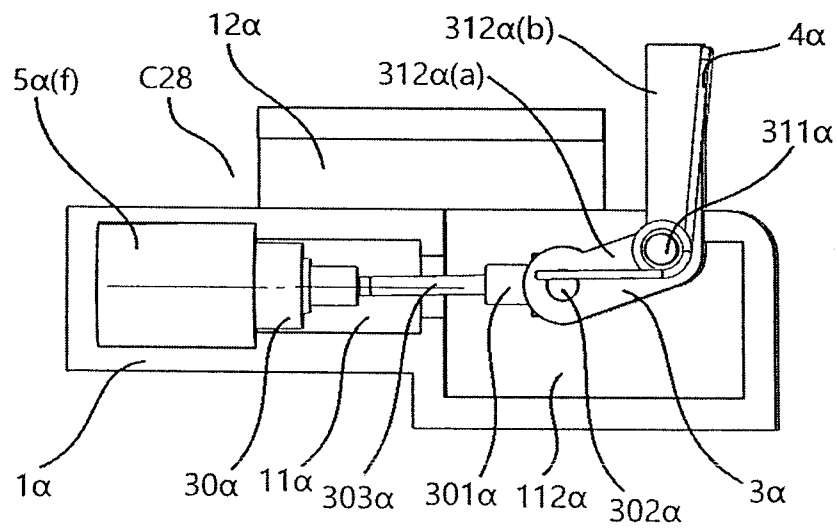


FIG 28.3

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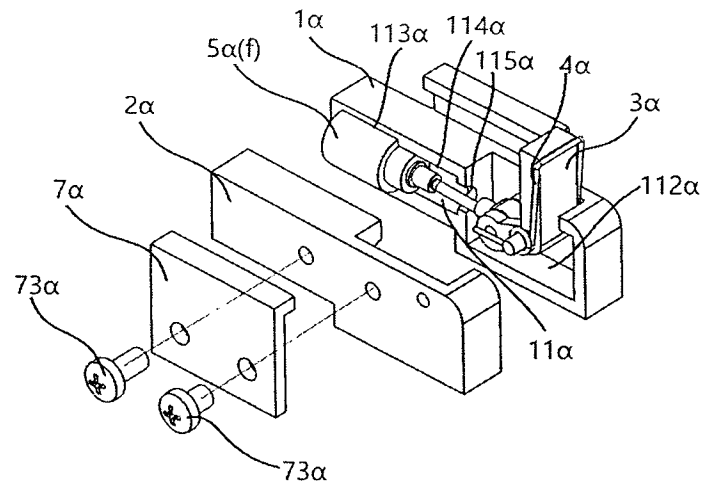


FIG 28.4

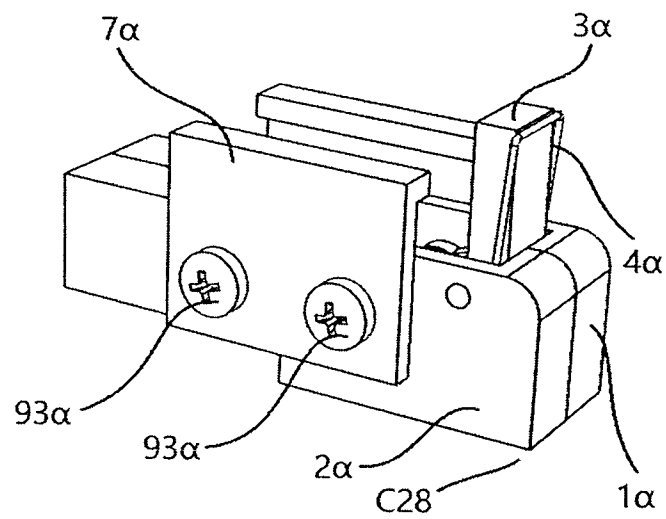


FIG 28.5

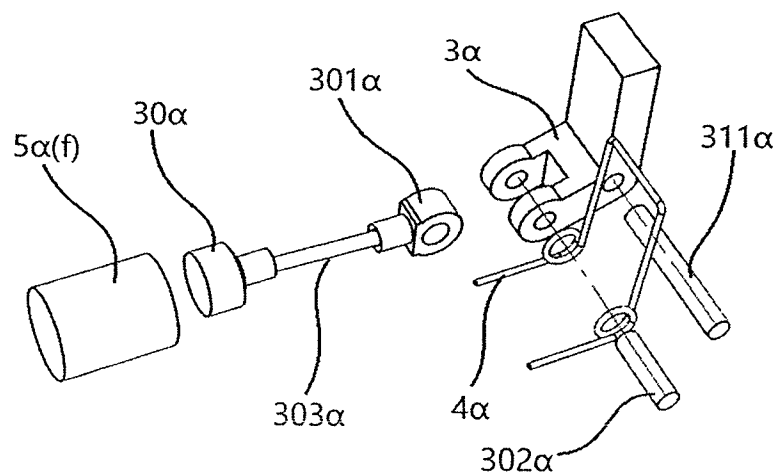


FIG 28.6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB2019/000326

A. CLASSIFICATION OF SUBJECT MATTER

F41A 19/14(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F41A19; F41A17; F41C17

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNKI,CNPAT,EPODOC,WPI:safe??, lock+, actuator, driv+, block+, interrupt+, fir+, trigger, portable 2w weapon, gun?, shotgun?, rifle?, firearm?, crossbow?, electromagnet, permanent w magnet, motor, gear, solenoid, tapeline, bar?.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4141166 A (SCHULTZ, Timothy R.) 27 February 1979 (1979-02-27) line 45 column 4 to line 39 column 5 of description, figures V-VI	1-8, 10-18
X	CN 107036486 A (GUANGDONG ZHONGTAO INFORMATION TECHNOLOGY CO., LTD.) 11 August 2017 (2017-08-11) paragraphs [0013]-[0015], figures 1-2	1, 2, 9
A	US 2002174588 A1 (R.A. BRANDS, L.L.C.) 28 November 2002 (2002-11-28) full text	1-18
A	CN 205482562 U (JINAN BAOTAI BEIJING TECHNOLOGY CO., LTD.) 17 August 2016 (2016-08-17) full text	1-18
A	US 4488370 A (LEMELSON, Jerome H.) 18 December 1984 (1984-12-18) full text	1-18
A	US 9841249 B1 (NICKS, Travis, et al.) 12 December 2017 (2017-12-12) full text	1-18
A	CA 2166849 A1 (J.R. SETINA MANUFACTURING CO., INC.) 11 September 1996 (1996-09-11) full text	1-18



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

17 December 2019

Date of mailing of the international search report

27 December 2019

Name and mailing address of the ISA/CN

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Facsimile No. (86-10)62019451

Telephone No. 86-10-53961117

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/IB2019/000326

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				WO	02095318	A2	28 November 2002
				US	6785996	B2	07 September 2004
				US	2006277808	A1	14 December 2006
CN	205482562	U	17 August 2016	None			
US	4488370	A	18 December 1984	None			
US	9841249	B1	12 December 2017	None			
CA	2166849	A1	11 September 1996	US	5683021	A	04 November 1997