July 24, 1962 E. M. STONER 3,045,555

AUTOMATIC TRIGGER MECHANISM WITH THREE SEARS AND A ROTATABLE CONTROL MEMBER

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FIG. 1.

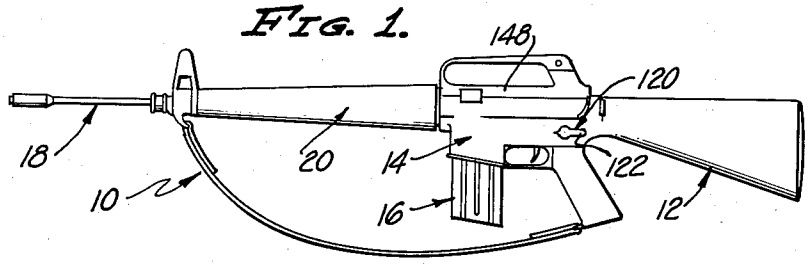


FIG. 2.

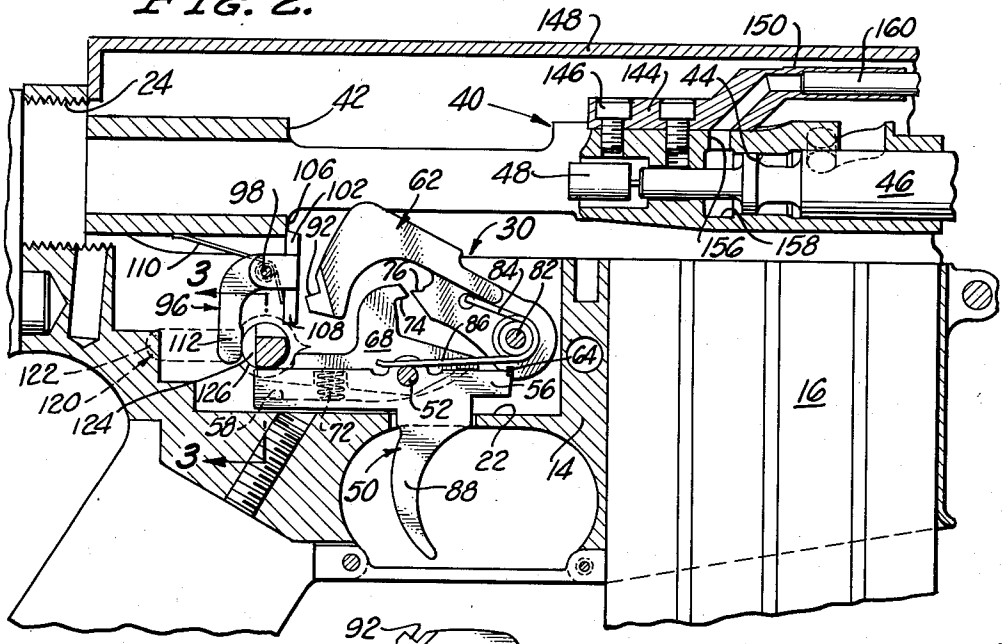


FIG. 4.

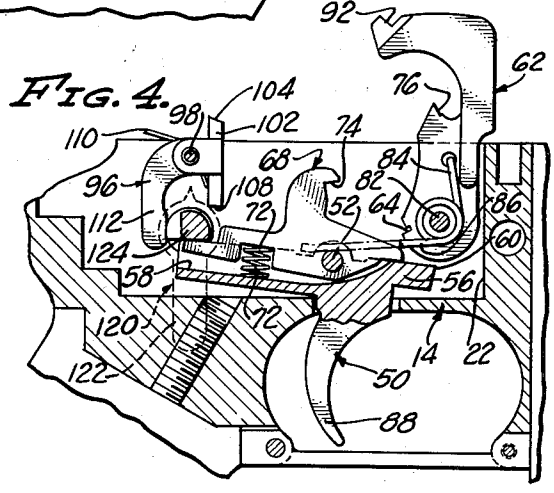
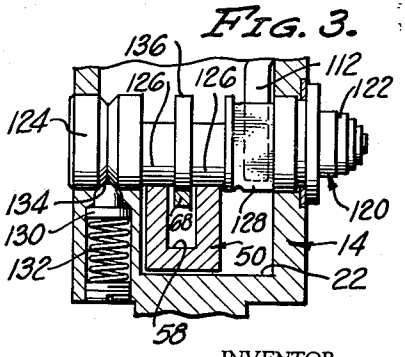


FIG. 3.



INVENTOR.
EUGENE M. STONER
BY Thomas P. McInerney
ATTORNEY

July 24, 1962 E. M. STONER 3,045,555

AUTOMATIC TRIGGER MECHANISM WITH THREE SEARS AND A ROTATABLE CONTROL MEMBER

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FIG. 5.

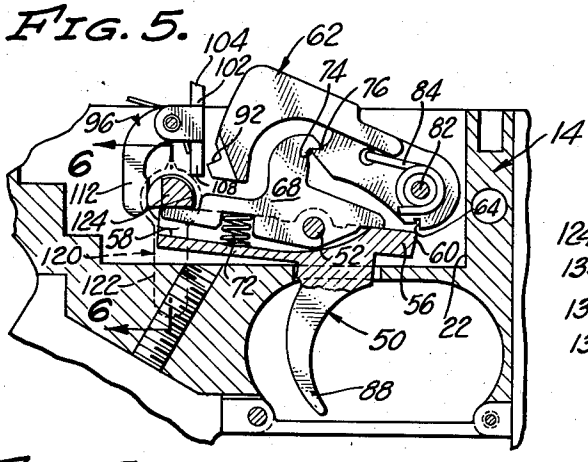


FIG. 6.

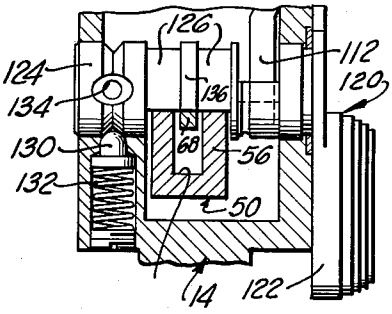


FIG. 7.

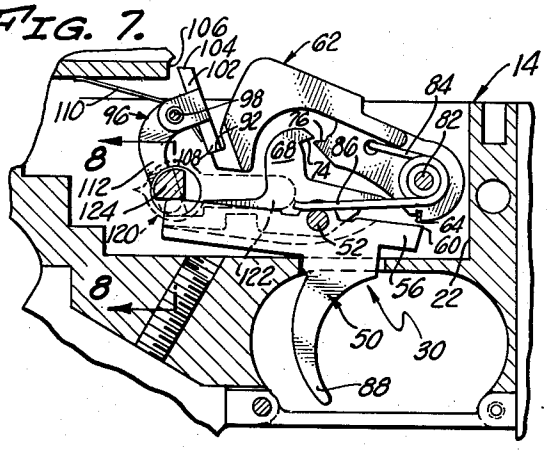


FIG. 8.

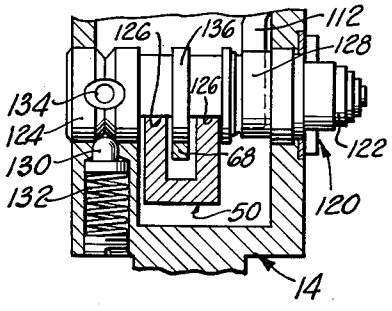
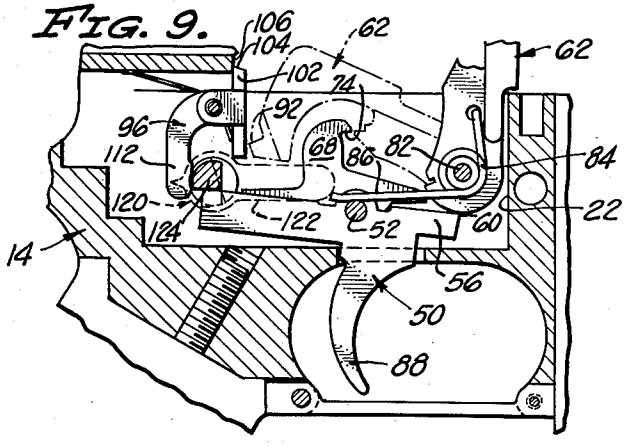


FIG. 9.



INVENTOR.
EUGENE M. STONER
BY Thomas P. Mahoney
ATTORNEY

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3,045,555

AUTOMATIC TRIGGER MECHANISM WITH THREE SEARS AND A ROTATABLE CONTROL MEMBER

Eugene M. Stoner, Newport Beach, Calif., assignor to Fairchild Engine and Airplane Corporation, Hagerstown, Md., a corporation of Maryland

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10 Claims. (Cl. 89—142)

This invention relates to a trigger mechanism for various types of guns, such as rifles, carbines and the like, and is characterized by the fact that it is of extremely simple construction and includes a minimum number of component parts.

The trigger mechanism of my invention is particularly adapted for use in guns of government issue since it is extremely resistant to the effects of the infiltration of dirt, sand and mud, which normally prevent operation of conventional trigger mechanisms. One of the factors largely responsible for the trigger mechanism's relative immunity to immobilization by sand and dirt, or the like, is the mounting of all of the larger components of the trigger mechanism upon pivot pins so that sliding motion of the various components is obviated and the tendency of sand and dirt to lock such sliding components is thus avoided.

It is, therefore, an object of my invention to provide a trigger mechanism which includes a hammer, a trigger, an intermediate sear and an automatic sear pivotally mounted in juxtaposition to each other within the receiver of a gun, said hammer, intermediate sear and automatic sear being subject to control by a single control member which, by its position, determines whether the gun is maintained in safety condition, in semi-automatic fire condition or automatic fire condition.

Another object of my invention is the provision of a trigger mechanism of the aforementioned character which incorporates a plurality of components characterized by the fact that they are particularly susceptible to manufacture by mass production techniques such as stamping or casting. Since comparable components in conventional guns are usually produced by machining techniques, considerable savings can be made in materials and labor by manufacturing guns with trigger mechanisms of the character of that disclosed herein.

A further object of my invention is the provision of a trigger mechanism wherein the control of the condition of the mechanism is determined by the manipulation of a single control member constituted by a rotatable element having a plurality of cam surfaces thereupon engageable with adjacent extremities of the trigger, the intermediate sear and the automatic sear. Therefore, by manipulation of the single control member the weapon can be placed in any desired condition of operation or non-operation.

Another object of my invention is the provision of a trigger mechanism of the aforementioned character wherein the component parts are assembled in an extremely compact relationship with each other and wherein a minimum number of such parts is necessary to cause the operation of the gun in semi-automatic or automatic fashion.

Other objects and advantages of the invention will be apparent from the following specification and the accompanying drawings, which are for the purpose of illustration only and in which:

FIG. 1 is a side elevational view of a gun incorporating the trigger mechanism of my invention;

FIG. 2 is a vertical sectional view of the receiver portion of the gun showing the trigger mechanism locked in safety condition;

FIG. 3 is an enlarged, vertical sectional view taken on the broken line 3—3 of FIG. 2;

FIG. 4 is a vertical sectional view showing the hammer incorporated in the trigger mechanism in fire position;

FIG. 5 is a vertical sectional view showing the components of the trigger mechanism in the position which they assume when the trigger mechanism is set for semi-automatic fire;

FIG. 6 is a vertical sectional view taken on the broken line 6—6 of FIG. 5;

FIG. 7 is a vertical sectional view showing the components of the trigger mechanism arranged in the position they assume when the trigger mechanism is set for automatic fire;

FIG. 8 is a vertical sectional view taken on the broken line 8—8 of FIG. 7; and

FIG. 9 is a vertical sectional view showing the manner in which the automatic sear is displaced by the action of the bolt assembly to permit repeated action of the hammer.

Referring to the drawings, and particularly to FIG. 1 thereof, I show a gun 10 which includes a stock 12 mounted on a receiver 14, said receiver having a cartridge magazine 16 mounted therein. A barrel 18 is operatively connected to the receiver and has a hand grip 20 mounted thereupon for isolating the hand of a shooter from direct contact with the barrel. The receiver 14 defines a trigger mechanism chamber 22, as best shown in FIG. 2 of the drawings, and a bolt assembly receiving chamber 24 which are, respectively, adapted to receive the trigger mechanism 30 and the bolt assembly 40, as best shown in FIG. 2 of the drawing.

The bolt assembly 40 includes an elongated bolt carrier 42 which, as best shown in my co-pending application for Gas Operated Bolt and Carrier System, Serial No. 603,913, filed August 14, 1956, now Patent No. 2,951,424, includes a gas chamber 44 having a bolt 46 mounted therein for movement relative to the bolt carrier. The bolt 46 has a firing pin 48 extending axially therethrough and adapted to engage and fire a cartridge when the bolt 46 is in battery position, that is, locked in the forward extremity of the receiver.

The trigger mechanism 30 includes a trigger 50 which is pivotally mounted within the trigger mechanism chamber 22 of the receiver 14 on a transversely oriented pivot pin 52. The trigger 50 has an elongated upper portion 56 which, as best shown in FIGS. 2 and 4 of the drawings, includes an elongated groove or recess 58. The forward extremity of the trigger constitutes a sear 60 which is adapted, in a manner to be described in greater detail below, to retain a hammer 62 in cocked position by engaging a sear abutment 64 on said hammer.

The pivot pin 52 which mounts the trigger 50 also serves to pivotally mount an intermediate sear 68 whose lower portion is located within the groove 58. A compression spring 72 is interposed between the bottom of the groove 58 and the underside of the intermediate sear 68 in order to urge the intermediate sear 68 in a clockwise direction about the pivot pin 52 so that a hook 74 on the intermediate sear will engage a corresponding intermediate sear abutment 76 formed on the hammer 62 intermediate its opposite extremities.

The rearward extremities of the upper portion 56 of the trigger 50 and the intermediate sear 68 terminate within the receiver 14 at approximately the same point, for a purpose which will be described in greater detail below. The hammer 62 is mounted for rotation on a pivot pin 82 and is biased into firing position by a torsion spring 84 whose lower arm 86 engages upon the pivot pin 52. The spring 72 biases the finger grip portion 88 of the trigger 50 into the inoperative position shown in FIG. 1 of the drawings.

The hammer 62 also includes an automatic sear abutment 92 and an automatic sear 96 is pivotally mounted on a pivot pin 98 adjacent the automatic sear abutment 92. The automatic sear 96 includes a head 102, normally oriented in a vertical position when the automatic sear 96 is inoperative, said head having its upper extremity 104 engageable by a shoulder 106 on the bolt carrier 42, for a purpose which will be described in greater detail below and as best illustrated in FIGS. 2 and 9 of the drawings.

The lower extremity 108 of the head 102 constitutes a sear for engagement with the automatic sear abutment 92 on the rearward extremity of the hammer 62, as best illustrated in FIG. 7 of the drawings. A torsion spring 110 is wrapped about the pivot pin 98 and has its upper leg engaged upon the underside of the bolt carrier 42 while its lower leg engages the inner surface of the head 102 of the automatic sear 96 to bias the head 102 of said automatic sear in a counterclockwise manner, as best shown in FIG. 7 of the drawings.

The automatic sear 96 has a depending tail portion 112 which, as best shown in FIGS. 2 and 3 of the drawings, depends into a position adjacent the contiguous extremities of the trigger 50 and the intermediate sear 68. A common control member or safety 120 is mounted in and upon the receiver 14 and includes a control handle 122 mounted on the exterior of the receiver and a control cam 124 extending transversely of the trigger mechanism chamber 22 of the receiver and juxtaposed to the adjacent extremities of the depending tail 112 of the automatic sear 96 and the trigger 50 and the intermediate sear 68.

Therefore, the control member 120 is adapted, in a manner to be described in greater detail below, to control the operation of the trigger mechanism to determine whether the trigger mechanism 30 is maintained in a safety, semi-automatic or automatic condition. In the safety condition, as best shown in FIGS. 2 and 3 of the drawings and as will be explained in greater detail hereinbelow, the trigger 50 is locked against movement and the hammer 62 is maintained in the cocked position.

In the safety condition, as best illustrated in FIGS. 2 and 3 of the drawings, the handle 122 of the control member is rotated into a horizontal position which brings safety cam surfaces 126 into engagement with the upper edges of the upper portion 56 of the trigger 50 to lock the trigger 50, thus preventing rearward rotation of the finger grip 88 of the trigger 50. In a locked or safety condition, shown in FIG. 1 of the drawings, the sear 60 on the forward extremity of the trigger 50 engages the sear abutment 64 on the forward extremity of the hammer 62 and thus locks the hammer 62 in the cocked position of FIG. 2 of the drawings.

With the trigger 50 in safety condition, the automatic sear 96 is also maintained in its inoperative position, as shown in FIG. 2 of the drawings, because the tail 112 thereof impinges on a cam surface 128 which maintains the head 102 of the automatic sear 96 in the vertical orientation shown in FIG. 2 of the drawings against the torsional effect of the torsion spring 110. A detent 130 is biased by a spring 132 into engagement with a detent recess 134 on the control cam 124 to maintain the control cam 124 in a predetermined position of adjustment and to prevent inadvertent rotation of said control cam.

When it is desired to place the gun 10 in condition for semi-automatic firing, that is, firing each time the finger grip 88 of the trigger 50 is depressed, the handle 122 of the control member or safety 120 is rotated into the vertical orientation shown in FIGS. 5 and 6 of the drawings. In this position the control cam 124 is rotated to free the trigger 50 and the intermediate sear 68 for rotation about the axis of the pivot pin 52. This is permitted because the lower portions of the cam surfaces 126 are rotated into juxtaposition to the upper edges of the upper portion 56 of the trigger 50 and the rearward extremity of the intermediate sear 68 is freed by rotation

of the cam 136 into a position in which its surface is flush with the adjacent surfaces of the cams 126.

Therefore, when the hammer 62 is driven downwardly in a counterclockwise direction against the bias of the torsion spring 84, into a position in which the intermediate sear 68 and, more particularly, the hook 74 thereupon, engages the intermediate sear abutment 76 on the hammer 62, as best shown in FIG. 5 of the drawings, release of the trigger 50 will cause the intermediate sear 68 to release the hammer but not until the sear 60 on the forward extremity of the upper portion 56 of the trigger 50 engages the sear abutment 64 on the hammer 62. When the sear 60 engages the sear abutment 64, the hammer 62 is in the cocked position of FIG. 2 of the drawings, but the trigger 50 is free to move.

Rearward movement of the finger grip portion 88 of the trigger 50 withdraws the sear 60 from engagement with the sear abutment 64 and permits the hammer 62 to be urged by the torsion spring 84 against the firing pin 43 to fire the cartridge. After this, the bolt carrier 42 is returned and drives the hammer 62 down into the position of FIG. 5 where the intermediate sear 68 can engage its hook 74 upon the intermediate sear abutment 76 intermediate the extremities of the hammer 62.

The operation of the gun 10 as an automatic weapon is accomplished by rotating the handle 122 of the common control member 120 into the position shown in FIG. 7 of the drawings wherein the control cam 124 is rotated to permit counterclockwise rotation of the tail 112 of the automatic sear 106 in order that the torsion spring 110 may rotate the head 102 of the automatic sear 106 into a position in which the lower extremity 108 of the head 102 may engage upon the corresponding automatic sear abutment 92 on the hammer 62. In addition, the rotation of the control cam 124 brings a deeper portion of the cam 136 into engagement with the rearward extremity of the intermediate sear 68 to lock the disconnect against movement about the axis of the pivot pin 52 and to prevent engagement of the hook 74 of said intermediate sear upon the corresponding abutment 76 on the hammer 62.

Therefore, when the bolt carrier 42 is driven rearwardly or to the left, as viewed in FIG. 7 of the drawings, the hammer 62 is driven downwardly and the lower extremity 108 of the head 102 of the automatic sear 96 engages the automatic sear abutment 92 on the hammer 62. However, when the bolt carrier 42 returns to battery position, which it does automatically, by virtue of associated bolt springs, not shown, the shoulder 106 on the bolt carrier 42 engages the upper extremity 104 of the head 102 and rotates the head 102 clockwise about the axis of the pivot pin 98 to immediately release the hammer 62 to fire another round. Thus, so long as the trigger 50 is maintained in depressed condition, that is with the finger grip 88 thereof pulled to the rear, the gun 10 will continue to fire.

However, when the trigger 50 is released, the sear 60 thereupon will move upwardly into engagement with the sear abutment 64 on the hammer 62 to prevent rotation of the hammer 62 by the torsion spring 84. However, the hammer is maintained in cocked position and rearward movement of the finger grip 88 of the trigger 50 will release the hammer for another burst of fire so long as the automatic sear 96 is maintained in the position shown in FIG. 7 of the drawings.

The trigger mechanism 30 is illustrated in FIG. 9 of the drawings with the components thereof in the position assumed after the completion of firing a round when the weapon is in the automatic condition. The hammer 62 has been driven upwardly by the action of the torsion spring 84 and the automatic sear 96 has had the head 102 thereof urged into the vertical position to free the hammer 62 while the intermediate sear 68 is maintained in locked condition.

The bolt carrier 42 has a key 144 secured to the upper

surface thereof by means of fasteners **146**. The key **144** is engageable in the upper part **148** of the receiver **14** and has an inlet gas tube **150** formed integrally therewith and communicating with an inlet gas port **156** into the gas chamber **158** of the bolt carrier **42**. The inlet gas tube **150** is adapted to engage upon a corresponding extremity of a gas conveying tube **160** which extends from the barrel to convey explosion gases to the chamber **158**, as best described in my above referenced co-pending application. Therefore, the key **144** and the gas tube **150** are formed as a unit and the cost of fabricating the key integral with the body of the receiver **42** and of fabricating elongated tubes or passages in the receiver **42** is eliminated.

I, thus provide a trigger mechanism which is characterized by a relatively small number of component parts and by the manner in which the single control **120** actually determines the operation of the trigger mechanism **30**. By rotation of the control cam **124** constituting the single control **120** into one of three positions, it is possible to place the rifle in safety, semi-automatic or automatic condition.

Moreover, since all of the larger components of the trigger mechanism **30**, such as the hammer **62**, the trigger **50**, the intermediate sear **68** and the automatic sear **96**, are mounted for rotation on supporting pivot pins, they are not so likely to jam when mud, dust or dirt infiltrates the trigger mechanism chamber **22** of the receiver **14**. Therefore, operation of the trigger mechanism under adverse combat conditions where trigger mechanisms having sliding component parts would fail, is assured. In addition, the peculiar configurations of the component parts of the trigger mechanism lend themselves to mass production techniques such as investment casting or stamping and the necessity for time consuming machining and hand fitting and filing characteristic of prior art constructions is obviated.

Of particular importance is the fact that the trigger mechanism **30** occupies a relatively small space within the receiver **14** and thus permits the over-all dimensions of the receiver **14** to be substantially reduced. Therefore, the trigger mechanism **30** of my invention is characterized by effective operation, reduced cost and a minimum number of cheaply fabricated, component parts.

I claim:

1. In a trigger mechanism, the combination of: a receiver; a bolt assembly mounted for longitudinal movement in said receiver between retracted and battery positions; a trigger pivotally mounted in said receiver having a fixed sear thereupon; a hammer on a pivot mounted in said receiver adapted to be urged into retracted position by said bolt assembly during its movement between battery and retracted positions, said hammer having a sear abutment thereupon engageable by said sear on said trigger to retain said hammer in cocked position; a torsion spring on said hammer pivot for actuating said hammer; an intermediate sear mounted in operative relationship with said trigger and engageable with said hammer to momentarily maintain said hammer in cocked position; an automatic sear pivotally mounted in said receiver adjacent said hammer and directly engageable with said hammer; and a common safety engageable with said trigger, said intermediate sear and said automatic sear to determine the effective relationship between said hammer, said trigger, said intermediate sear and said automatic sear.

2. In a trigger mechanism, the combination of: a receiver; a bolt assembly mounted for longitudinal movement in said receiver between retracted and battery positions; a trigger pivotally mounted in said receiver having a fixed sear thereupon; a hammer pivotally mounted in said receiver adapted to be urged into retracted position by said bolt assembly during its movement between battery and retracted positions, said hammer having a sear abutment thereupon engageable by said sear on said trigger to retain said hammer in cocked position; an intermediate sear pivotally mounted in operative relationship with said trigger and engageable with said hammer to momentarily maintain said hammer in cocked position; an automatic sear mounted in said receiver adjacent said hammer and directly engageable with said hammer; and a common safety engageable with said trigger, said intermediate sear and said automatic sear to determine the effective relationship between said hammer, said trigger, said intermediate sear and said automatic sear, said common safety including an elongated cam having a plurality of cam surfaces thereupon engageable with said trigger, said intermediate sear and said automatic sear to limit or permit movement of said trigger, said intermediate sear and said automatic sear.

3. In a weapon including a receiver and a bolt assembly longitudinally reciprocatable in said receiver between battery and retracted positions, the combination of: a trigger mounted in said receiver having a fixed sear thereupon; a hammer mounted in said receiver and engageable by said trigger; a rotatable intermediate sear operatively connected to said trigger and engageable with said hammer to momentarily maintain said hammer in cocked position; a rotatable automatic sear mounted in said receiver and engageable with said hammer; and a common control member in said receiver engageable with said trigger, said intermediate sear and said automatic sear to permit or prevent relative movement of said trigger, said intermediate sear and said automatic sear.

4. In a weapon including a receiver and a bolt assembly longitudinally reciprocatable in said receiver between battery and retracted positions, the combination of: a trigger mounted in said receiver having a fixed sear thereupon; a hammer mounted in said receiver and engageable by said trigger; an intermediate sear operatively connected to said trigger and engageable with said hammer to momentarily maintain said hammer in cocked position; an automatic sear mounted in said receiver and engageable with said hammer; and a common control member in said receiver engageable with said trigger, said intermediate sear and said automatic sear to permit or prevent relative movement of said trigger, said intermediate sear and said automatic sear, said common control member extending transversely of said receiver and being adapted to engage adjacent portions of said trigger, said intermediate sear and said automatic sear to determine the extent of movement and location of said trigger, said intermediate sear and said automatic sear.

5. In a gun having a receiver incorporating a longitudinally reciprocatable bolt assembly movable between first and second positions in said receiver, the combination of: a trigger pivotally mounted in said receiver, said trigger having a sear thereupon; a hammer pivotally mounted in said receiver adjacent said trigger and having a sear abutment thereupon engageable by said sear on said trigger; an intermediate sear pivotally mounted in said trigger and engageable with said hammer; an automatic sear pivotally mounted in said receiver adjacent said hammer and engageable with said hammer; and a control member mounted for rotation in said receiver and located between adjacent extremities of said automatic sear, said trigger and said intermediate sear to determine the operating condition of said automatic sear, said trigger and said intermediate sear.

6. In a gun having a receiver incorporating a longitudinally reciprocatable bolt assembly movable between first and second positions in said receiver, the combination of: a trigger pivotally mounted in said receiver, said trigger having a sear thereupon; a hammer pivotally mounted in said receiver adjacent said trigger and having a trigger sear abutment thereupon engageable by said sear on said trigger, said hammer having an intermediate sear abutment intermediate its extremities and an automatic

sear abutment thereupon opposite said trigger sear abutment; an intermediate sear pivotally mounted in said trigger and engageable with said intermediate sear abutment on said hammer; an automatic sear pivotally mounted in said receiver adjacent said hammer and engageable with said automatic sear abutment on said hammer; and a control member mounted for rotation in said receiver and located between adjacent extremities of said automatic sear, said trigger and said intermediate sear to determine the operating condition of said automatic sear, said trigger and said intermediate sear.

7. In a gun having a receiver incorporating a longitudinally reciprocatable bolt assembly movable between first and second positions in said receiver, the combination of: a trigger pivotally mounted in said receiver, said trigger having a sear thereupon; a hammer pivotally mounted in said receiver adjacent said trigger and having a sear abutment thereupon engageable by said sear on said trigger; an intermediate sear pivotally mounted in said trigger and engageable with said hammer; an automatic sear pivotally mounted in said receiver adjacent said hammer and engageable with said hammer; and a control member mounted for rotation in said receiver and located between adjacent extremities of said automatic sear, said trigger and said intermediate sear to determine the operating condition of said automatic sear, said trigger and said intermediate sear, said control member being constituted by a rotatable safety having a plurality of cam surfaces thereupon engageable, respectively, with said trigger, said intermediate sear and said automatic sear to determine the relative positions and operation of said elements.

8. In a gun having a receiver incorporating a longitudinally reciprocatable bolt assembly movable between first and second positions in said receiver, the combination of: a trigger pivotally mounted in said receiver, said trigger having a sear thereupon; a hammer pivotally mounted in said receiver adjacent said trigger and having a sear abutment thereupon engageable by said sear on said trigger, said hammer having an intermediate sear abutment intermediate its extremities and an automatic sear abutment thereupon opposite said trigger sear abutment; an intermediate sear pivotally mounted in said trigger and engageable with said intermediate sear abutment on said hammer; an automatic sear pivotally mounted in said receiver adjacent said hammer and engageable with said automatic sear abutment on said hammer; and a control member mounted for rotation in said receiver and located between adjacent extremities of said automatic sear, said trigger and said intermediate sear to determine the operating condition of said automatic sear, said trigger and said intermediate sear, said control member being constituted by a rotatable safety having a plurality of cam surfaces thereupon engageable, respectively, with said trigger, said intermediate sear and said automatic sear to determine the relative positions and operation of said elements.

9. In a gun, the combination of: a receiver; a bolt assembly longitudinally reciprocatable in said receiver between first and second positions; a hammer pivotally mounted in said receiver, said hammer having sear, intermediate sear and automatic sear abutments thereupon; a trigger pivotally mounted in said receiver adjacent said hammer and having a sear engageable with said sear abutment on said hammer; an intermediate sear pivotally mounted on said trigger for movement relative to said trigger and engageable with said intermediate sear abutment on said hammer; an automatic sear mounted in said receiver adjacent said hammer and engageable with said automatic sear abutment of said hammer; and a common control member mounted contiguous to the adjacent extremities of said trigger, intermediate sear and automatic sear to control the operation of said trigger, intermediate sear and automatic sear.

10. In a gun, the combination of: a receiver; a bolt assembly longitudinally reciprocatable in said receiver between first and second positions; a hammer pivotally mounted in said receiver, said hammer having sear, intermediate sear and automatic sear abutments thereupon; a trigger pivotally mounted in said receiver adjacent said hammer and having a sear engageable with said sear abutment on said hammer; an intermediate sear pivotally mounted on said trigger for movement relative to said trigger and engageable with said intermediate sear abutment on said hammer; an automatic sear mounted in said receiver adjacent said hammer and engageable with said automatic sear abutment of said hammer; and a common control member mounted contiguous to the adjacent extremities of said trigger, intermediate sear and automatic sear to control the operation of said trigger, intermediate sear and automatic sear, said common control member being constituted by an elongated rotatable cam having a plurality of cam surfaces thereupon selectively engageable with said trigger, intermediate sear and automatic sear to lock said trigger, said intermediate sear and said automatic sear against movement.

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