The present invention relates to a new and improved trigger mechanism for automatic and semiautomatic guns. It is a principal object of the present invention to provide a trigger mechanism which facilitates not only single shot and automatic firing of a gun but also provides for the firing of a predetermined burst of shots with a single actuation of the trigger.

An additional object of the present invention is the provision of a trigger mechanism which facilitates the repeated firing of a burst of shots upon repeated actuation of the trigger and without further manipulation of the gun by the operator.

Another object of the present invention is to provide an improved trigger mechanism which is capable of providing automatic, semiautomatic and burst firing of a gun by the selective control of the operation of the hammer.

A further object of the present invention is to provide an improved trigger mechanism which exhibits not only the functional characteristics mentioned hereinbefore but is of simple and compact design so that it is adapted to be applied to guns of current design.

Other objects will be in part obvious and in part pointed out in the appended claims. The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth and the scope of the application which will be indicated in the appended claims.

In the drawings:

FIG. 1 is a side elevational view partly in section and partly broken away, showing the trigger mechanism of the present invention incorporated within a gun;

FIG. 2 is an enlarged sectional view taken along the line 2—2 of FIG. 1 showing the fire control selector mechanism;

FIG. 3 is a view similar to FIG. 1 taken along the line 3—3 of FIG. 2;

FIG. 4 is an enlarged view of a portion of the trigger mechanism of FIG. 1 in the area of the hammer pivot;

FIG. 5 is a sectional view taken along the line 5—5 of FIG. 4;

FIG. 6 is a sectional view of the trigger cam on the fire control selector;

FIG. 7 is a view similar to FIG. 1 showing the trigger mechanism in the burst condition after actuation of the trigger and before movement of the hammer;

FIG. 8 is a view similar to FIG. 7 showing the trigger mechanism during an intermediate stage of burst firing; and

FIG. 9 is another view similar to FIG. 7 showing the trigger mechanism during release of the bolt carrier when the gun is in a burst firing condition.

Referring now to the drawings in detail wherein like reference characters indicate like parts throughout the several figures, FIG. 1 shows a trigger mechanism, generally designated 10, positioned within a trigger mechanism chamber 12 located in the lower receiver 14 of a gun 15. Immediately above trigger mechanism chamber 12 and in communication therewith is a bolt carrier assembly receiving chamber 18 which extends longitudinally within the upper receiver 15 and operatively encloses a bolt carrier assembly, generally designated 20. The bolt carrier assembly 28 includes an elongated bolt carrier 22 mounted for reciprocal movement within the chamber 18 and has axially disposed therein a firing pin 24 adapted to engage and fire a cartridge positioned within the firing chamber of the gun.

Mounted in and on the lower receiver 14 is a manually adjustable fire control selector 26 including an indicator 28 and a selector handle 30 mounted on the exterior of receiver 14 and a fire control cam 32 integral or rotatably fixed with the indicator 28 and extending transversely of the chamber 12 adjacent the rear wall thereof. As hereinafter more fully described, the control cam 32 provides a plurality of cam surfaces so that movement of the selector handle 30 so that the indicator 28 points to one of four equally spaced fire control positions, the operator may place the gun in a locked, safety condition, as shown in FIG. 1, or in a condition for full automatic, semiautomatic or burst firing.

The general construction of the trigger mechanism 10 is similar in design and operation to the mechanism disclosed in greater detail in U.S. Patent No. 3,045,555 issued July 24, 1962 to E. M. Sonner and entitled "Automatic Trigger Mechanism with Three Seats and a Rotatable Control Member." However, according to the present invention the trigger mechanism 10 includes a burst control system which provides for the firing of two, three or more shots during a single actuation of the trigger. Broadly, this burst control system provides for the full automatic firing of the gun for a predetermined number of shots and then stops the firing of the gun until the trigger is released and then pulled again for the firing of a similar burst.

Referring now to FIGS. 1 and 3, the trigger 34 of the trigger mechanism 10 is shown to be pivotally mounted on a trigger pin 36 in such a manner that the downwardly extending finger grip portion 38 of the trigger 34 protrudes outwardly of the receiver 14 for manipulation by the operator. Integrelly connected to portion 38 of the trigger 34 is an elongated upper portion 40 which includes a flat generally rectangular lug 42 providing at the forward extremity thereof a trigger sear 44. Immediately rearward of lug 42 is located an elongated groove or trigger well 46 which extends to the opposite end of portion 40 from the trigger sear 44 and defines a pair of trigger cam followers 48.

Located within the trigger well 46 in substantial parallelism to each other and pivotally mounted on trigger pin 36 are a pair of disconnectors 50, 52. The disconnecter 50 is substantially identical to the intermediate disconnecter disclosed in the above mentioned U.S. Patent No. 3,045,555 while the auxiliary disconnecter 52 is of somewhat different design as disclosed in greater detail hereinafter. The disconnecters 50, 52 include forward portions 54, 56, respectively, which overlap the flat lug 42 of trigger 34 and the vertically disposed intermediate sears 58, 60 extending upwardly from the respective disconnecters intermediate the ends thereof. Positioned between the bottom of trigger well 46 and the under side of disconnecters 50, 52 are a pair of compression springs 62, 64 which tend to urge the forward portions 54, 56 of the respective disconnecters in contact with the top surface of lug 42 on trigger 34. On the rearward extremity of the disconnecters 50, 52 are the disconnecter cam follower 66 and the auxiliary disconnecter cam follower 68, respectively, both of which abut the fire control cam 32 under the bias of compression springs 62, 64.

The trigger sear 44 is biased upwardly in a counterclockwise direction by means of a torsion trigger spring 70 whose upper arm 72 acts upon the lug 42 while the lower arm 74 rests against the bottom of chamber 12. As shown in FIG. 1, the trigger sear 44, acting under this bias, engages a trigger sear abutment 76 on the hammer 78 and thereby maintains the hammer in a cocked position.
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3. The hammer 78, as best shown in FIGS. 4 and 5, is pivotally mounted on the hammer pivot pin 80 by means of the hammer hub 82 which extends outwardly on both sides of the hammer body 84. Slidably positioned over a portion of the hammer hub 82 is the ratchet type cam wheel 86 which is shown as being provided with a plurality of ratchet teeth spaced at intervals of 60° about the periphery of the cam wheel. In the two-shot burst design illustrated, the shallow ratchet teeth 88 are equally spaced at 120° intervals about the periphery of the ratchet cam wheel 86 while the larger ratchet teeth 90 are positioned intermediate the shallow teeth 88. Each of teeth 90 are provided with a gullet 92 which is closer to the axis of the hammer pivot pin 80 than the corresponding gullets 94 of the teeth 88 as best shown in FIG. 4.

Integral with the body of ratchet cam 86 is a transversely extending cam hub 96 spaced from the hammer hub 82 so as to permit the incorporation therebetween of the small helical one-way clutch spring 98. The spring 98 possesses an inside diameter which is slightly smaller than the diameter of the hammer hub 82 and consequently provides a snug frictional fit therewith. The spring 98 is provided with an outwardly bent tail 100 which is seated within a slot 102 in the hub of ratchet cam wheel 86. To permit freedom of movement of the first coil of spring 98, there has been found beneficial to make a longitudinal cut 104 in the cam hub 96 adjacent the slot 102. This cut permits the spring to be bent outwardly on a reasonably large radius thereby adding to the strength of the spring at this point and facilitating manufacturing operations.

A counterclockwise rotation of the hammer hub 82 will cause the spring 98 to tighten and compressively engage the hammer hub and therefore to turn in the counterclockwise direction with the hammer hub 82. Since the spring 98 is fastened to the ratchet cam wheel 86 by means of the position between outwardly bent tail 100 and slot 102, the cam will also turn with the spring and the hammer. However, when the hammer hub 82 is rotated in a clockwise direction, the spring will loosen on the hub 82 and will therefore permit the hub to rotate within the spring without carrying the spring and the ratchet cam wheel 86 along with it in the clockwise direction.

Assisting the ratchet cam wheel 86 in its one-way clutch actuation is the vertically disposed pawl 106 which is fixedly mounted on the forward portion 108 of the auxiliary disconnector 52. As will be appreciated, the pawl 106 is transversely offset from the general horizontal plane of the auxiliary disconnector 52 so as to mesh with the teeth of the ratchet cam and cooperate therewith in effectuating the one-way clutch action. As can be seen from FIG. 1, the hook 108 of the pawl 106 is forwardly disposed so as to contact the ratchet teeth 88, 90 irrespective of the disposition of the remainder of the trigger mechanism. Accordingly, the hook 108 will at all times prevent the clockwise turning of the ratchet cam wheel 86 by engagement of the ratchet teeth thereby permitting the hammer to rotate clockwise without turning the cam. The hook 108, however, is permitted to follow the camming surfaces of the ratchet teeth by pivotal movement of the auxiliary disconnector 52 about the trigger pin 36 and against the bias of compression spring 64.

4. The hammer 78 is biased in a clockwise direction by the torsion hammer spring 110 which is mounted on the exterior of cam hub 96 and includes an upper arm 112 which acts on the hammer 78 and a lower arm 114 which engages the trigger pin 36. The hammer 78 additionally includes an automatic sear abutment 116 located on the opposite end of the hammer 78 from the hammer hub 82, which abutment is adapted to cooperate with the automatic hammer control 118. The automatic control 118, which is pivotally mounted on pin 120 adjacent the fire control selector 26 and is biased in a counterclockwise direction, includes a tail portion 122 which abuts the fire control cam 32 and a head portion 124 which is maintained by tail portion 122 in a vertical position when the automatic hammer control is inoperative. The head portion 124 is provided with an upper arm 126 which is adapted to be engaged by a shoulder 128 of the bolt carrier 22 during the automatic and burst functions of the weapon and a lower arm 130 which constitutes a sear for engagement with the automatic sear abutment 116.

As can be seen in FIGS. 2, the fire control cam elements 132, best shown in FIGS. 2 and 6, are disposed so that the trigger cam surfaces 134 which are adjacent the periphery of the fire control cam 32 are positioned so as to face the trigger cam followers 48. Thus, when the selector 26 in the safety position, the trigger cam followers 48 engage cam surfaces 132 and are prevented from moving upwardly when the trigger 38 is pulled. Accordingly, the trigger sear 44 is securely held in engagement with the trigger sear abutment 76 thus preventing actuation of the hammer 78. In safety position, the forward lug 42 of the disconnectors 56, 58 engage the forward lug 42 of trigger 34 and are held out of contact with the hammer 78.

Positioned intermediate the trigger cam elements 132 and constituting a portion of the fire control cam 32 are the disconnector cam 136 and the auxiliary disconnector cam 138. As best shown in FIGS. 1 and 3, cam elements 136 and 138 both possess substantially identical semi-circular configurations although the respective orientation of the elements are such that they are displaced relative to each other by 90° with the cam element 138 in a leading position when the hammer 78 is rotated counterclockwise.

As best shown in FIG. 2, the automatic trigger cam element 144 is positioned at the end of fire control cam 32 adjacent the indicator 28 and includes a pair of diametrically opposed peripheral cam surfaces 146 which act against the tail portion 122 of the automatic hammer control 118 to maintain the hammer 78 in an inoperative position and out of engagement with the automatic sear abutment 116 of the hammer 78. The inoperative status of the automatic hammer control 118 thus will be maintained when the fire control selector 26 is set in a safety or semiautomatic condition. Disposed between the cam surfaces 146 of the automatic trigger cam element 144 is a pair of notches 148 which permit the inward and counterclockwise rotational movement of the tail portion 122 on the automatic hammer control 118, thereby facilitating the cooperative operation of the automatic sear 130 and the automatic sear abutment 116 when the fire control selector 26 is placed in an automatic or burst firing position.

Located on the opposite end of fire control cam 32 from the automatic cam element 144 is a rotation control member 150 having a plurality of dent recesses 152 located about the periphery thereof for a dent 154 which is biased by spring 156 into engagement with the dent recesses in order to maintain the fire control selector 26 in a predetermined position of adjustment to prevent inadvertent rotation thereof.

When the gun is loaded and the trigger mechanism 10 is in the cocked position shown in FIG. 1, the fire control selector 26 may be placed in condition to fire by moving the fire control selector out of the safety position and into either the automatic, semiautomatic or burst position.

Referring first to the use of the gun in a semiautomatic firing condition, it is, where a single shot is fired each time the trigger 34 is pulled, the fire control selector 26 is moved from the safety position shown in FIG. 1 through an arc of 180° by appropriate manipulation of selector handle 30. By such movement of the selector 26, the
trigger cam surfaces 134 and the disconnect cam surface 140 are moved out of contact with their respective cam followers thereby permitting the pivotal movement of both the disconnect cam elements 132. However, the move to the axis of the trigger pivot pin 26. The trigger 34, however, is held in a nonfiring position by the action of trigger spring 70 which biases the lug 42 in a counterclockwise direction thereby maintaining contact between the trigger sear 44 and the sear abutment 76 on the hammer 78. Thus, so long as the trigger 34 is maintained in pulled or depressed position by the operator, the bolt carrier 22 will continue to fire. As soon as the trigger 34, the trigger sear 44 will move upwardly under the bias of trigger spring 70 so as to contact the sear abutment 76 and prevent further actuation of the hammer 78. As will be appreciated, the hammer is then in the cocked position, shown in FIG. 1 and is ready for firing.

According to the previous invention, the trigger mechanism 10 may also be set so that the gun can fire a pre-determined and limited number of shots in a burst during the single actuation of the trigger 34.

Referring now to FIGS. 7 through 9, there is shown the trigger mechanism with the fire control selector 25 positioned for burst firing of the gun. The orientation of fire control cam 32 is such that in the cocked position only disconnect cam 136 contacts its cam follower 65 and maintains the disconnector 50 in an inoperative position during the firing sequence. Upon actuation of the trigger 34, the auxiliary disconnect 52 is free to pivot about the axis of trigger pin 36 as shown in FIG. 7, thus permitting the forward movement of hook 105 on the auxiliary disconnecter 52 under the bias of spring 64 into the deep gullet 92 of ratchet tooth. As mentioned herebefore, the one-way clutch spring 98, which causes the ratchet type cam 86 to rotate in a counterclockwise direction, the hammer 78, is so constructed that it slips when the hammer rotates to strike the firing pin and the hook 105 on pawl 106 contacts the ratchet tooth 90 preventing the counterclockwise rotational movement of the ratchet cam 86 with the hammer 78. However, when the hammer 78 is returned, the pin 20 is moved in a counterclockwise direction, the spring 98 grips the hammer hub 82 to tighten itself about the hub to rotate the cam 86 in synchronization with the hammer 78. Therefore, the return of the hammer 78 rotates the ratchet cam 86 in a counterclockwise direction and brings the pawl hook 106 of auxiliary disconnect 52 into engagement with the next successive tooth 88, located on the periphery of cam 86. Due to the fact that gullet 94 of tooth 88 is radially offset from the axis of hammer pivot 80 a greater distance than gullet 92, the intermediate sear 60 on the auxiliary disconnect 52 is held so as to prevent the engagement of the intermediate sear 60 with the intermediate sear abutment 158.

Upon recoil of the bolt carrier 22, the hammer is returned sufficiently to permit contact between the automatic sear 130 on automatic hammer control 116 and the automatic sear abutment 116 of the hammer 78. The return travel of the bolt carrier 22 allows the hammer to be fired again. As shown in FIG. 8, releases the automatic sear 130 from the sear abutment 116 and since the trigger is still pulled and the intermediate sear 60 is prevented from catching the hammer 78 by the engagement of pawl hook 106 against the bottom of gullet 94, the hammer 78 will fire a second shot as in full automatic operation.

When the hammer is again retracted by the second recoil of the bolt carrier 22, the ratchet cam 86 again turns in synchronization with the hammer 78, thereby bringing the following tooth 90 into engagement with the hook 108 of the auxiliary disconnecter 52. As can be seen in FIG. 9, the gullet 92 of tooth 90 permits the movement of the hook 108 to a full forward position thereby positioning the intermediate sear 60 above the intermediate sear abutment 158 on the hammer 78 for engagement thereby causing the hammer 78 to be held in the cocked position and the gun will not fire again unless the trigger is released and pulled again. As explained above, the trigger sear 44 will move upwardly a sufficient distance to engage the sear abutment 76 before intermediate sear 69 disengages sear abutment 158 as the trigger is released.

It will, of course, be understood that the ratchet cam 86 may be constructed so that three or more shots can be fired during each burst by increasing the number of shallow teeth 88. In this regard, it may be noted that in the
illustrated design, the hammer rotates approximately 60° from the firing position to the cocked position. Consequently, when the gun recoils and the lower face of the bolt carrier 22 forces the hammer 78 backwardly and downwardly, there is an overtravel due to the inertia which results from the high speed of the hammer during cocking, as shown in FIG. 9, which ensures sufficient movement of the ratchet cam 86 so as to advance the pawl to the next successive ratchet tooth. It will of course be understood that should the magazine become empty during a two-shot burst so that only one shot is fired, the remaining single shot of the original burst will be fired upon insertion of a new magazine and actuation of the trigger to complete the burst cycle after which the burst will include the number of shots determined by the arrangement of ratchet teeth on the cam wheel 86.

As will be apparent to persons skilled in the art, various modifications and adaptations of the structure above described will become readily apparent without departure from the spirit and scope of the invention, the scope of which is defined in the appended claims.

I claim:

1. A trigger mechanism comprising in combination a hammer mounted for movement between cocked and firing positions; a trigger connected with the hammer for retaining the hammer in a cocked position; a burst control means including cam means mounted in side-by-side relationship with said hammer and connected thereto for synchronously moving therewith between the firing and cocked positions, a disconnectable moveable relative to the trigger and with said cam means to permit a predetermined sequence of operation wherein said hammer is cocked and the firing position, said cam means permitting greater movement of the disconnectable upon termination of the predetermined sequence, an automatic control for engaging said hammer during said sequence of operation, and a fire control selector to effect the predetermined sequence of operation.

2. A trigger mechanism comprising in combination a hammer mounted for movement between cocked and firing positions; a trigger connected with the hammer for retaining the hammer in a cocked position; and a burst control including cam means mounted in side-by-side relationship with said hammer and connected thereto for synchronously movement therewith between the firing and cocked positions, a disconnectable movable relative to the trigger and with said cam means to permit a predetermined sequence of operation wherein said hammer is cocked and the firing position, said cam permitting greater movement of the disconnectable upon termination of the predetermined sequence, an automatic control for engaging said hammer during said sequence of operation, and a fire control selector to effect the predetermined sequence of operation.

3. A trigger mechanism comprising in combination a hammer mounted for movement between cocked and firing positions; a trigger connected with the hammer for retaining the hammer in a cocked position; a ratchet cam mounted coaxially with the hammer for movement between the cocked position and the firing position, a disconnectable movable relative to the trigger and with said cam means to permit a predetermined sequence of operation wherein said hammer is cocked and the firing position, said cam permitting greater movement of the disconnectable upon termination of the predetermined sequence, an automatic control for engaging said hammer during said sequence of operation, and a fire control selector to effect the predetermined sequence of operation.

4. A trigger mechanism comprising in combination a hammer mounted for movement between cocked and firing positions; a trigger connected with the hammer for retaining the hammer in a cocked position; a ratchet cam mounted coaxially with the hammer for movement between the cocked position and the firing position, a disconnectable movable relative to the trigger and with said cam means to permit a predetermined sequence of operation wherein said hammer is cocked and the firing position, said cam permitting greater movement of the disconnectable upon termination of the predetermined sequence, an automatic control for engaging said hammer during said sequence of operation, and a fire control selector to effect the predetermined program of operation.

5. A trigger mechanism comprising in combination a hammer mounted for movement between cocked and firing positions; a trigger connected with the hammer for retaining the hammer in a cocked position; a ratchet cam mounted coaxially with the hammer for movement between the cocked position and the firing position, a disconnectable movable relative to the trigger and with said cam means to permit a predetermined sequence of operation wherein said hammer is cocked and the firing position, said cam permitting greater movement of the disconnectable upon termination of the predetermined sequence, an automatic control for engaging said hammer during said sequence of operation, and a fire control selector to effect the predetermined sequence of operation.

6. A trigger mechanism comprising in combination a hammer mounted for movement between cocked and firing positions; a trigger connected with the hammer for retaining the hammer in a cocked position; and an automatic control for momentarily retaining the hammer in a cocked position after the trigger is pulled to fire a shot and the hammer is returned to a cocked position, the disconnecter being responsive to the rotation of the ratchet cam relative to the hammer to retain the hammer in cocked position until the trigger is released.

7. A trigger mechanism comprising in combination a trigger mechanism comprising in combination a hammer mounted for movement between cocked and firing positions; a trigger connected with the hammer for retaining the hammer in a cocked position; and an automatic control for momentarily retaining the hammer in a cocked position after the trigger is pulled to fire a shot and the hammer is returned to a cocked position, the disconnecter being responsive to the rotation of the ratchet cam relative to the hammer to retain the hammer in cocked position until the trigger is released.

8. A trigger mechanism comprising in combination a hammer mounted for movement between cocked and firing positions; a trigger connected with the hammer for retaining the hammer in a cocked position; and an automatic control for momentarily retaining the hammer in a cocked position after the trigger is pulled to fire a shot and the hammer is returned to a cocked position, the disconnecter being responsive to the rotation of the ratchet cam relative to the hammer to retain the hammer in cocked position until the trigger is released.
9. A burst fire control system for use in a trigger mechanism comprising a hammer mounted for movement between cocked and firing positions and a trigger having sear means engageable with said hammer for the retention thereof in the cocked position and for releasing said hammer to fire a burst comprising a specific plural number of shots, said system including second sear means engageable with said hammer to stop the same, and means operable by the hammer during the movement thereof from the firing position to the cocked position to render said second sear means effective to engage said hammer after the specific plural number of shots are fired.

10. A trigger mechanism for burst firing comprising in combination a hammer mounted for movement between cocked and firing positions; a cam operatively connected to the hammer for movement during movement of the hammer between the firing and cocked positions; and a disconnector movable into engagement with the cam to provide unidirectional advance of the cam relative to the hammer during the movement of said hammer, said cam upon moving a preselected amount providing for additional movement of the disconnector sufficient to engage the hammer and retain the same in a cocked position to terminate burst firing.

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