Dec. 5, 1950 C. A. S. TEECE 2,532,794

AUTOMATIC CONTROL FOR BURST FIRING

Filed March 27, 1946 2 Sheets-Sheet 1

Fig. 1.

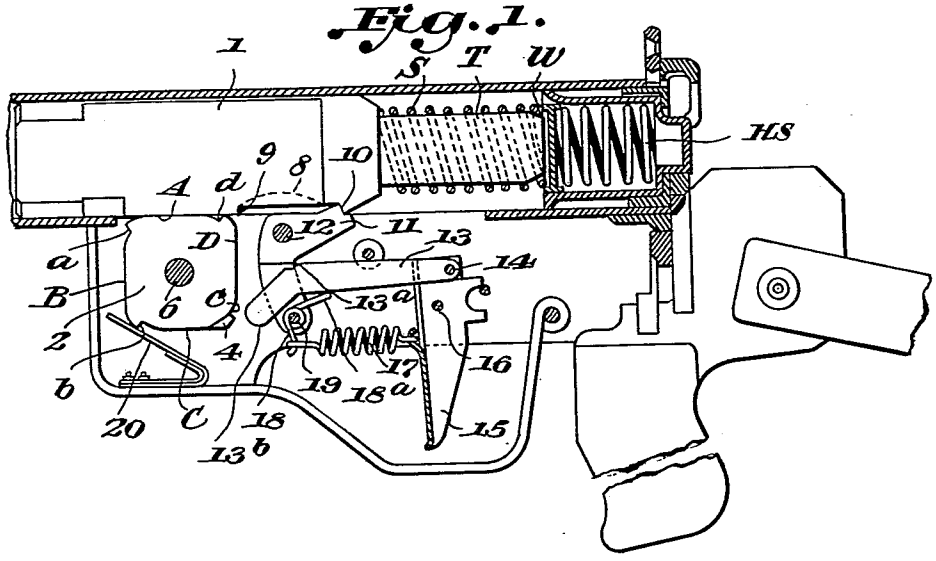


Fig. 2.

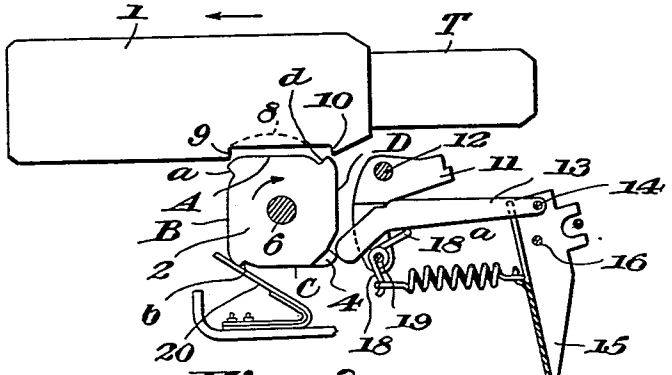
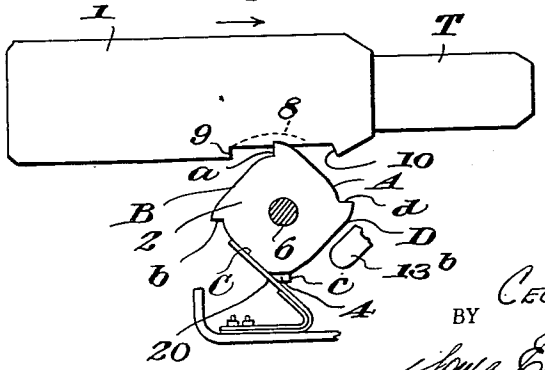


Fig. 3.



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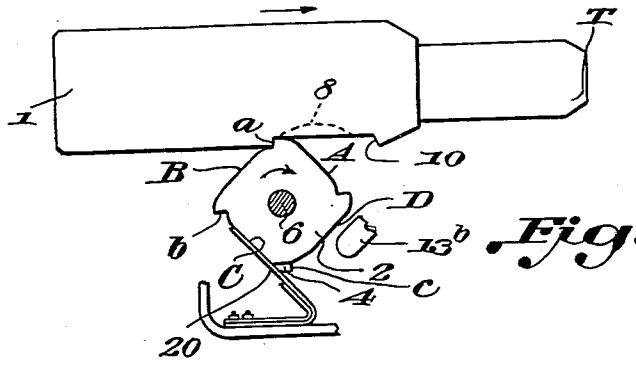


Fig. 4.

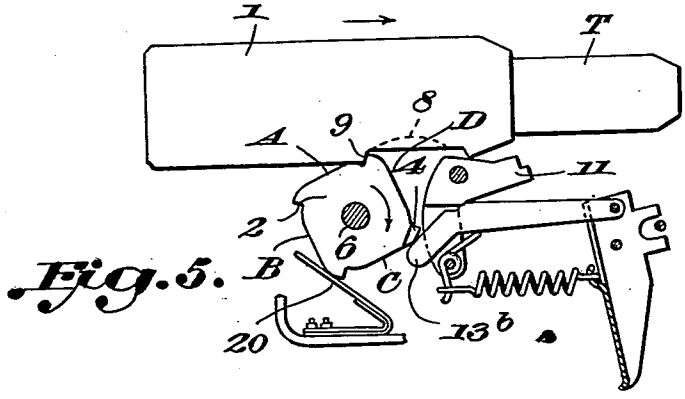


Fig. 5.

Fig. 7.

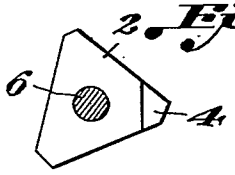


Fig. 6.



Fig. 8.



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AUTOMATIC CONTROL FOR BURST FIRING

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10 Claims. (Cl. 89—149)

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This invention relates to automatic firearms including automatic rifles, machine guns, light machine guns, and so called sub-machine guns, and has particular, but not necessarily limiting, reference to such firearms which operate on the "blow-back" principle.

Hitherto, interruption of continuous firing has been dependent upon manual release of the firing trigger. Military operations, however, have proved that, on account of the high rate of fire, manual control is quite inadequate and that serious wastage of ammunition occurs leading to combat troops becoming devoid of ammunition at vital or critical periods.

With a view to conserving ammunition under combat conditions, attempts have been made to reduce the rate of fire of automatic firearms, the objective being to interrupt continuous firing by manual release of the trigger after a relatively small number of cartridges has been discharged. According to one proposal of such a character, it has been suggested to slow down the rate of fire by deliberately increasing the weight of a part or parts of the action.

Such proposals, while they may facilitate conservation of ammunition, are actually retrograde in principle and in result, primarily in that they sacrifice the beneficial results which accrue from an optimum high rate of fire. Thus, reduction of the rate of fire, below the optimum for any particular automatic firearm, inevitably impairs the accuracy of a continuous cone of fire. In this connection it may be taken as established that the optimum cyclical rate of fire of practically any automatic firearm, in order to obtain maximum accuracy in continuous fire, is so high as to render it physically impossible for the trigger to be manually released with such speed and precision as to ensure that only a predetermined and relatively small number of cartridges will be discharged in a burst of continuous fire.

It will be apparent from the foregoing that in endeavouring to achieve the objective of conserving ammunition by reducing the rate of fire in order that the continuous fire may be effectually arrested after a particular number of cartridges has been discharged, conditions have been established in the rate of fire which are detrimental to the achievement of maximum accuracy during continuous fire.

The primary object of this invention is to provide simple, practical and reliable means for reconciling these two hitherto incompatible conditions, whereby ammunition may be conserved and, at the same time, the optimum rate of fire

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may be adopted for accuracy of the trajectory of any particular firearm.

With that object in view, the invention eliminates the necessity for manual manipulation of the trigger in order to arrest continuous fire, and provides for the interposition between the trigger mechanism and the action of the firearm of an automatic control device which is adapted to be intermittently actuated directly by the action in order that, irrespective of the rate of fire, the trigger mechanism will automatically arrest firing immediately after a predetermined number of cartridges has been discharged in a burst of continuous firing. The control device is of such form and is so co-ordinated with the action as to be positive and definite in operation and is locked in a stationary condition after each intermittent actuation by direct physical contact with the action.

Thus with the invention, control of continuous firing (i. e. the number of cartridges discharged during a burst of continuous fire) is taken out of the hands of the marksman but he may, by normal manipulation of the trigger, discharge series of the predetermined relatively short bursts in rapid succession whenever so desired.

Provision may be made whereby the marksman may also cause firing to be automatically interrupted after each shot, or throw the control device out of operation so that true or unlimited continuous firing may be achieved.

From the foregoing and from the description to follow, it will be apparent that a control device for automatic firearms is provided which, by virtue of being constrained in its intermittent actuation, is capable of functioning in an automatic firearm having a very high cyclical rate of fire. As previously stated, every automatic firearm has an optimum cyclical rate of fire for the best grouping of shots under continuous firing conditions. This optimum rate of fire, however, is very much higher, especially in automatic firearms of the sub-machine gun type, than is acceptable to military authorities with manual control of continuous firing conditions.

It is accordingly possible, with the realization of this invention, to raise the cyclical rate of fire to the optimum rate referred to for any particular automatic firearm, in consequence of the fact that there is available, according to said invention, an automatic control device which positively interrupts the firing after a predetermined number of shots has been discharged under continuous firing conditions for each pressure of the trigger.

Among the factors which determine the cyclical rate of fire of an automatic firearm operating on the "blow-back" principle is, in addition to the weight and stroke of the bolt, both of which may be reduced, the difference in spring pressure acting upon the bolt when the bolt is in the closed position and when it is at its extreme rearward position. The adoption of a single spring system exerting the requisite high pressure on the bolt necessitates excessive and objectionable manual pressure on the cocking handle during manual cocking of the bolt.

Therefore as a further feature of the invention, which will enable full advantage to be derived from the ability to raise the cyclical rate of fire to the optimum value while permitting of controlled continuous firing, I contemplate employing, in combination with a control device as aforesaid, a duplex spring arrangement, itself of known or any suitable form, in which a first or relatively light spring yieldingly opposes rearward movement of a reciprocating bolt or like action for a substantial distance from the bolt closed position, and a second or relatively heavy spring which upon being compressed by continued rearward movement of the bolt into its extreme rearward position exerts a greatly increased pressure on the bolt.

The foregoing and other objects and advantages of the invention will become readily apparent from the following description and annexed drawings which relate, by way of example, to an adaptation of the invention to a sub-machine gun of well known type which embodies a reciprocating bolt action and operates on the "blow-back" principle. It is to be understood that the invention is not limited to such a gun or to guns operating upon the "blow-back" principle.

In the drawings:

Figure 1 is a side elevation, partly in section, of the essential parts of a sub-machine gun incorporating a control device according to one form of the invention. The parts are shown in a condition ready to commence a burst of continuous fire.

Figure 2 shows the relevant parts after the trigger has been pressed to initiate firing.

Figure 3 shows the parts after the first shot has been fired and the bolt is returning under recoil.

Figure 4 shows a further stage in the recoil movement of the bolt which has reached the stage where it engages the control device and commences to turn it.

Figure 5 shows the parts after the last round of a burst has been fired, the control device being about to act upon the trigger mechanism in order to restore it to the normal position, ready to arrest continuous fire and to initiate another burst of firing.

Figure 6 is a diagram indicating how adjustments may be made to permit of single shot firing or complete continuous firing.

Figure 7 is a face view of a rotary control member suitable for bursts of three shots.

Figure 8 is a diagram similar to Figure 6 but applicable to the control member of Figure 7.

According to Figures 1 to 6, the control device comprises a rotary member 2 in the form of a cam or plate of approximately square shape having its perimeter constituted by the straight edges ABCD each of which is recessed near one end so as to produce abutment faces *a*, *b*, *c*, *d* at the respective corners of the plate. The member 2 is also provided at or near its perimeter with

a laterally projecting lobe or striker 4. The member 2 may be fast upon a spindle 6 which extends transversely beneath the firearm action, e. g. the reciprocating bolt 7, the spindle being rotatably supported, as by bearings (not shown) in the trigger guard or other convenient part.

The bolt 7 may be of any appropriate design and construction but according to the illustrated form of the invention is provided in its under surface and toward its rear with a recess 8 in longitudinal alignment with the rotary member 2, the recess being curved as shown or of other suitable shape and depth as will enable member 2 to turn partly into the recess 8 as the latter comes into registry with the upper forward corner of member 2. The recess terminates at its forward end in a shoulder 9 for co-operation with the abutment faces *a*, *b*, *c*, *d* of member 2 as will be described hereinafter.

The bolt is provided with the usual inclined face or bent 10 to be engaged by an extremity of the sear 11, herein exemplified as a bell crank lever pivoted at 12 and co-operating with a step 13*a* formed intermediately of the length of connector 13 the rear end of which is pivoted at 14 to the upper part of the trigger 15 which is pivoted at 16. The forward end 13*b* of the connector extends beyond the sear and is disposed in the path of the striker 4 on the rotary member 2.

The trigger spring 17 is shown connected at its rear end, to the trigger and at its forward end, to a rat trap spring 18 encircling a pin 19 outstanding from the lower end of the sear, the free end portion 18*a* of the spring extending transversely beneath the connector 13 in order to yieldingly urge it upwards about pivot 14.

A biassing spring 20 is shown acting upon the rotary member 2 in order to turn it initially as soon as the recess 8 in the under surface of the bolt comes into registry with the upper forward corner portion of the rotary member 2.

In Figure 1, the parts are shown in position ready to commence a burst of continuous fire, which, in the present case, will consist of four shots. It will be noted that edge A of the rotary member 2 is in linear contact with the under surface of the bolt so that member 2 is at the moment locked against rotation.

Upon pressing the trigger, the connector 13 by its forward movement swings the sear 11 about its pivot 12, thus releasing the bolt 7 for the first shot. When the forwardly travelling bolt reaches the position shown in Figure 2, the biassing spring 20 automatically turns member 2 in the direction of the arrow and locks it by co-operation of the straight edge of the spring with the flat edge of the member 2 as in Figure 3, so that its corner portion enters the bolt recess 8 and thus brings abutment face *a* into position to be engaged by the shoulder 9 at the forward end of the bolt recess 8 during return or recoil of the bolt which is assumed to have commenced in Figure 3.

Figure 4 depicts a further stage of the recoil movement from which it will be apparent that as the bolt continues its recoil movement, member 2 will be turned by the engagement of shoulder 9 with face *a* until it has completed one-quarter of a revolution from the initial position. Thereby edge B is brought into contact with the under surface of the bolt and arrests the member 2 when its angular momentum is greatest, and locks it against further rotation.

As the sear 11 remains retracted from the bent

10, the bolt continues its reciprocating motion to fire three additional shots. During that phase, movements similar to those described in relation to Figures 2, 3 and 4 are repeated with the exception that it is the edges C, D and A which are successively brought into contact with the under surface of the bolt. During the recoil of the bolt after the fourth or final shot, the striker 4 on member 2 engages the forward end 13b of the connector, as indicated in Figure 5, swinging it downwardly about its pivot. This releases the sear 11 for swinging movement under influence of spring 18, with the result that the sear engages the bent 10 and arrests firing.

Upon relaxing pressure on the trigger the gun is ready for a further burst of continuous fire.

It will be appreciated that the control afforded by the invention is most positive and definite, due primarily to the fact that the control member 2 is directly operated by the firearm action (e. g. the reciprocating bolt) and also, because at all periods, other than when the control member is under forced and deliberate motion, it is positively locked against movement by physical contact with the firearm action, consequently there is no possibility of backlash or other undesired or inadvertent movement of the control device which might interfere with its efficient, reliable and precise controlling function.

It will also be apparent that, on account of its direct action and self-locking properties, the control device can be of the utmost simplicity and compactness and be made sufficiently robust as to withstand prolonged and hard use.

As previously mentioned the embodiment of Figures 1 to 6 provides for burst of four shots but by providing member 2 with another striker diametrically opposite the striker 4, the bursts would be limited to two shots.

Should it be desired to provide for three shot bursts then the control member may be of generally triangular shape as seen in Figure 7.

The control device also lends itself to adjustment in order that single shot and true continuous fire may be obtained whenever so desired. For this purpose a spring influenced plunger or press button of a kind well known in the art may be associated with the connector 13 to enable it to be displaced laterally in relation to the rotary member 2. Thus referring to Figure 6, with the connector in the unbroken line position four-shot or two-shot bursts will be obtained depending upon whether one or two strikers 4 are provided, in the dot-dash line position only single shots would be possible while in the dotted line position continuous fire interrupted only by manual release of the trigger would be obtainable.

Similar remarks apply to the three-shot control device of Figure 7 as will be apparent from Figure 8 without further description.

In order that full advantage may be taken in the application of the present invention to an automatic firearm by way of raising the cyclical rate therein to the optimum value referred to hereinbefore, a duplex spring system as illustrated in Figure 1 of the drawings may be adopted. In this spring system, the spring S controls the bolt movement between the bolt closed position and slightly rearward of the position at which the sear 11 engages with the bent 10, after which the tailpiece T of the bolt 7 abuts against the washer W interposed between the spring S and the heavier spring HS, which then yieldingly opposes further rearward movement of the bolt, and in doing so imposes a much higher pressure thereon for any given further rearward movement of the bolt.

By means of this duplex spring arrangement the pressure which must be exerted on the cocking handle to cock the bolt is only dependent upon the compression of the spring S, whereas the pressure exerted on the spring HS by the tailpiece T upon contacting the washer W causes the spring HS to exert a very much increased spring pressure on the bolt than that exerted by the spring S, the maximum value of which is the primary factor in determining the cyclical rate of fire.

It will be understood that while according to the exemplification of the invention as illustrated in the drawings the rearward face of the bolt constituting part of the action actuates the polygonally shaped cam, such cam may be arranged so as to be actuated by the forward end of the bolt or by any suitably positioned member.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:

1. In an automatic firearm, the combination with an action and a trigger mechanism of a control device including a straight edged cam member, an axle member extending transversely of said action and about which said cam member is mounted to turn, said cam member being intermittently turned about said axle by engagement of said action while moving in one direction in order to ensure that said trigger mechanism will automatically arrest firing immediately after a predetermined number of cartridges has been discharged in a burst of continuous firing, said control device being positively constrained from movement immediately after each intermittent actuation by one of its edges being brought into contact with a surface of said action, means for biasing said control device so as to initially turn the same into operative position in relation to said action after said action has completed each forward movement thereof, said control device comprising a rotary member having a perimeter constituted by a series of angularly related edges, an abutment face between each adjacent two of said edges, and an outstanding striker, the rotary member being so mounted and disposed as to be repeatedly and intermittently turned by direct contact of a member of the firearm action with the successive abutment faces during a burst of continuous firing, whereby said edges are successively brought into linear engagement with said action member between each turning motion of the rotary member in order to lock the latter against undesired turning, said striker after at least two successive turning motions of the rotary member, engaging in element of the trigger mechanism to restore it to an operative condition which arrests continuous firing.

2. In an automatic firearm, the combination with an action and a trigger mechanism of a control device including a straight edged cam member, an axle member extending transversely of said action and about which said cam member is mounted to turn, said cam member being intermittently turned about said axle by engagement of said action while moving in one direction in order to ensure that said trigger mechanism will automatically arrest firing immediately after a predetermined number of cartridges has been discharged in a burst of continuous firing, said control device being positively constrained from movement immediately after each intermittent

actuation by one of its edges being brought into contact with a surface of said action, means for biasing said control device so as to initially turn the same into operative position in relation to said action after said action has completed each forward movement thereof, said control device comprising a control member having a perimeter constituted by a series of substantially straight edges, an abutment face at or near each of the respective corners, and a striker adjacent the perimeter, said control member being rotatably mounted in juxtaposition to the firearm action, and the latter being provided with a formation for successively engaging said abutment faces, whereby during a burst of continuous firing the control member will be intermittently turned to eventually cause said striker to engage an element of the trigger mechanism and restore it to a condition to arrest the continuous fire, said straight edges of the control member being successively brought into lineal contact with a lineal surface of said action as a result of and immediately after each turning motion of the control member so that the latter is prevented from turning about its axle until it is again turned by movement of said action.

3. In an automatic firearm, the combination with a reciprocating action and a trigger mechanism, of a device for controlling continuous firing comprising a control member having a perimeter constituted by at least three substantially straight edges and provided with an abutment face at or near each corner, and with a laterally projecting striker adjacent its perimeter, said control member being rotatably mounted about an axis extending in a plane normal to the axis of said reciprocating action, said action being provided with a shoulder for engagement with said abutment faces, whereby during a burst of continuous firing the control member will be intermittently turned by the reciprocating action until such striker is caused to engage said trigger mechanism and restore it to a condition to arrest continuous fire, said edges of the control member being successively brought into lineal contact with said action immediately after each turning motion of the control member in order to maintain the latter stationary pending its next turning motion, and means for biasing said control member so as to initially turn the same into operative position in relation to said action after said action has completed each forward movement thereof.

4. In an automatic firearm according to claim 3, wherein said control member is disposed beneath said reciprocating action so that said edges of the control member engage the under surface of said action.

5. In an automatic firearm according to claim 3, wherein said reciprocating action is provided at a position in longitudinal alignment with said control member with a recess to enable the corner portions of said control member to enter said recess during the intermittent turning motions of the control member, said recess terminating at one end in said shoulder for engaging said abutment faces.

6. In an automatic firearm, the combination with a reciprocating bolt having a bent and a trigger mechanism adapted to actuate a sear for co-operating with said bent, of a device for controlling continuous firing, comprising a control member having substantially straight-edges, means for rotatably mounting said control member about an axis extending transversely of said bolt so that said edges may make lineal contact with a surface of said bolt in a lengthwise direction thereof, abutment faces located one adjacent each corner of said control member, a shoulder formation on said bolt for successively engaging said abutment faces during recoil of said bolt thereby intermittently to turn said control member, a striker outstanding from said control member, a connector extending between said trigger mechanism and said sear and having a portion disposed in the path of said striker, and means for biasing said control member so as to initially turn the same into operative position in relation to said action after said action has completed each forward movement thereof.

7. In an automatic firearm, the combination with a reciprocating action and a trigger mechanism, of a device for controlling continuous firing comprising a control member having a perimeter constituted by at least three substantially straight edges and provided with an abutment face at or near each corner, and with a laterally projecting striker adjacent its perimeter, said control member being rotatably mounted about an axis extending in a plane normal to the axis of said reciprocating action, said action being provided with a shoulder for engagement with said abutment faces, whereby during a burst of continuous firing the control member will be intermittently turned by the reciprocating action until such striker is caused to engage said trigger mechanism and restore it to a condition to arrest continuous fire, said edges of the control member being successively brought into lineal contact with said action immediately after each turning motion of the control member in order to maintain the latter stationary pending its next turning motion, and a spring arranged to initiate each intermittent turning action of said control member.

8. In an automatic firearm, the combination with a reciprocating action and a trigger mechanism of a control device including a straight edged cam member, mounted to turn about an axis extending transversely of said action, means associated with said cam member intermittently engageable by said action whereby said cam member is intermittently turned about said axis during movement of the action in one direction, further means associated with said cam member adapted to engage an element of said trigger mechanism to ensure that said trigger mechanism will automatically arrest firing immediately after a predetermined number of cartridges has been discharged in a burst of continuous firing, said control device being positively constrained from movement immediately after each intermittent actuation by one of its edges being brought into linear contact with a surface of said action, and means for biasing said control device so as to initially turn the same into operative position in relation to said action after said action has completed its said movement in one direction.

9. In an automatic firearm, the combination with an action and a trigger mechanism of a control device, said control device comprising a rotary member having a perimeter constituted by a series of angularly related edges, an abutment face between each adjacent two of said edges, and a striker outstanding from the perimeter, the rotary member being so mounted and disposed as to be repeatedly and intermittently turned by direct contact of a member of the firearm action with the successive abutment faces

during a burst of continuous firing, intermittent turning of said rotary member bringing successive edges of said latter member into lineal contact with said action member said lineal contact locking said rotary element against undesired turning between each turning motion; said striker after at least two successive turning motions of the rotary member, engaging an element of the trigger mechanism to restore it to an operative condition to arrest continuous firing.

10. In an automatic firearm, the combination with an action and a trigger mechanism of a control device, said control device comprising a control member having a perimeter constituted by a series of substantially straight edges, an abutment face at or near each of the respective corners, and a striker adjacent the perimeter, said control member being rotatably mounted in juxtaposition to the firearm action, and the latter being provided with a formation for successively engaging said abutment faces, whereby during a burst of continuous firing the control member will be intermittently turned to eventually cause said striker to engage an element of the trigger mechanism and restore it to a condition to arrest the continuous fire, intermittent turning of said control member bringing successive straight edges into lineal contact with a surface on said action member to lock said rotary member against undesired turning pending its next turning motion.

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