Jan. 21, 1958 J. GERICK 2,820,401

MACHINE GUN ANTI-JAMMING DEVICE

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FIG. 1.

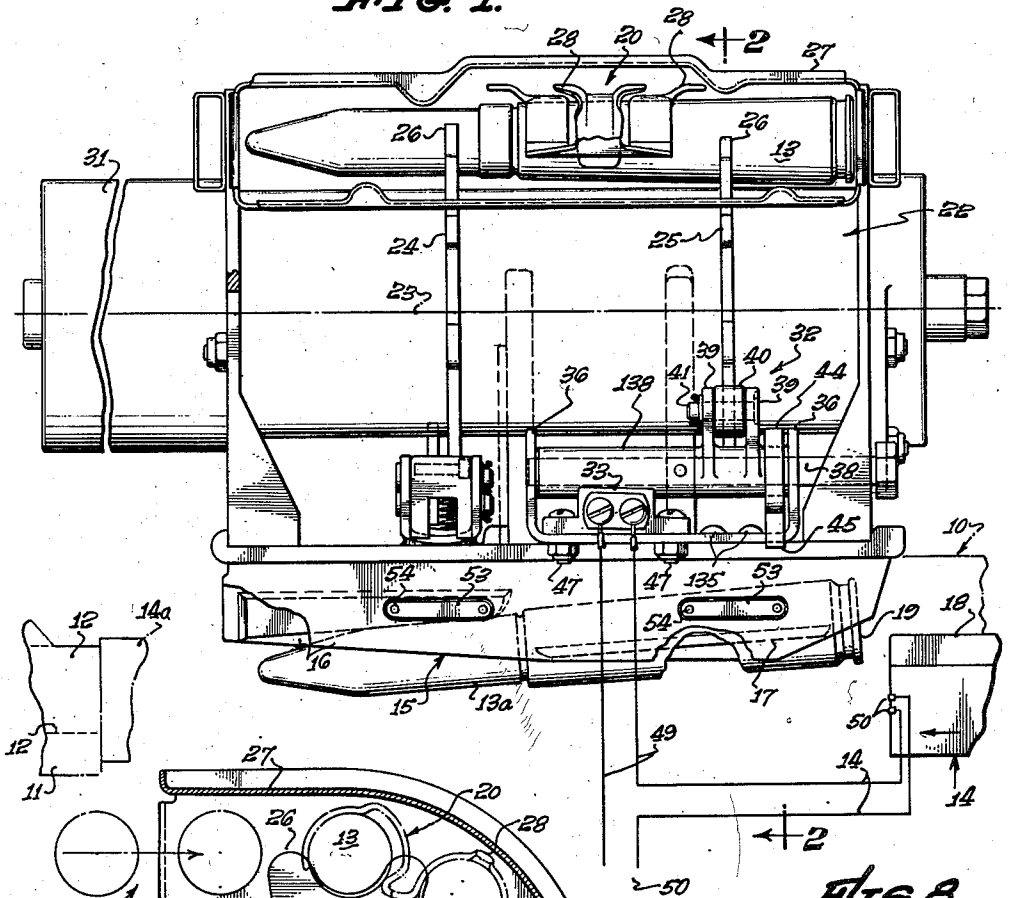


FIG. 2.

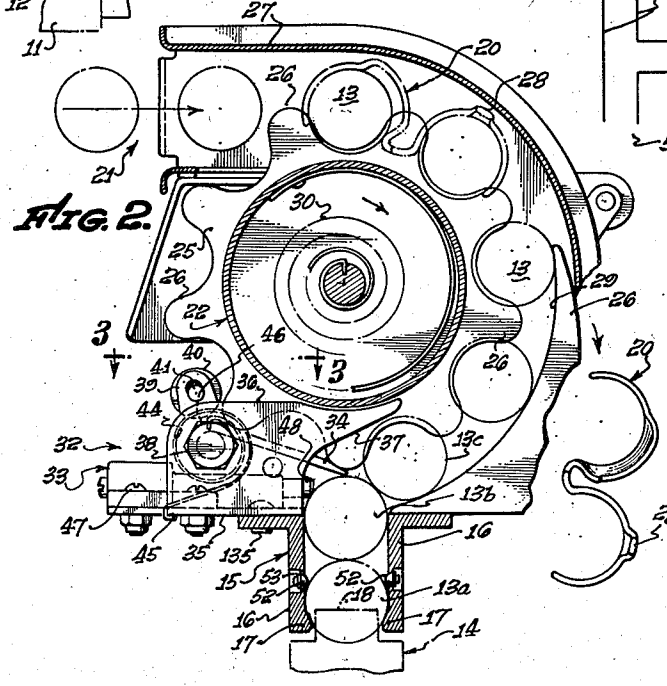
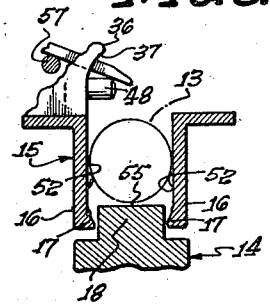


FIG. 8.



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MACHINE GUN ANTI-JAMMING DEVICE

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FIG. 3.

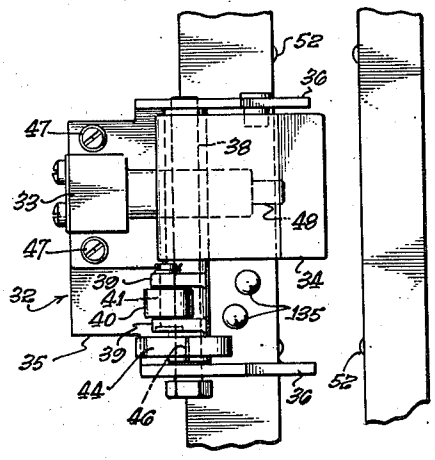


FIG. 4.

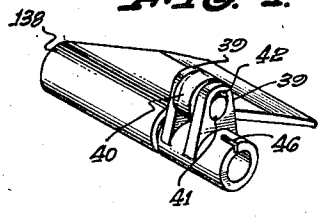


FIG. 5.

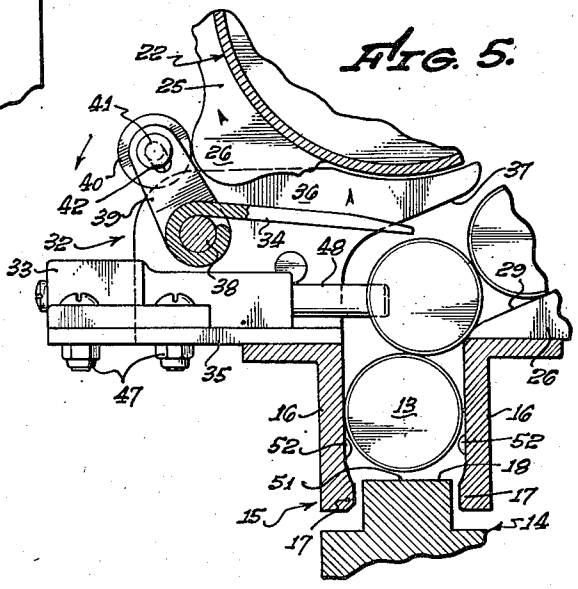


FIG. 6.

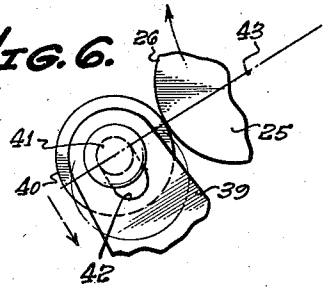
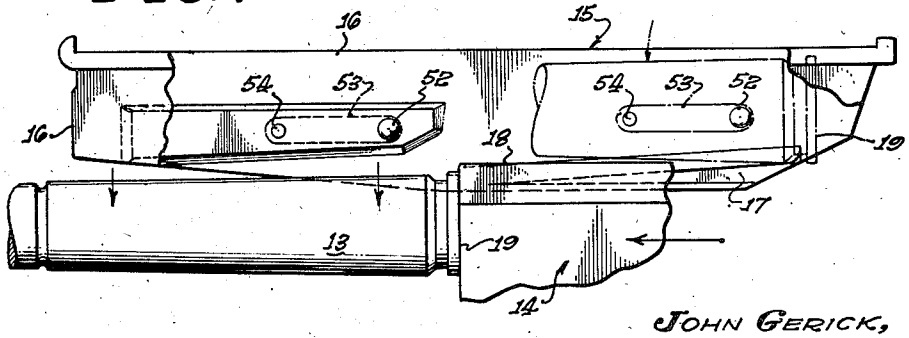


FIG. 7.



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2,820,401

MACHINE GUN ANTI-JAMMING DEVICE

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Application May 17, 1954, Serial No. 430,159

10 Claims. (Cl. 89—33)

This invention relates to improved apparatus for preventing the jamming of machine guns.

In certain types of machine guns, as for instance in conventional 20 mm. guns, the mechanism for feeding shells or rounds of ammunition to the barrel may under some circumstances stick or hang up for a short interval, and as a result the entire gun may become jammed. The greatest difficulties caused by such improper feeding result when the feeding mechanism only partially advances a shell toward a position at which it is to be picked up by the bolt of the gun for firing, so that the bolt improperly engages the shell, and instead of moving it into firing position in the barrel, damages the shell and displaces it in a manner jamming and often seriously damaging the gun.

The general object of the present invention is to provide means for positively preventing such jamming of a machine gun. This result is achieved in part by providing control apparatus acting to automatically interrupt the firing of the gun if the feeding mechanism fails to advance a shell properly to a predetermined position along the path leading toward firing position. More specifically, an electric switch is positioned to be actuated by a shell when advanced to that predetermined position, but will automatically break the firing circuit and interrupt the firing of the gun if a shell is not so positioned.

To further assure against jamming, the present apparatus includes an auxiliary shell advancing element which acts to urge a leading shell toward loading position even though the main feed mechanism may fail. Preferably, this element is spring urged in a shell advancing direction, and is intermittently and automatically retracted out of the shell path as a shell is advanced to a point at which the element may act against it. For thus retracting the auxiliary advancing element, I provide timed actuating means which act against the element in a manner other than by merely allowing the shells themselves to deflect the element. More specifically, the retraction may be controlled by the turning of a sprocket wheel, which is a part of the main shell advancing unit, and which functions as the primary means for engaging and advancing the shells toward loading position. The teeth of this sprocket wheel may be utilized as cam projections for actuating a cam follower associated with the auxiliary element.

A particular feature of the invention involves the formation of this cam follower to automatically circularly advance through a predetermined limited extent relative to the sprocket wheel, after passing the peak of a sprocket tooth, to thereby assure return of the auxiliary element from a retracted position to an active position in time for giving the desired advancing boost to a shell. To effect such advancement, the cam follower, usually a roller, is mounted for bodily shifting movement relative to the carrier to which it is attached.

In connection with the previously mentioned safety control switch which controls the firing circuit of the gun, this switch is preferably so located as to respond to positioning of a shell at a location to be acted against by the above discussed auxiliary shell advancing unit. That is, if there is no shell positioned beneath the auxiliary advancing element, the firing circuit is automatically broken and the firing of the gun stopped.

The above and other features and objects of the present invention will be better understood from the following detailed description of the typical embodiment illustrated in the accompanying drawings, in which:

Fig. 1 is a fragmentary side view of the shell feeding mechanism of a machine gun constructed in accordance with the present invention;

Fig. 2 is a transverse vertical section taken on line 2—2 of Fig. 1;

Fig. 3 is a fragmentary view taken on line 3—3 of Fig. 2;

Fig. 4 is a perspective view of the shell advancing antijamming element;

Fig. 5 is an enlarged fragmentary sectional view showing the position of the shells and other parts near the end of a shell advancing actuation of the bolt;

Fig. 6 is a further enlarged fragmentary view of the cam and cam follower, in a position advanced slightly beyond that of Fig. 5;

Fig. 7 is a fragmentary side view of the bolt and shell during advancement of the bolt into the barrel; and

Fig. 8 is a fragmentary transverse sectional view showing the position in which a final shell remains when all but one shell in the gun have been fired.

In the drawings, I have shown fragmentarily a machine gun, typically a conventional 20 mm. machine gun, equipped with antijamming mechanism constructed in accordance with the invention. Referring particularly to Fig. 1, the gun includes a body typically represented at 10 and carrying the usual firing barrel 11 containing a shell receiving bore 12. The shells 13 are successively displaced forwardly from the position of the lower shell in Fig. 1 and into the open rear end of barrel 11, by a bolt 14. This bolt is mounted for movement axially of barrel 11 between the rear full line position of Fig. 1 and a forward broken line position designated 14*a* in Fig. 1, in which latter position the bolt closes the rear end of barrel 11 for firing of the shell advanced into the barrel.

The lower shell in Fig. 1 is shown suspended in a slightly inclined loading position 13*a* in which position the shell is supported by a cradle member 15 having a pair of vertical side walls 16 forming a shell receiving passage which is open at its upper and lower sides and extends axially of the barrel. Side walls 16 of the cradle member have a pair of inwardly projecting inclined elongated lugs 17, whose upper surfaces are curved essentially in correspondence with the outer surface of shells 13, and which act to extend beneath and support a shell 13 in the loading position of Fig. 1. In the loading position, a shell 13 is supported somewhat above the axis of barrel 11, but is directed downwardly toward the open rear end of the barrel. The bolt 14 has an upwardly projecting portion 18 which engages the bottom portion of the rear face 19 of a shell in loading position, to actuate the shell forwardly into the barrel upon forward movement of the bolt.

The shells are supplied to the gun as an interconnected series, with successive shells being articulately joined together by a plurality of conventional clips 20. Each of these clips has two arcuate portions extending about the two adjacent shells interconnected by that particular clip, these arcuate portions being resilient and adapted to be stripped from the shells by the feeding mechanism. The series of shells are advanced from an intake location 21 to the location of cradle 15 by rotation of a feeding drum 22, which is mounted for rotation about an axis 23

extending parallel to the axis of barrel 11. Drum 22 carries a pair of axially spaced sprocket wheels 24 and 25, having circularly and evenly spaced teeth 26 between which are received the shells 13.

A housing member 27 extends about one side of drum 22, to enclose the shells as they are advanced by the drum toward the cradle. The shells are advanced about the drum from its upper side downwardly to the cradle, and as they reach approximately a vertical midway point of their travel, they engage a pair of strippers 26, which act to engage ears 28 on the advancing clips, and thereby progressively strip the clips from the shells. The housing 27 is open at the location of strippers 26, to allow the clips 20 to fall into a suitable container. The inner surfaces 29 of strippers 26 are curved about the axis of drum 22, and act as guide surfaces for directing the shells downwardly into cradle 15 after the spring clips have been removed from the shells. The shell feeding drum 22 is yieldingly urged in a shell advancing clockwise direction as seen in Fig. 2 by an internal spring represented typically at 30, this spring being continuously kept in tightened or wound condition, as by an electric winding motor 31.

The mechanism thus far described is all conventional and of the type commonly provided on 20 mm. machine guns. The present invention is concerned with the provision on such machine guns of special antijamming mechanism represented at 32 in the figures. This mechanism includes an electric switch 33 which is connected into the firing circuit of the gun for breaking that circuit if the feeding mechanism fails, and includes also a spring actuated auxiliary feed finger 34, for assuring positive actuation of the two leading shells into loading positions if drum 22 fails to do so. Both of these antijamming elements may be mounted to a supporting plate 35, which is attached by suitable screws 135 or other means to cradle 15. Plate 35 is turned upwardly at its opposite ends, to form a pair of parallel support elements 36 extending transversely of the gun axis and having curved inner surfaces 37 coacting with surfaces 29 of strippers 26 for guiding the advancing shells downwardly into cradle 15.

An elongated mounting shaft 38 (typically taking the form essentially of a long bolt) extends through support elements 36, and is mounted thereby in parallel relation to the axis of the gun. This shaft 38 acts to pivotally mount the shell advancing finger 34 for swinging movement about the axis of the shaft. For this purpose, the part which forms finger 34 has an integral tubular portion 138, which extends and is rotatable about shaft 38. Both this tubular portion 138 and finger 34 have extended lengths axially of the gun, as will be seen in the figures. Projecting upwardly from tubular portion 138 of the finger carrying element, there are formed a pair of parallel arms 39, which act to rotatably mount a cam following roller 40, carried on a shaft 41. Shaft 41 extends parallel to the axis of the gun, and has its opposite ends received within parallel elongated slots 42 formed in arms 39, to mount the roller for limited bodily movement radially of shaft 38. This limited bodily movement of the roller may also be defined as being in a direction perpendicular to a line 43 (see Fig. 6) extending between the roller and the center of drum 22. Roller 40 engages the outer surfaces of teeth 26 on sprocket wheel 25, so that those sprocket teeth act as cams for pivoting the parts 34, 138, 39, 40 about shaft 38 in accordance with the shell advancing rotation of drum 22. This sprocket or cam actuation of the specified part acts to swing finger 34 upwardly out of the path of advancing shells as they are moved by the drum 22 between the 13*c* and 13*b* positions of Fig. 2. The finger 34 and parts integral therewith are yieldingly urged in a clockwise direction as seen in Figs. 2, 5 and 8 by a coil spring 44, whose opposite ends bear against plate 35 at 45, and tubular portion 138 of the finger element 34 at 46. Such clockwise or downwardly actuation of finger 34 is limited in the Fig. 8 position of that finger by its engagement with a stop pin 57 carried by one of the upwardly projecting support elements 36.

Switch 33 is suitably mounted to plate 35, as by screws 47, and is actuated between open and closed conditions by horizontal movement of an axially movable elongated actuating pin 48, between the full line and broken line positions of Fig. 5. In the broken line position of this pin as seen in Fig. 5, the switch 33 is open, but when deflected to the left to the full line position of that figure, the switch is closed. Such actuation of the switch is effected by advancement of a shell to the position of the second round or shell in Fig. 5. Switch 33 is connected into a firing control circuit of the gun by leads 49, which circuit includes power source 50, and means energized by the power source to fire or control firing of the gun. When this firing circuit is broken, the firing of the gun is automatically interrupted. Usually, the firing control circuit includes contacts 50 at the forward side of the bolt which act to engage the rear of shell 13 when the round and bolt are in firing position, and are fed current from the power source to the round, to fire the round.

To now describe the operation of the illustrated apparatus, assume first that the bolt 14 is in the retracted position of Fig. 1, and that rounds are in the position illustrated in that figure and Fig. 2. From this Fig. 1 position, bolt 14 is advanced forwardly through the position of Fig. 7 and to a forward firing position in which the bolt engages and closes the rear end of barrel 11 (see position 14*a* in Fig. 1). As the bolt is thus displaced forwardly, its upper portion 18 engages the back of the lowermost round 13*a* in Fig. 1, and moves that round forwardly into the barrel. During the first part of this forward bolt movement, roller 40 is free of engagement with any of the teeth on sprocket wheel 25, so that spring 44 urges finger 34 downwardly against the second round 13*b*, to yieldingly and positively hold rounds 13*a* and 13*b* in their Fig. 2 positions even though drum 22 may temporarily be jammed or hung up in a position such that the drum itself does not hold these rounds in their desired positions. Normally, of course, the drum induced force exerted against shell 13*b* by the next successive shell 13*c* acts to hold shells 13*a* and *b* in their desired loading positions, finger 34 merely being provided as a safety device, to position the rounds in the event of temporary failure of the drum 22.

Fig. 7 represents the point at which bolt 14 has moved 13*a* just beyond cradle lugs 17, so that the round may be forced down from its inclined position on the cradle 15, for advancement directly axially into the barrel. At this Fig. 7 point, roller 40 is first engaged by a leading side of one of the sprocket teeth 26, to commerce upward actuation of finger 34. The roller then progressively rides up the leading side of that sprocket tooth through the position of Fig. 5, to actuate the finger 34 upwardly out of the path of the shell positioned at 13*c* in Fig. 2, to allow that shell to advance to a position beneath finger 34 and into engagement with switch actuating pin 48. The spring force exerted against drum 22 effects such advancement of the round, as permitted by the displacement of the originally lowermost round from its loading position 13*a* into the barrel. Such actuation of the round in Fig. 5 with the pin 48 closes the firing circuit of the gun, so that the round in the barrel may be fired when ready. The round which had originally been in the position of 13*b* in Fig. 2 advances downwardly into engagement with the upper surfaces 51 of the bolt, and is supported by this bolt surface until the bolt has retracted to the Fig. 1 position.

Fig. 6 represents the position in which roller 40 is riding at approximately the peak or highest point of a tooth 26 of the sprocket wheel. This point is preferably reached at approximately the time of firing the round in the barrel. As the roller advances very slightly beyond the peak of tooth 26, the roller moves bodily downwardly as seen

in Fig. 6 through the limited extent permitted by slots 42 (such movement of the roller being effected by the camming action of the rear side of the tooth against the roller), so that the roller is in effect advanced circularly along the sprocket in a manner speeding the descent of the roller along the trailing side of the tooth. This automatically advances the downward displacement of finger 34 against the adjacent round, to assure actuation of the two leading shells to the loading positions of 13*a* and 13*b* of Fig. 2 prior to the next forward movement of the bolt. It has been found that this automatic advancement of finger 34 relative to the actuating sprocket wheel 25 is highly desirable, in order to positively prevent jamming of the device.

Fig. 8 illustrates the manner in which a final round is supported in the cradle 15, when all but one of the supply of rounds have been fired. This final shell of Fig. 8 is engaged by two pairs of ball detents 52 projecting inwardly from side walls 16 of the cradle, at locations to engage the underside of the last round and support it just above the bolt. Ball detents 52 may be hemispherical in shape, and resiliently actuated into holding positions within the round passing space by individual leaf springs 53, attached at first ends 54 to the cradle structure, and carryng ball detents 52 at their opposite ends. In the position in which the last round is supported by the ball detents, the lowermost portion of this round is spaced above the upper surface of the bolt at 55 a distance which is small, but which is sufficient to assure against engagement of the bolt with the round during movement in either direction. During normal operation of the gun, the round advanced downwardly within cradle 15 of course acts to resiliently deflect ball detents 52 to pass by them into loading position.

I claim:

1. A machine gun comprising a gun barrel, a reciprocating bolt acting to successively engage a series of rounds of ammunition and displace them into said barrel for firing, a rotating ammunition advancing unit operable to progressively advance a series of rounds to a predetermined loading position in the path of said bolt for displacement thereby into the barrel, a movable anti-jamming member operable to engage one of said rounds which is near said loading position and urge said one round in a direction to advance a leading round to said position even though said advancing unit may be jammed, a spring yieldingly urging said anti-jamming member in ammunition advancing direction, and means for actuating said anti-jamming member in predetermined timed relation with said advancing unit in a direction to retract said anti-jamming member against the force of said spring out of the path of a round which is being advanced by said rotating unit into position for engagement by the anti-jamming member, said means being constructed to retract said anti-jamming member in timed relation to said rotating unit even though no round is present in the gun, said rotating unit including a rotating cam structure having cam projection means turning in accordance with the advancement of said rounds, said actuating means comprising a cam follower engaging and actuable by said cam projection means and acting to retract said anti-jamming member in accordance with the rotation of said cam structure, and means mounting said cam follower for deflection by said projection means transversely of the direction of movement of said projection means, and for limited movement in the same general direction as said projection means to effect a timing advancement of the follower after it passes the peak of said projection means.

2. A machine gun as recited in claim 1, including means forming an electric circuit controlling firing of the gun, and a switch controlling said circuit positioned to be actuated by a round which is in position to be acted against by said anti-jamming member and acting to interrupt firing of the gun when no round is so positioned.

3. A machine gun comprising a gun barrel, a reciprocating bolt acting to successively engage a series of rounds of ammunition and displace them into said barrel for firing, a rotating ammunition advancing unit operable to progressively advance a series of rounds to a predetermined loading position in the path of said bolt for displacement thereby into the barrel, a movable anti-jamming member operable to engage one of said rounds which is near said loading position and urge said one round in a direction to advance a leading round to said position even though said advancing unit may be jammed, a spring yieldingly urging said anti-jamming member in ammunition advancing direction, and means for actuating said anti-jamming member in predetermined timed relation with said advancing unit in a direction to retract said anti-jamming member against the force of said spring out of the path of a round which is being advanced by said rotating unit into position for engagement by the anti-jamming member, said means being constructed to retract said anti-jamming member in timed relation to said rotating unit even though no round is present in the gun, said rotating unit having outwardly projecting teeth between which said rounds are received and by which the rounds are advanced, said actuating means comprising means engageable and deflectible by said teeth for retracting said anti-jamming member in accordance with the rotation of said ammunition advancing unit.

4. A machine gun comprising a gun barrel, a reciprocating bolt acting to successively engage a series of rounds of ammunition and displace them into said barrel for firing, a rotating ammunition advancing unit operable to progressively advance a series of rounds to a predetermined loading position in the path of said bolt for displacement thereby into the barrel, a movable anti-jamming member operable to engage one of said rounds which is near said loading position and urge said one round in a direction to advance a leading round to said position even though said advancing unit may be jammed, a spring yieldingly urging said anti-jamming member in ammunition advancing direction, and means for actuating said anti-jamming member in predetermined timed relation with said advancing unit in a direction to retract said anti-jamming member against the force of said spring out of the path of a round which is being advanced by said rotating unit into position for engagement by the anti-jamming member, said means being constructed to retract said anti-jamming member in timed relation to said rotating unit even though no round is present in the gun, said rotating unit having outwardly projecting curved surface teeth between which said rounds are received and by which the rounds are advanced, said actuating means comprising a cam follower roller engaging and actuable by said teeth, a member carrying said roller and movable radially of said rotating unit with the roller upon deflection thereof by said teeth, means operatively connecting said roller carrying member to said anti-jamming member to actuate it in accordance with said deflection, and means mounting said roller for limited bodily movement relative to said roller carrying member in a direction generally tangential to the teeth of said unit.

5. A machine gun as recited in claim 4, in which said roller carrying member comprises a swinging arm rigidly carried by said anti-jamming member, there being means mounting said anti-jamming member and said roller carrying arm for swinging movement about an axis extending essentially parallel to the axis of said rotary unit.

6. A machine gun as recited in claim 5, including means forming an electric circuit controlling firing of the gun, and a switch controlling said circuit positioned to be actuated when a round is in position to be acted against by said anti-jamming member and acting to interrupt firing of the gun when no round is so positioned.

7. An anti-jamming unit for use in a machine gun comprising a gun barrel, a reciprocating bolt acting to

successively engage a series of rounds of ammunition and displace them into said barrel for firing, and a rotating ammunition feed mechanism operable to progressively advance a series of rounds to a predetermined loading position in the path of said bolt for displacement thereby into the barrel; said unit including a movable anti-jamming member operable to engage one of said rounds which is near said loading position and urge said one round in a direction to advance a leading round to said position even though said feed mechanism may be jammed, yielding means urging said anti-jamming member in ammunition advancing direction, and actuating means operable by said feed mechanism to actuate said anti-jamming member in predetermined timed relation therewith in a direction to retract said anti-jamming member against the force of said yielding means out of the path of a round which is being advanced by the feed mechanism into position for engagement by the anti-jamming member, said means being constructed to retract said anti-jamming member in timed relation to said rotating unit even though no round is present in the gun, said feed mechanism having cam projections which engage and advance the rounds, said actuating means comprising an arm formed integrally with said anti-jamming member and mounted to swing therewith, and a roller carried by said arm for rotary movement and for limited lateral movement and engaged and actuated by said cam projections.

8. A machine gun comprising a gun barrel, a reciprocating bolt acting to successively engage a series of rounds of ammunition and displace them into said barrel for firing, a rotating ammunition advancing unit operable to progressively advance a series of rounds to a predetermined loading position in the path of said bolt for displacement thereby into the barrel, a movable anti-jamming member operable to engage one of said rounds which is near said loading position and urge said one round in a direction to advance a leading round to said position even though said advancing unit may be jammed, a spring yieldingly urging said anti-jamming member in ammunition advancing direction, and means for actuating said anti-jamming member in predetermined timed relation with said advancing unit in a direction to retract said anti-jamming member against the force of said spring out of the path of a round which is being advanced by said rotating unit into position for engagement by the anti-jamming member, said means being constructed to retract said anti-jamming member in timed relation to said rotating unit even though no round is present in the gun, said rotating unit having a series of circularly spaced cam projections turning therewith, said actuating means comprising means engageable and deflectible by said projections for retracting said anti-jamming member in accordance with the rotation of said ammunition advancing unit.

9. A machine gun comprising a gun barrel, a reciprocating bolt acting to successively engage a series of rounds of ammunition and displace them into said barrel for firing, an ammunition advancing unit operable to progressively advance a series of rounds to a predetermined loading position in the path of said bolt for displacement thereby into the barrel, a movable anti-jamming member operable to engage one of said rounds which is near said loading position and urge said one round in a direction to advance a leading round to said position even though said advancing unit may be jammed, a spring yieldingly urging said anti-jamming member in ammunition advancing direction, and means for actuating said anti-jamming member in predetermined timed relation with said advancing unit in a direction to retract said anti-jamming member against the force of said spring out of the path of a round which is being advanced by said rotating unit into position for engagement by the anti-jamming member, said means being constructed to retract said anti-jamming member in timed relation to said rotating unit even though no round is present in the gun, said ammunition advancing unit having a rotary cam structure rotatably driven thereby and having cam projection means, said actuating means comprising a cam follower engaging and actuable by said cam projection means and acting to retract said anti-jamming member in accordance with the rotation of said cam structure, and means mounting said cam follower for deflection by said projection means, and for limited movement in the same general direction as said projection means to effect a timing advancement of the follower after it passes the peak of said projection means.

10. A machine gun comprising a gun barrel, a reciprocating bolt acting to successively engage a series of rounds of ammunition and displace them into said barrel for firing, a rotating ammunition advancing unit operable to progressively advance a series of rounds to a predetermined loading position in the path of said bolt for displacement thereby into the barrel, a guide structure beneath said rotary structure through which the rounds advance downwardly to said loading position, said guide structure being adapted to hold a first round at said loading position and a second round above said loading position, a movable anti-jamming member operable to engage said second round and urge it and said first round downwardly and to thereby advance the first round to said loading position even though said advancing unit may be jammed, means forming an electric circuit controlling firing of the gun, and a switch controlling said circuit positioned to be actuated by said second round when that round is in position to be urged downwardly by said anti-jamming member, and acting to interrupt firing of the gun when no round is so positioned.

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