Dec. 29, 1959 I. R. BARR 2,918,847

MACHINE GUN

Filed Feb. 16, 1955 2 Sheets-Sheet 1

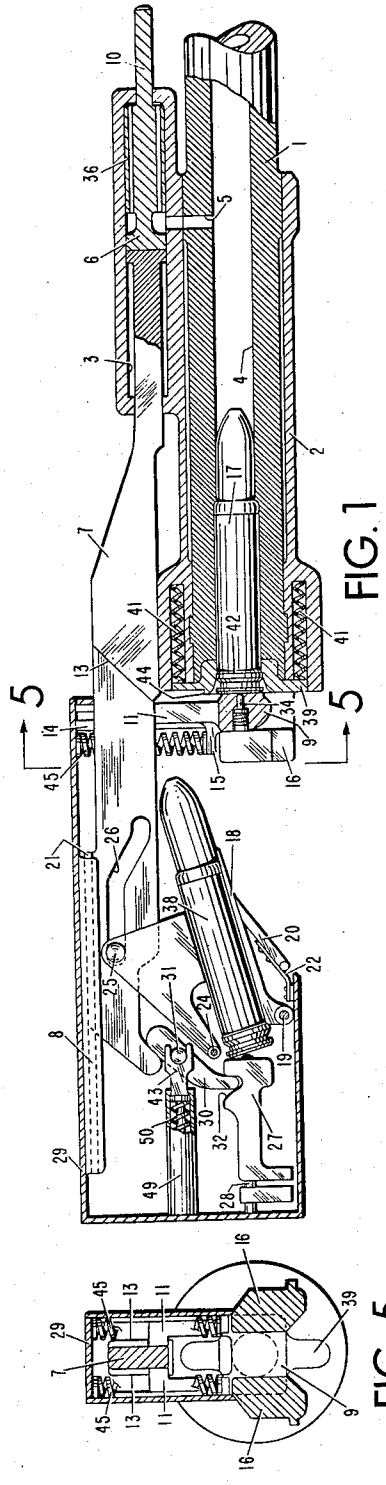

FIG. 1

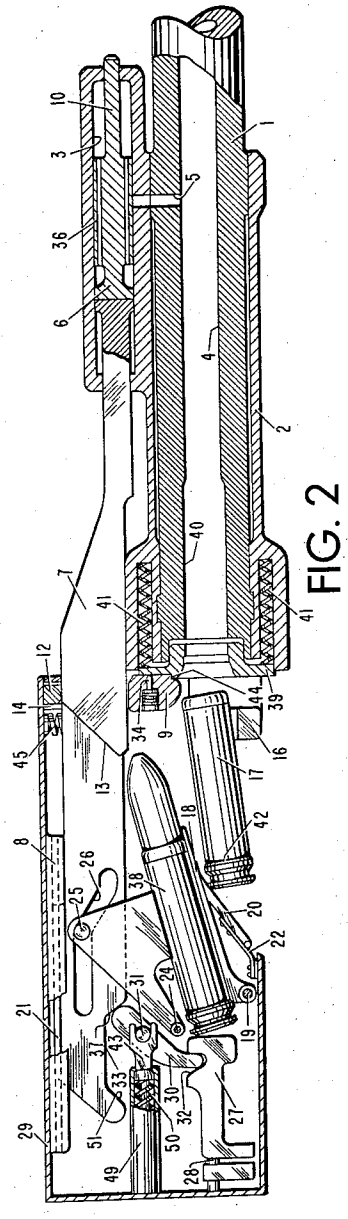

FIG. 2

FIG. 5

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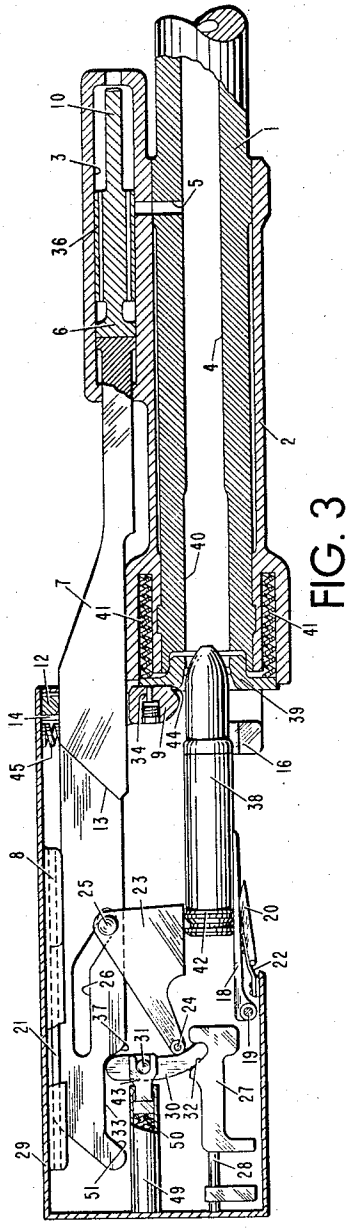

FIG. 3

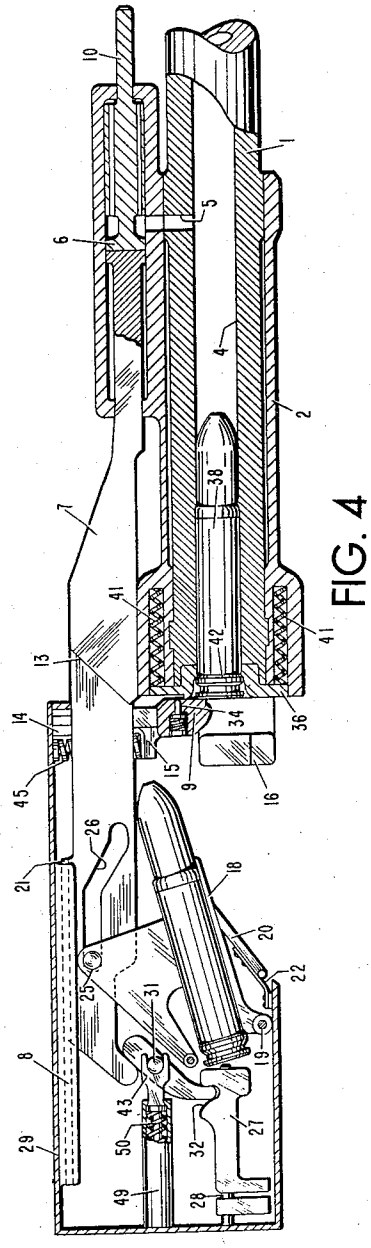

FIG. 4

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MACHINE GUN

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13 Claims. (Cl. 89—125)

This invention relates to machine guns, and more particularly to a machine gun having a high rate of fire coupled with a light and compact configuration.

For certain military purposes, particularly in high speed combat aircraft, it is important to provide machine guns having an extremely high rate of fire. It is also essential that such guns be light and compact because of the limitations imposed on these factors by the design characteristics of combat aircraft. The conventional guns presently in use utilize a reciprocating bolt moving axially with respect to the bore of the gun to extract the empty cartridge case from the gun chamber on the aft stroke and to push a new cartridge into the chamber on the forward stroke. This reciprocating action of the bolt establishes the rate of fire for the gun. Obviously, the stroke of such a bolt must be slightly longer than the cartridge in order to allow ejection and insertion of a new cartridge in the chamber. Since the stroke of the bolt is fixed by the length of the ammunition used, any increase in the rate of fire must be accomplished by increasing the velocity of the bolt. This, in turn, results in increased accelerations in the bolt and the other moving parts of the gun mechanism, so that the maximum rate of fire is determined by the maximum permissible accelerations in the moving parts.

The present invention overcomes this limitation by providing a sliding breech block arrangement and a short stroke rammer for loading the cartridge into the chamber. Utilization of a sliding breech block allows the use of the residual gas pressure in the barrel to blow the spent case from the chamber, thus eliminating the need for an extractor. Because of the short distances which the breech block and the rammer are required to move, an extremely high rate of fire may be obtained without increasing the velocities of the moving parts above the permissible limits.

It is the object of this invention therefore, to provide a machine gun having a high rate of fire.

In the drawing:

Figure 1 is a sectional view of a gun constructed in accordance with this invention showing a round in the chamber of the gun with the breech block closed for firing.

Figure 2 is a sectional view showing the breech block open and an empty cartridge case striking the deflector plate after having been expelled from the chamber by residual gas pressure remaining in the barrel of the gun after firing.

Figure 3 is a sectional view showing a new round traveling forward into the chamber after having been accelerated by the rammer and being guided by the cartridge guide which has moved the round into alignment with the bore of the gun.

Figure 4 is a sectional view showing the new round in the chamber, having disengaged the latch from the breech block to allow it to close behind the round in position for firing.

Figure 5 is a cross-section taken along line 5—5 of Figure 1.

As may be seen in Figure 1, the arrangement contemplated by this invention comprises a gun barrel 1 carried in a conventional manner by a barrel support 2. A gas cylinder 3, which may be formed integrally with the barrel support 2, as shown in the drawing, connects with the bore 4 of the gun by means of a port 5. A piston 6 carried by the forward end of a slide 7 is contained within the cylinder 3. The rear end of the slide 7 is supported by a pair of slide tracks 8 which engage projections 21 which are formed integrally with the slide.

Breech block 9, which is disposed at the rear end of the barrel 1, is free to slide vertically in guide block 14 from the closed position depicted in Figure 1 to the open position shown in Figure 2.

A pair of upstanding arms 11 carried by the breech block have cam surfaces 12 formed at the upper end of each arm which are engaged by the inclined surfaces 13 on the slide 7 to lift the breech block 9 upon rearward motion of the slide. A pair of compression springs 45, best seen in Figure 5, act against lugs 15 carried by the breech block 9 to urge the block into its closed position between guide block 16 and the rear end of the cartridge case 17 as shown in Figure 1. A cartridge stop 39 is carried at the rear of chamber 40 to act as a buffer and limit the forward motion of the cartridge. The stop 39 encircles the rear of the chamber 40 and is urged toward its rear position, as shown in Figure 2, by springs 41.

A rocking cartridge guide 18 is pivoted on pin 19 for motion between an inclined position as in Figure 1 and an aligned position with respect to the gun barrel 1 as shown in Figure 3. Deflector plate 20 is urged against the bottom of guide 18 by spring 22 which acts to maintain the guide and the deflector plate in the upwardly tilted position shown in Figure 1. A tipper 23 is pivoted on pin 24 and carries a follower 25 which is engaged in cam slot 26 formed in slide 7 so that reciprocating motion of the slide will rock the tipper between upper and lower positions.

A rammer 27 axially aligned with the bore 4 of the gun barrel 1 is carried for sliding motion on guide pin 28 which is fixed to the gun housing 29. One end of a rocking lever 30, which is pivoted on pin 31, engages a slot 32 formed in the rammer 27, the other end of the lever extending into an elongated slot 33 formed in the underside of slide 7. Pin 31 is carried in yoke arm 43, which is reciprocable within tube 49 against the action of spring 50.

Beginning with a round in the chamber, the gun is fired by actuating the firing pin 34 carried within the breech block 9. Since the mechanism for actuating the firing pin is conventional and forms no part of the invention, it has been omitted from the drawing for clarity in presentation. As the projectile 35 moves past the gas port 5 in the gun barrel 1, a portion of the propelling gases enters the cylinder 3 and accelerates the piston 6 and slide 7 rearwardly. A shoulder 36 which is carried on the piston rod 10 forward of piston 6 closes the port 5 shortly after the slide has begun its rearward motion. At the same time, cam surfaces 13 on slide 7 act to lift the breech block 9 from behind the cartridge case 17. When the breech block has been lifted clear, the residual gas pressure in the bore 4 blows the cartridge case 17 rearwardly out of the barrel to be deflected downwardly and out of the gun by the deflector plate 20 which is in its upwardly tilted position. When released by the ejected cartridge case the cartridge stop 39, which has been held in its forward position by shoulder 42 on the cartridge, will be moved rearwardly by the action of springs so that projection 44 on the stop engages the underside of the breech block, locking it in the up position. Immediately thereafter, the continued rearward motion of the slide causes the cam slot 26 to force the tipper 23 downward toward its lowermost position. Simultaneously, the forward end 37 of the slot 33 in the

underside of slide 7 strikes the lever 30, driving rammer 27 forward to accelerate a new round 38 toward the barrel 1. As the round coasts forward cam slot 26 continues to move the tipper downward until the round is axially aligned with the bore 4 at which time the round is just entering the chamber.

The arrangement of piston 6 and piston rod 10 is such that practically all the energy of the gases trapped behind the piston in gas cylinder 3 when shoulder 36 closes port 5 is extracted in driving slide 7 toward its rearward position (Figure 3) so that slide 7 is powered throughout its entire stroke. After slide 7 has lifted breech block 9 and the residual gases have extracted spent round 17, slide 7 is in the position shown in Figure 2, with tipper 23 about to act on the fresh round. Before this position of slide 7 is reached, port 5 has been closed by shoulder 36 and the gases having entered in gas cylinder 3 are trapped therein because rod 10 is still closing the exhaust port. As the slide moves from the position shown in Figure 2 to the position shown in Figure 3, it is still under the influence of the gas trapped in the cylinder so that both tipper and spring 50 are effectively actuated to perform their functions. After this positive actuation of tipper 23, rod 10 is withdrawn from the exhaust port (Figure 3) and the trapped gases are vented to atmosphere, so that spring 50 which had previously been compressed can return slide 7 to its first position. Thus the gases generated upon firing a round are efficiently utilized to positively actuate component parts in the system.

As cartridge guide 18 reaches its lowermost position, the rammer 27 reaches the limit of its forward travel, preventing further rotation of lever 30, so that spring 50 is compressed and then reacts to accelerate slide 7 forwardly to continue the cycle. If desired, additional means may be included to accelerate the slide 7 during its forward stroke, the use of a portion of the propelling gases from the gun barrel being suitable for this purpose. As the slide 7 approaches the forward limit of its travel, the rear end 51 of the slot 33 strikes lever 30, returning the rammer 27 to its rearmost position in readiness to accelerate the next round as the action of the gun continues. The breech block 9, at this point, is held open by the projection 44 on the cartridge stop 39 as in Figure 3. Thus, cartridge stop 39 serves as a releasable latch for breech block 9.

Meanwhile, the velocity imparted by the rammer 27 to round 38 carries the round home into the chamber 40, so that shoulder 42 on the cartridge case engages stop 39, compressing springs 41 and releasing breech block 9, which is slid downward by action of springs 45 into position behind the round so that the cycle is ready to be repeated.

The feed mechanism used to advance subsequent rounds into position in the cartridge guide as the gun is fired is of a conventional type and is consequently omitted from the drawing for clarity.

By eliminating the conventional reciprocating bolt in the above described manner, the ramming stroke can be begun almost as soon as the breech block has travelled the short distance necessary to open the breech of the gun, since the spent cartridge case is expelled from the barrel at a high velocity as soon as it is released by the breech block. Thus a substantial portion of the time interval required for a conventional reciprocating bolt to be retracted from the breech is saved and the firing rate of the gun can be markedly increased.

The arrangement described provides a simple and reliable system for reducing the time required to open the breech, remove the spent cartridge case, insert a new round, and lock the breech before firing. It eliminates the need for an extractor by allowing the spent case to be blown free of the chamber by the residual gas pressure in the gun barrel, and by a unique arrangement of a swinging cartridge guide and spent case deflector, allows a compact and light configuration in a gun having an extremely high rate of fire.

Although but one embodiment of this invention has been shown and described, it is evident that many changes and modifications may be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. A machine gun comprising a barrel, slide means responsive to gas pressure within said barrel to be reciprocated with respect thereto, closure means reciprocable transversely with respect to said barrel for closing the breech thereof, said closure means being responsive to motion of said slide to open said breech, pivoted means supported behind said barrel and responsive to reciprocating motion of said slide to be pivoted between an inclined position intersecting the axis of said barrel and a position axially aligning a cartridge with the bore of said barrel, the side of said pivoted means presented toward said breech when in said inclined position acting to deflect a cartridge case when ejected from said breech, ramming means responsive to rearward motion of said slide to impart an initial velocity to said cartridge sufficient to impel said cartridge into said breech, the other side of said pivoted means forming a guide for said cartridge during its motion into said breech, latch means for latching said closure means in open position, said latch means being engageable by said cartridge during entry of said cartridge into said breech to unlatch said closure means.

2. A machine gun comprising a barrel, slide means responsive to gas pressure within said barrel to be reciprocated with respect thereto, closure means reciprocable transversely with respect to said barrel having means cooperable with and responsive to motion of said slide to open the breech of said barrel, resilient means for urging said closure means into closed position, releasable latch means for latching said closure means in open position, pivoted means supported behind said barrel having means cooperable with and responsive to reciprocating motion of said slide to be pivoted between an inclined position intersecting the axis of said barrel and a position axially aligning a cartridge with the bore of said barrel, the side of said pivoted means presented toward said breech when in said inclined position acting to deflect a cartridge case when ejected from said breech, and ramming means having means responsive to motion of said slide to impart a velocity to said cartridge sufficient to impel said cartridge into said breech, the other side of said pivoted means forming a guide for said cartridge during its motion into said breech, said latch means having means responsive to movement of said cartridge into said breech to unlatch said closure means and allow said closure means to be moved into closed position by said resilient means.

3. An automatic firearm comprising a barrel and a slide member longitudinally reciprocable upon firing, a breech block transversely reciprocable with respect to said barrel for opening and closing the breech thereof, means responsive to rearward motion of said slide member for opening said breech while the gas pressure within said barrel due to firing is sufficient to eject the spent cartridge case from said breech, spring means acting to urge said breech block into closed position, releasable latch means effective when said breech is empty to latch said breech block in open position, means responsive to insertion of a cartridge into said breech for disabling said latch means whereby said spring means is effective to close said breech, cartridge guide means pivotally carried behind said breech for movement between an inclined position intersecting the axis of said barrel and a position aligning said cartridge in said guide with said breech, ramming means responsive to rearward motion of said slide member to impart a forward velocity to said cartridge in said guide sufficient to carry said cartridge

into said breech, and means responsive to reciprocating motion of said slide member for moving said cartridge guide means between said inclined position during ejection of said spent cartridge case to said position aligning said cartridge in said guide with said breech as said cartridge is impelled forward by said ramming means.

4. A machine gun comprising a barrel, a slide longitudinally reciprocable upon firing said gun, a transversely reciprocable breech block, spring means acting to close said breech block, cooperating cam surfaces carried by said slide and said breech block respectively, said cam surfaces being engageable upon rearward motion of said slide to open said breech block, latch means carried by said barrel for motion between latching and unlatched positions, spring means normally urging said latch means into latching position so that said latch means may latch said breech block in open position, said latch means being engageable by a cartridge inserted into the breech of said gun to be moved out of engagement with said breech block, cartridge case deflecting means responsive to reciprocation of said slide to be interposed behind said breech each time said breech is opened by rearward motion of said slide, to deflect a cartridge case ejected from said breech, cartridge guide means also responsive to reciprocating motion of said slide to be moved between an inclined position to receive a new cartridge and a position aligning said new cartridge with the bore of said barrel, and ramming means disposed behind said guide means and responsive to rearward motion of said slide to impart a forward velocity to said new cartridge sufficient to propel said new cartridge into said breech, whereby said new cartridge engages said latch means to unlatch said breech block and allow said breech block to be moved into closed position by action of the first said spring means.

5. A machine gun comprising a barrel, a slide longitudinally reciprocable upon firing said gun, a transversely reciprocable breech block, spring means acting to close said breech block, cooperating cam surfaces carried by said slide and said breech block respectively, said cam surfaces being engageable upon rearward motion of said slide to open said breech block, latch means carried by said barrel for motion between latching and unlatched positions, spring means normally urging said latch means into latching position so that said latch means may latch said breech block in open position, said latch means being engageable by a cartridge inserted into the breech of said gun to be moved out of engagement with said breech block, cartridge guide means pivoted for motion between an inclined position to receive a new cartridge and a position aligning said new cartridge with the bore of said barrel, cartridge case deflecting means pivoted for swinging motion between a first position and an inclined position behind said breech to deflect a cartridge case ejected from said breech, spring means acting to urge said deflecting means into said inclined position and against the underside of said guide means, means responsive to reciprocating motion of said slide to move said guide means between said inclined position and said position aligning said new cartridge with the said bore, and ramming means disposed behind said guide means and responsive to rearward motion of said slide to impart a forward velocity to said new cartridge sufficient to propel said new cartridge into said breech, whereby said new cartridge engages said latch means to unlatch said breech block and allow said breech block to be moved into closed position by action of the first said spring means.

6. A machine gun comprising a barrel, a breech block reciprocable transversely with respect to said barrel to open and close the breech thereof, resilient means urging said breech block into closed position, and latch means for latching said breech block in open position comprising a member mounted at the rear of said breech for axial movement with respect thereto, resilient means urging said member rearwardly, means formed on said

member for engaging said breech block to latch it into open position, and means forming an opening in said member axially aligned with said breech, the edge of said opening being engageable by the base of a round of ammunition inserted into said breech to move said member forwardly to unlatch said breech block.

7. In a device of the type described, a barrel having a breech, a breech block mounted for transverse movement from a first position blocking said breech to a second position unblocking said breech, spring means biasing said breech block to said first position, means on said barrel responsive to firing a round in the breech for causing said transverse movement, a latch on said barrel, means on said latch engageable with said breech block when in said second position to releasably retain the same thereat, and additional means on said latch adapted to be engaged by a fresh round upon its insertion into said breech to disable said first named means whereby said spring means causes said breech block to move to said first position.

8. In a device of the type described, a barrel having a breech, a breech block mounted for transverse movement from a first position blocking said breech to a second position unblocking said breech, spring means biasing said breech block toward said first position, movable actuating means responsive to firing a round in the breech for causing said transverse movement, means to releasably retain said breech block in second position while the expandable gases generated upon firing extract the spent round and until a fresh round is inserted therein, and deflecting means positioned behind and in alignment with said breech for deflecting said spent casing upon extraction of the same.

9. The device of claim 8 provided with loading means comprising means responsive to said actuating means for moving said deflecting means out of alignment after said spend round is deflected, and ram means actuated by said actuating means for inserting a fresh round into said breech.

10. The device of claim 8 having said deflecting means movably mounted, means associated therewith to hold said fresh round, means made effective by movement of said actuating means for moving said deflecting means out of alignment, and ram means responsive to further movement of said actuating means for moving said fresh round from said associated means and loading it into said breech.

11. The combination, with a machine gun having a barrel with an axially extending bore and a breech at one end, of a breech block, means mounting said breech block on said breech for movement from a first position to retain a cartridge therein during firing to a second position to effect movement of a cartridge in said breech, an actuator displaceable relative to said barrel, means on said actuator responsive to firing a cartridge for causing a rearward displacement of said actuator, means on said actuator cooperable with said breech block during initial rearward displacement for moving said breech block to said second position so that residual gas pressure within said bore will extract the cartridge, supporting and deflecting means adapted to support a fresh cartridge and normally positioned in the path of the extracted cartridge for deflecting the same, means mounting said supporting and deflecting means for movement from its normal position to a position aligned with said bore so as to provide a guide for insertion of a fresh cartridge into said breech, means responsive to final rearward displacement of said actuator for simultaneously effecting movement of said supporting and deflecting means from its normal position and imparting an acceleration to said fresh cartridge to insert the same in said breech, means for causing forward displacement of said actuator, and means for causing movement of said breech block to its first position.

12. A machine gun for firing a succession of cartridges

comprising a barrel having a breech into which a cartridge is insertable, a slide reciprocably mounted on said barrel, means responsive to gas pressure generated within the bore of the barrel when the cartridge is fired for causing rearward movement of said slide, a breech block movable from a first position closing the breech for preventing rearward movement of the cartridge as it is fired to a second position opening the breech for effecting movement of the cartridge after it is fired, means responsive to initial rearward movement of said slide for moving said breech block to the second position before the gas pressure within the bore is dissipated whereby such gas pressure ejects the cartridge in a rearwardly directed path, guide means mounted rearwardly of said breech for supporting a fresh cartridge and movable from a normal position at which the fresh cartridge is inclined with respect to the axis of said bore to a loading position at which the fresh cartridge is aligned with respect to the axis of said bore, and means responsive to final rearward movement of said slide for simultaneously imparting a forward acceleration to the fresh cartridge and moving said guide means to the loading position so that the fresh round is aligned with the axis of said bore when it enters the breech.

13. The machine gun of claim 12 wherein said guide means, when in its normal position, is in the path of the ejected cartridge and serves to deflect the same.

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