March 11, 1947. J. L. LOCHHEAD 2,417,080

CARTRIDGE FEED SYSTEM

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Fig. 1.

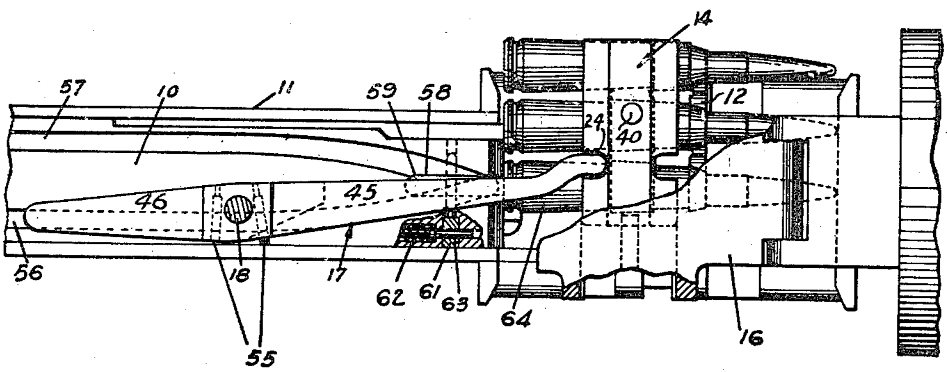
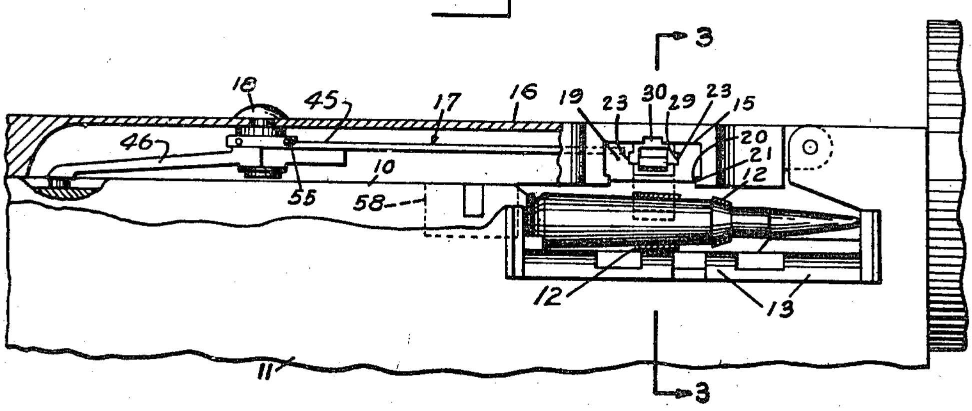


Fig. 2.



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CARTRIDGE FEED SYSTEM

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Fig. 3.

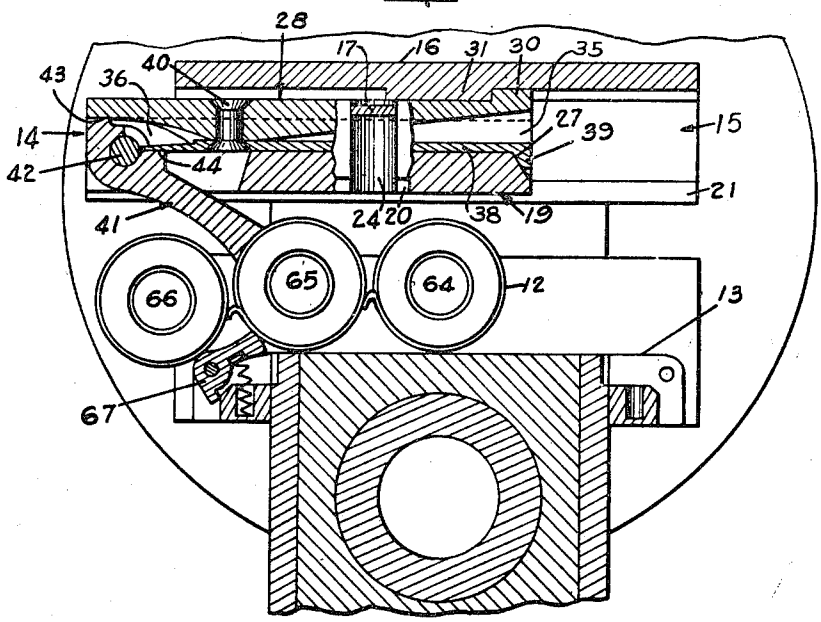


Fig. 4.

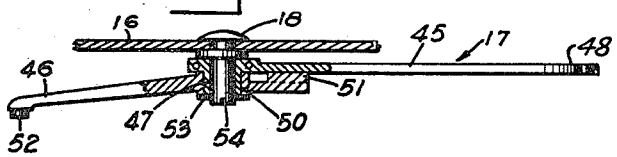
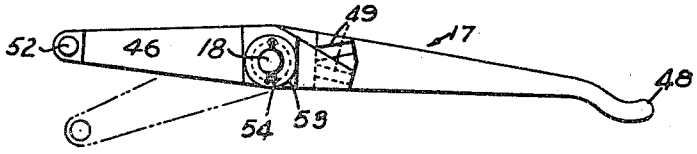


Fig. 5.



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CARTRIDGE FEED SYSTEM

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Fig. 6.

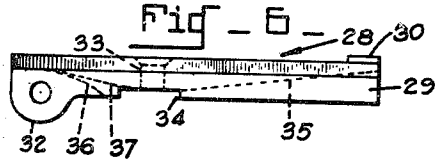

Fig. 7.

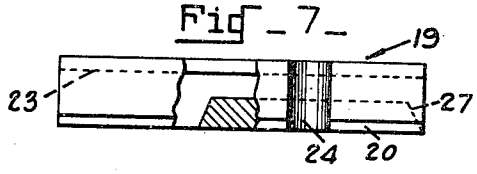

Fig. 8.

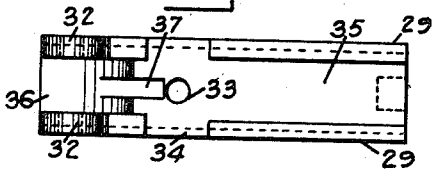

Fig. 9.

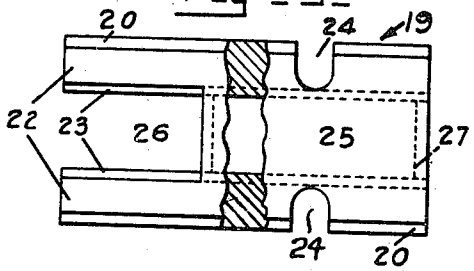

Fig. 10.

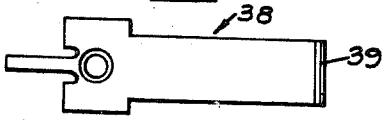

Fig. 11.

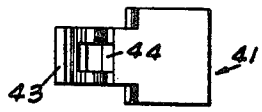

Fig. 13.

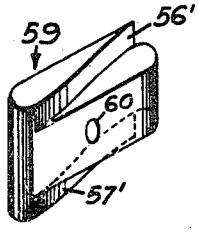

Fig. 12.

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Patented Mar. 11, 1947 2,417,080

UNITED STATES PATENT OFFICE

2,417,080

CARTRIDGE FEED SYSTEM

John L. Lochhead, Springfield, Mass., ass'gnor to United States of America, as represented by the Secretary of War

Application August 24, 1940, Serial No. 354,070

4 Claims. (Cl. 89—33)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to an improved cartridge feed system particularly adapted for use in machine guns of the Browning type.

In the present Browning type of machine gun the cartridge belt is advanced step-by-step through the feedway by a reciprocating slide and feed pawl which are actuated by a lever oscillated by the movement of a breech bolt in recoil and counterrecoil. The lever is at present oscillated in such manner that the cartridge belt advancing stroke of the slide and feed pawl is performed on the counterrecoil movement of the bolt which is objectionable in that the driving spring used to move the bolt in counterrecoil must also provide the energy for advancing the cartridge belt. The two-fold function imposed upon the driving spring by the present cartridge belt advancing system under certain conditions becomes a burden, with the result that the cyclic rate of the gun is reduced because of the weakness of the driving spring action due to the burden of both driving the bolt in counterrecoil and providing the energy to advance the cartridge belt. Under some conditions the driving spring action is so weakened as to be of insufficient strength to properly close the bolt.

It is an object of the present invention to obviate the inherent weakness of the cartridge feeding system presently employed as standard on the Browning type machine gun.

It is a further object of the invention to relieve the driving spring used in the Browning type machine gun to drive the breech bolt in counterrecoil of the additional function of providing the energy to advance the cartridge belt.

It is still a further object of the invention to use the recoil movement of the breech bolt of a machine gun, such as the Browning type, for example, to perform the cartridge belt advancing step in the cartridge feeding operation of the gun.

Another object of the invention is to utilize the force of recoil during firing to provide the source of energy for advancing the cartridge belt.

Another object of the invention is to increase the cyclic rate of a machine gun.

Still another object of the invention is to make

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possible the satisfactory feeding of cartridge belts of greater length than hitherto feasible.

Another object of the invention is to provide for the advance of the cartridge feed belt through the feedway from either the right or left hand side of the gun by the recoil movement of the breech bolt.

Still another object of the invention is to arrange the belt feed mechanism in such a manner that the belt feed pawl and the belt feed pawl reciprocating devices may relatively reciprocate with respect to each other in the event of excessive pressure being exerted on the belt feed pawl due to feeding malfunctions caused by failure to properly feed the belt or extract cartridges therefrom through premature ignition of a cartridge or cartridge of the so-called "short round" type, and similar reasons equally familiar to those acquainted with the art.

The specific nature of the invention as well as other objects and advantages thereof will clearly appear from a description of a preferred embodiment as shown in the accompanying drawings in which:

Fig. 1 is a fragmentary plan view partially in section of a machine gun of the Browning type showing the cartridge belt feeding mechanism of this invention in relation to the breech bolt in battery position;

Fig. 2 is a fragmentary elevational view partially in section of the right hand side of a machine gun of the Browning type showing the cartridge belt feeding mechanism of this invention in relation to the breech bolt in battery position;

Fig. 3 is an enlarged transverse sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is a view in elevation partially in section of the belt feed lever of this invention;

Fig. 5 is a bottom plan view of the belt feed lever of this invention showing in dashed lines how the lever may be arranged for use in feeding a cartridge belt reversely of the direction in which the lever as arranged in full lines is adapted to feed the cartridge belt;

Fig. 6 is a side elevation of the belt feed slide of this invention;

Fig. 7 is a side elevation partially broken away and in section showing the belt feed slide body of this invention;

Figs. 8 and 9 are bottom plan views of the structures shown in Figs. 6 and 7, respectively;

Fig. 10 is a plan view of a flat spring used in the belt feed slide and body assembly;

Figs. 11 and 12 are plan and elevation views, respectively, of the belt feed pawl;

Fig. 13 is a view in perspective of a reversible cut off block used in the breech bolt assembly.

Referring now to the drawings by characters of reference and more particularly to Figs. 1, 2 and 3 there is shown the cartridge belt feed mechanism of this invention as applied to a machine gun of the Browning type, although it will be understood that the principles of the invention are applicable with equal facility to any desirable machine gun or similar automatic weapon.

As in the case of all machine guns of the Browning type a breech bolt 10 is mounted in a receiver 11 for reciprocable movement in recoil and counterrecoil from and to a normal battery position, respectively, which latter position is shown in Figs. 1 and 2. In the cartridge belt feed mechanism of the present invention, as hitherto, reciprocable movement of the bolt 10 is utilized to advance the belt 12 through feedway 13 step-by-step. In the organization of the feed mechanism of the present invention, however, recoil movement of bolt 10 is utilized to advance the belt 12 instead of counterrecoil movement of the bolt as heretofore.

To this end the cartridge belt feed mechanism comprises generally a belt feed pawl assembly 14 mounted in a suitable guideway 15 located in the pivoted cover 16 over the feedway 13 for reciprocating movement transversely of the direction of reciprocation of bolt 10 and a lever 17 mounted on the cover 16 intermediate its ends by means of a stud, as indicated at 18, adapted to be oscillated by reciprocable movement of the bolt and in turn through such oscillation reciprocate the belt feed pawl assembly 14 in a manner to advance the cartridge belt during and from the force acting to move bolt 10 in recoil.

The belt feed pawl assembly 14 comprises a body member 19, which as shown in Figs. 1, 2, 3, 7 and 9, is of general channel shape in cross-section and is longitudinally grooved adjacent its lower outside corners, as indicated at 20, or otherwise suitably formed to cooperate with complementary guide elements 21 formed in the guideway 15 of cover 16 for the purpose of retaining the body member mounted within guideway 15 for reciprocable movement as shown in Fig. 2. The interior faces of the flanges 22 of body member 19 are longitudinally grooved or similarly formed as indicated at 23 to provide a guideway to receive the belt feed pawl slide for relative reciprocable movement as more particularly hereinafter described, and the outside faces of flanges 22 are provided with opposed vertically extending belt feed lever recesses 24. Also the web 25 of body member 19 is cut away, as at 26, between the flanges 22 adjacent one end portion thereof and the opposite end portion is beveled as indicated at 27 for a purpose subsequently made apparent.

The belt feed pawl assembly 14 also comprises a belt feed pawl slide 28 coextensive in length with the body member 19 and adapted to slidably fit within and be retained in the guideway of the body member through interengaging relation of the complementary grooves 23 of the body member and projections 29 on the slide 28 as clearly

shown in Fig. 2. The upper surface of slide 28 is formed with an upstanding projection 30 which extends above the upper surfaces of the flanges 22 of body member 19 in such manner as to be engageable with a projection 31 depending centrally of a longitudinal groove in the transverse surface defining guideway 15 in the cover to limit outward sliding movement of the slide as shown in Fig. 3. Upon its end portion remote from projection 30 the slide 28 is provided with transversely spaced depending axially aligned perforated ears 32. The slide 28 is perforated on and normally of its longitudinal axial line, preferably on the side of its transverse median line adjacent its end portion bearing the ears 32, as indicated at 33 and the bottom surface of the slide is formed with a transverse recess 34 disposed symmetrically with respect to the perforation as shown in Fig. 6. The bottom surface of the slide is also formed to provide a longitudinal recess 35 extending upwardly and outwardly to its rightmost end from the horizontal defining surface of recess 34 and a similar recess 36 extending upwardly and outwardly to its leftmost end from a point intermediate the recess 34 and ears 32 also as shown in Fig. 6. The surface defining the transverse wall of recess 36 is longitudinally grooved as indicated at 37 from a point inwardly from its leftmost end to and with its transverse wall coinciding with the transverse wall of recess 34.

A flat spring 38 shown in Fig. 10 of the same general configuration as and adapted to be fitted within the recessed portion of slide 28 defined by the recesses 35, 34 and groove 37 is formed with an end portion 39 disposed at the same angle with regard to its body portion as the angle of the beveled portion 27 of the body member 19. The spring 38 is secured to the slide 28 within the recessed portion defined by recesses 35, 34 and groove 37 by means of a rivet 40 as shown in Fig. 3 with its end portion 39 disposed outwardly of the recess 35.

A belt feed pawl 41 shown in Figs. 3, 11 and 12 is pivotally mounted on the ears 32 of slide 28 by means of a pin 42 and is formed with a seat 43 adapted to engage the upper surface of recess 36 of the slide to limit outward turning movement of the pawl and a seat 44 engageable by the adjacent end portion of the spring 38 in such manner as to be normally biased to a position with the seat 43 engaging the upper surface of recess 35.

The belt feed lever 17 shown in detail in Figs. 4 and 5 is comprised of two arms 45 and 46. The arm 45 at one end is formed with a projecting hub 47 and at its opposed end 48 is suitably formed to be engageable within a recess 24 of the body member 19. Arm 45 is also formed with two grooves 49 extending radially from hub 47 in proper arcuately spaced relation as more fully explained hereinafter. Arm 46 in the form of the invention herein shown is shorter than arm 45 for a purpose subsequently made apparent and is perforated at 50 adjacent one end to receive the hub 47 of arm 45. The end of arm 46 adjacent perforation 50 is formed with a projection 51 adapted to be positioned in either one of the grooves 49 of arm 45 while the opposed end of arm 46 is provided with a stud 52 projecting in opposed relation to projection 51. By the provision of the hub 47 the bearing of arm 45 on stud 18 is increased and likewise the bearing of arm 46 on the hub is substantial. The two arms

45 and 46 assembled with the perforation 50 of arm 46 receiving the hub 47 of arm 46 and the projection 51 of arm 46 positioned within either one of the grooves 49 of arm 45 are mounted on the stud 18 and secured thereon by any suitable means such as the washer 53 and pin 54. The lever 17 is mounted on the stud 18 with the stud 52 of arm 46 in depending relation and means, such as the spring actuated plungers 55 carried by the lever 17 on either side of the stud 18 coact with the cover 16 to maintain the lever in a normal position relative to the cover, when the latter is raised.

The upper surface of the breech bolt 10 is provided with cam grooves 56 and 57 operable to oscillate the lever 17 for right and left hand feed of the cartridge belt through the feedway 13, respectively. Each cam groove is extended in parallelism with the sides of the bolt from the rear end of the latter forwardly and near its forward end portion is inwardly directed in such manner as to impart pivotal movement under uniform acceleration to lever 17 when moved relative to the lever stud 52 normally disposed therein. To facilitate the use of either cam groove, both grooves 56 and 57 are designed to extend to close proximity of the forward end of the bolt where they terminate in overlapping relation symmetrically of the longitudinal median line of the bolt. That portion of the bolt 10 upon which the cam grooves 56 and 57 overlap is vertically recessed as indicated at 58 and a cut-off block 59 shown in detail in Fig. 13 is snugly receivable within the recess 58 and formed with one end surface at 56' to constitute a continuation of cam groove 56 when disposed in the recess 58 with such surface uppermost and similarly formed on its opposed end surface 57' to constitute a continuation of cam groove 57 when the latter end surface is uppermost. The cut-off block is transversely pierced as shown at 60 in Fig. 13 and is retained in position in the recess 58 by a headed pin 61 which is inserted in a perforated part 60 of the cut-off block as shown in Fig. 1.

To retain the headed pin 61 in position in the bolt 10 the forward end portion of the driving spring rod 62 is extended to pass through a transverse opening 63 in the head of pin 61 as will be clearly seen in Fig. 1.

To assemble the feed mechanism the spring 38 is secured to the belt feed pawl slide 28 and the belt feed pawl is pivotally connected to the ears 32 as shown in Fig. 3. The slide 28 is then assembled with the body member 19 by inserting the rightmost ends of guide projections 29 thereon in the leftmost ends of complementary grooves 23 of the body member as viewed in Fig. 3. The end 39 of spring 38 is then flexed into recess 35 and the body member and slide moved to the relative positions shown in Fig. 3 whereupon the end 39 of spring 38 is released to engage the cooperating bevel surface 27 on body member 19. This completes assembly of the body and slide and the spring 38 will serve to retain these two elements in the relative positions disclosed in Fig. 3 under ordinary operating conditions. If, however, the belt feed pawl encounters an excessive load due to a jam the body member 19 may move relative to the slide, as such excessive load will cause the angled end 39 of spring 38 to cam out of securing engagement with the body member 19 through the bevel surface 27, it being understood of course that the load required to part the body member 19 and slide 28 is dependent upon the angle of bevel 27 and the tail 39 of spring 38.

At other times, in normal operation of the action, there will be a shock-absorbing function performed by the spring, which will lessen liability of strain of belt links and cartridge cases.

Upon completion of assembly of the slide 28 and body 19, the unit comprised of these elements is mounted in the guideway 15 formed in the cover 16 of the gun, and the manner in which it is mounted in guideway 15 will be dependent upon whether it is desired to arrange the gun for right or left hand feed of the cartridge belt through feedway 13. If the gun is to be arranged for left hand feed then the unit will be mounted in guideway 15 as shown in Fig. 3 and vice-versa for right hand feed.

For the purpose of this description it will be assumed that the gun is to be arranged for left hand feed, therefore, the unit comprised of the slide 28 and body member will be inserted within guideway 15 from the right side of the latter with the complementary guide elements 20 and 21 in interguiding relation and the projection 30 adapted to abut the right side of abutment or projection 31 as shown in Fig. 3.

The belt feed lever 17 is next assembled for actuating the body member 19 for left hand feed by arranging the projection 51 on arm 46 to be received within the rightmost groove 49 of arm 45 as viewed in Fig. 5, and with the perforation 50 of arm 46 receiving the hub 47 of arm 45. As thus assembled the lever 17 is mounted with its hub 47 on stud 18, with the stud 52 of arm 46 projecting away from the cover 16, and the forward end portion 48 of the arm 45 disposed in the adjacent recess 24 of the body member 19 and secured onto the stud 18 by the retaining collar 53 and pin 54.

Since in the illustration shown, it was assumed that the gun was to be arranged for left hand feed, it will be necessary to utilize the cam groove 56 in bolt 10 to oscillate lever 17 through stud 52, therefore, cut-off block 59 will be arranged in recess 58 with its cam surface 56' uppermost and forming a continuation of cam groove 56. The cut-off block is secured in position within the recess 58 by inserting the pin 61 through the perforation 60 thereof and the pin 61 is in turn secured within the bolt by inserting the projection 63 of the driving spring rod 62 through the head of the pin all as shown in detail in Fig. 1.

The feed mechanism of this invention is now assembled on the gun for left hand feed and will function during operation in the following manner: Plungers 55 on lever 17 and engaging cover 16 will so relatively position the lever with respect to the cover that when the bolt 10 occupies a predetermined position the stud 52 will fall within a cam groove 56 or 57, as the case may be, when the cover is lowered to closing position and latched to the receiver as is well understood in the art. With the cover lowered to closing position and latched to receiver 11, with stud 52 positioned in cam groove 56, the bolt 10 in battery, and endmost cartridge 64 in the axial plane of the bore of the barrel abutting the cartridge feed stops in the feedway 13, the belt feed pawl 41 will engage the next adjacent cartridge 65 and the belt holding pawl 67, arranged on the left side of the gun in the case illustrated, will also engage cartridge 65 to hold the loaded belt in place. To load the gun the bolt 10 is drawn to its counterbattery position. During initial movement of the bolt 10 in a recoil direction the

lever 17 will not be moved from the position shown in Fig. 1 owing to the delay or dwell period in cam groove 56; that is, owing to the fact that during this initial movement the cam groove 56 will relatively move in counterbattery tangent to the initial position of stud 52. Upon initiation of movement of bolt 10 toward its counterbattery position the usual extractor thereon, not shown for the sake of clarity, will extract cartridge 64 from the cartridge feed belt and under the influence of the extractor cam in the cover, also omitted, move cartridge 64 downwardly into the T-cut in the forward face of the bolt. The cam groove 56 is so designed and correlated to the length of arm 46 of lever 17 that when the bolt has been moved in recoil to cause cartridge 64 to clear feedway 13 the curved portion of the cam groove will engage stud 52 and swing lever 17 about its stud 18 moving arm 45 to the right, or downwardly as viewed in Fig. 1 under uniform acceleration thereby moving the belt feed pawl 41 to the right to advance the pawl 41 to the right and advance the cartridge belt one step. Completion of the movement of bolt 10 in a recoil direction will cause cartridge 65 to occupy the position formerly occupied by cartridge 64 in the feedway 13 with belt holding pawl 67 engaging the next succeeding cartridge 66. Release of the bolt from its counterbattery position for movement in counterrecoil under the driving energy of the driving spring and rod 62 will effect chambering of cartridge 64 and reposition pawl 41 in its initial position of Fig. 3. The gun is now conditioned for firing and will upon firing cartridge 64 repeat the cartridge feeding cycle above described in connection with loading.

If, for any reason, the rightmost cartridge 64 in feedway 13 fails to be extracted or a jam of some other source occurs the slide 28 and pawl 41 attached thereto will under the excess force part from body member 19 by overcoming the spring 38 which urges its tail portion 39 into engagement with the bevel surface 27 on body member 19.

Due to the long delay or dwell period in the cam grooves 56, 57, it will be apparent that if for any reason the rightmost cartridge 64 in feedway 13 is withdrawn by the extractor on the bolt 10 and the bolt fails to travel its normal cyclic distance in recoil then the long delay in the cam grooves will serve to prevent advance of the succeeding cartridge 65 in the feedway, thereby obviating the condition that the cartridge 64 carried by the bolt could strike the primer of the succeeding cartridge 65 in the feedway.

By the arrangement herein shown the throw of each cam groove has been reduced to substantially 20 degrees, thereby increasing the leverage on lever 17. Due to the decreased throw of the cam grooves the lever arm 45 has been shortened and the stud 18 repositioned with respect to guns arranged to feed on the counterrecoil stroke of the bolt thereby facilitating proper reciprocation of the belt feed pawl which in the instant case advances the belt through moving the cartridge 65 next succeeding the endmost cartridge 64 in the feedway.

While the device has been described in connection with the gun arranged for left hand feed it will at once be obvious that it may also be arranged for right hand feed by rearranging the lever 17 as shown in dashed lines in Fig. 5; reversing the unit in guideway 15 comprised of the slide 28, body member 19 and feed pawl 41; reversing the cut-off block 58; and changing the belt holding pawl 67 to its corresponding position on the right side of the gun; and using cam groove 57 to drive lever 17 through stud 52.

Having now described a present preferred embodiment of the invention I claim:

1. In an automatic gun of the type having a reciprocable breech bolt movable to a counterbattery position by the force of recoil, a cartridge feeding mechanism comprising in combination a body member reciprocable transversely of the direction of movement of said bolt, a slide mounted on said body member adapted for relative movement in the direction of reciprocation thereof, a flat resilient member secured to said slide, means detachably interconnecting the flat member and body member whereby movement of the latter will be transmitted to the slide, a pawl pivotally mounted on the slide, a lever pivoted on the gun and having one end portion engageable with the body member to reciprocate the same upon oscillation of the lever and means defining a cam track on said bolt adapted to oscillate the lever upon reciprocation of the bolt, said cam track and lever being correlated to move the body member in cartridge advancing direction during movement of the bolt toward counterbattery position.

2. In a feed mechanism for an automatic gun, a body member of general channel shape in cross section formed with opposed vertical recesses extending inwardly from the outside of the opposed flanges, the web of said body member being cut-away between opposed flanges for a portion of its length at one end and beveled at its opposed end, the interior of the flanges of said body member being formed to provide longitudinal guide elements, a slide element having longitudinal guide elements complementary to the first named guide elements slidably mounted between the flanges of said body element with the guides in complementary relation, said slide having a pair of transversely aligned ears depending over the cut-away web portion of the body and being recessed upwardly, a pawl mounted on the ears and depending through the cut-away portion of the body, a flat spring secured to the slide intermediate the confronting faces of the slide and body and engaging the pawl in outwardly biasing relation, said spring also being formed with an angled tail portion engaging said beveled end in complementary relation to secure the slide to the body.

3. The structure of claim 2 wherein the flat spring is secured to the slide intermediate its ends with one end portion engaging the pawl and said slide is upwardly and outwardly recessed from the zone of attachment of the spring thereto to provide for upward flexure of the spring whereby the pawl may have limited pivoted movement and the angled end of the spring disengaged from the beveled surface on the body to permit separation of the body and slide.

4. In a machine gun having a bolt and drive spring for its counterrecoil wherein belted cartridges are fed transversely to a position over the chamber of the gun and a bolt-actuated extractor withdraws a cartridge from its belt to a loading position alined with the barrel for chambering by the bolt on counterrecoil, the feeding means including a transversely reciprocable pawl device, a lever pivoted on the gun for oscillation parallel to the plane of feed, its forward arm connected to the pawl device, and its rearward arm having a wiper engaged with a cam groove in the bolt, said cam extending longitudinally of the bolt and

curved in its forward part in a direction and with a lateral component such as to engage said wiper on recoil of the bolt and move the lever to feed one cartridge to said position over the chamber; the improvement wherein the pawl device includes a body engaged directly by the lever, a pawl-carrying part slidable thereon in the direction of feed, and including means yieldable to predetermined force to disconnect the lever-engaged part from propelling relation to the pawl-carrying part under recoil action of the bolt.

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