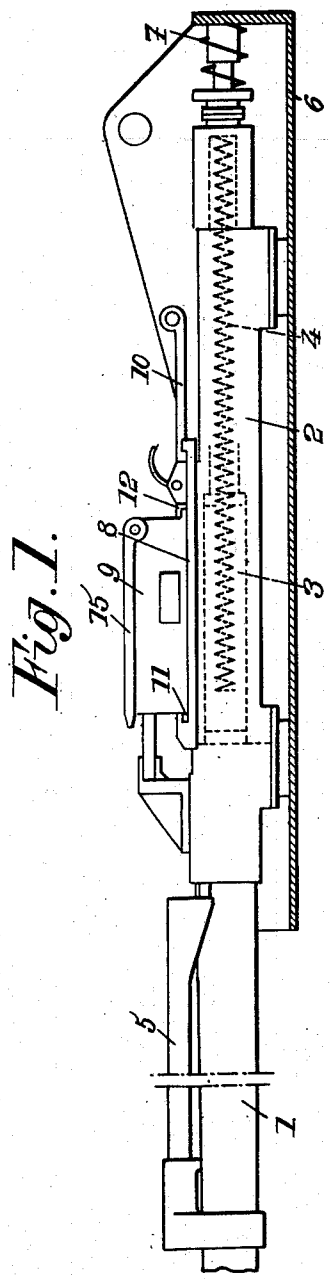
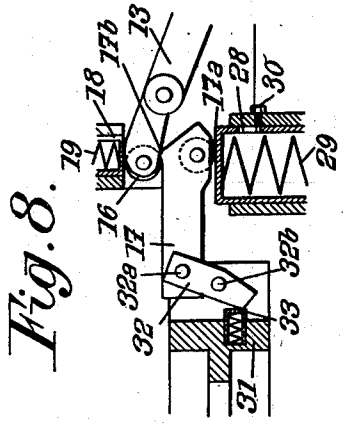
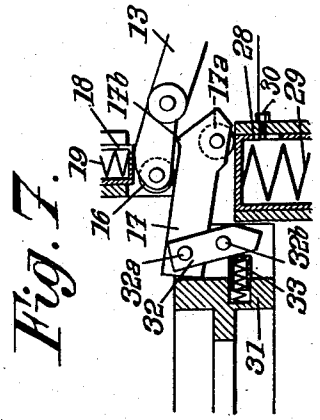
July 7, 1953 B. MAILLARD 2,644,365

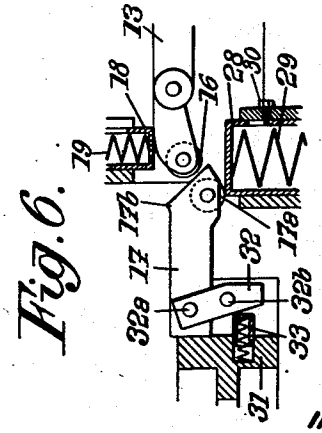
FEED MECHANISM FOR AUTOMATIC FIREARMS
CARTRIDGE BELT FEED TYPE

Filed Nov. 10, 1950 5 Sheets-Sheet 1









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FEED MECHANISM FOR AUTOMATIC FIREARMS
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Fig. 2

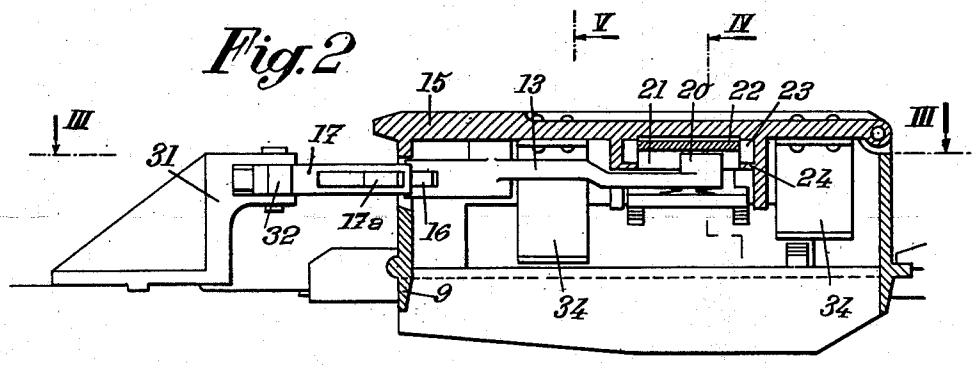


Fig. 3.

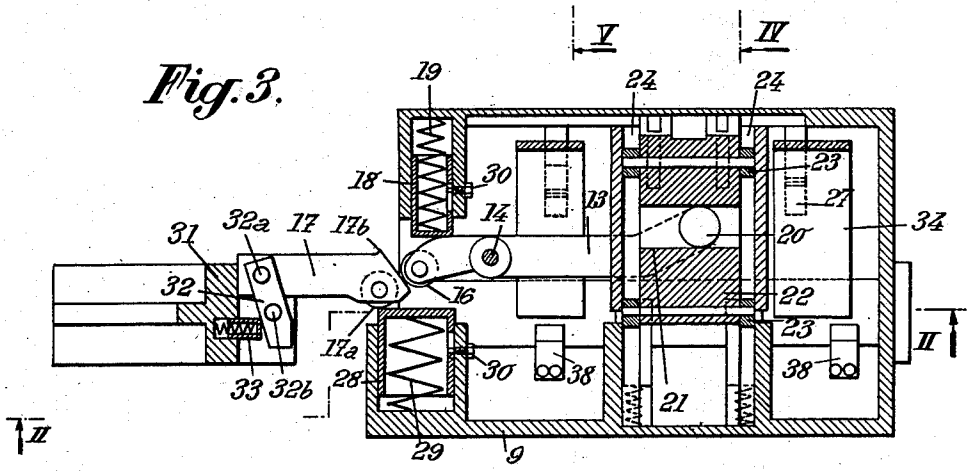


Fig. 5.

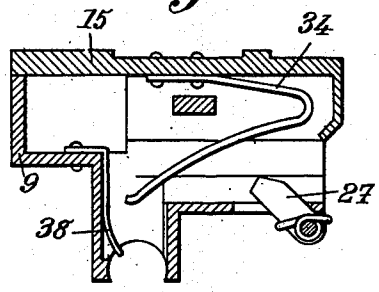
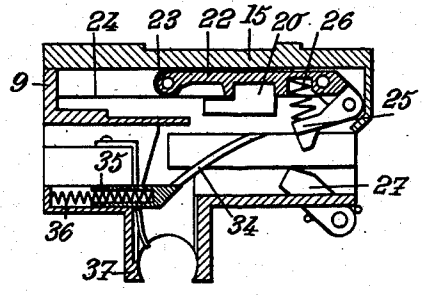


Fig. 4.



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FEED MECHANISM FOR AUTOMATIC FIREARMS
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Fig. 13.

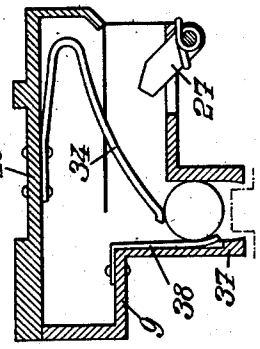


Fig. 12.

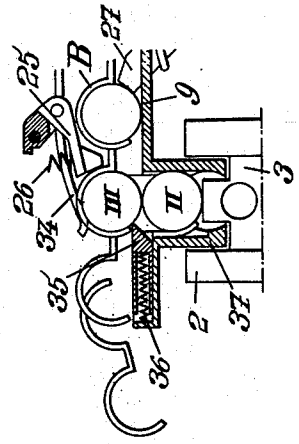


Fig. 11.

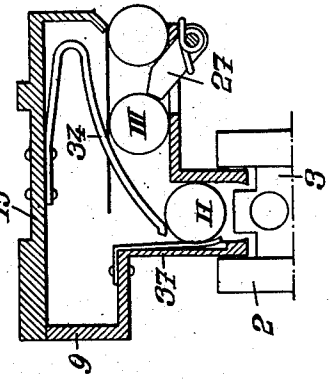


Fig. 9.

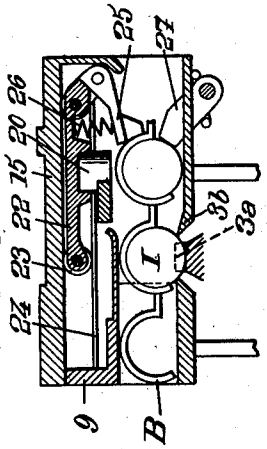
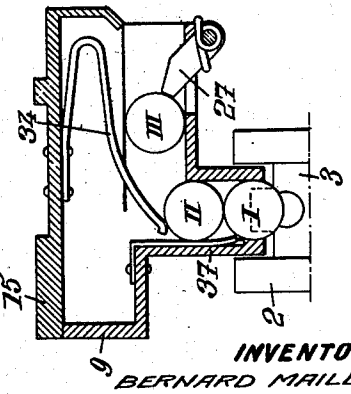


Fig. 10.



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FEED MECHANISM FOR AUTOMATIC FIREARMS
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Fig. 14.

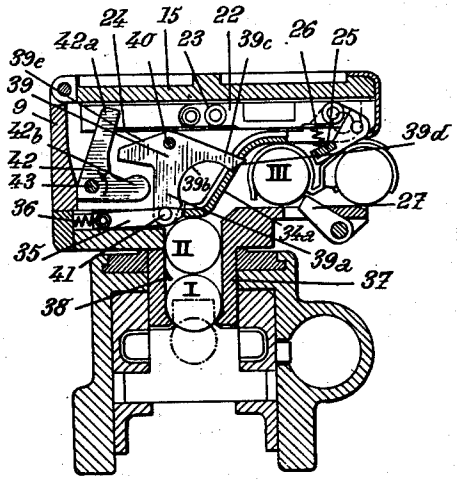


Fig. 15.

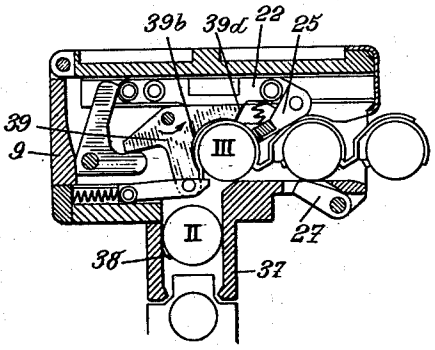
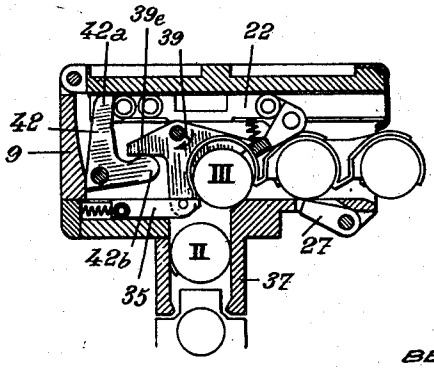


Fig. 16.



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FEED MECHANISM FOR AUTOMATIC FIREARMS
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Fig. 18

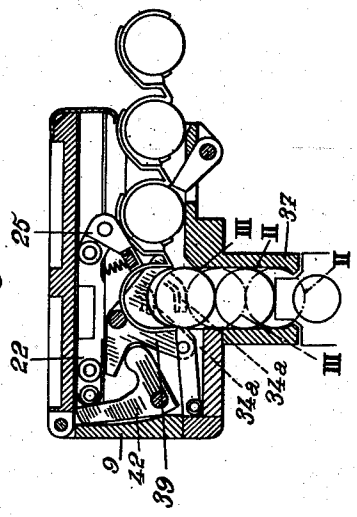


Fig. 20.

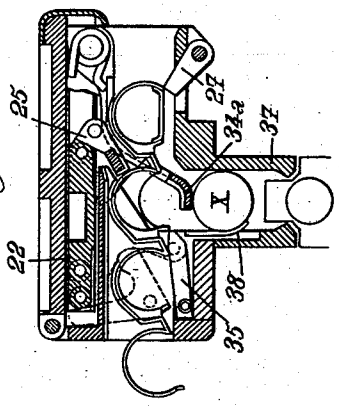


Fig. 17.

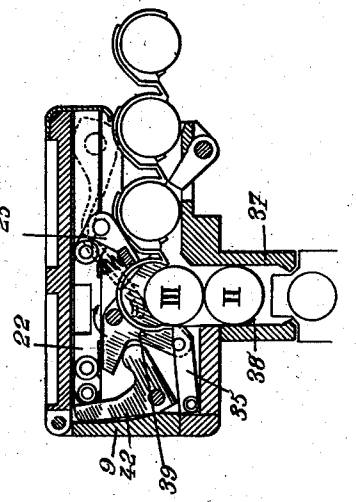
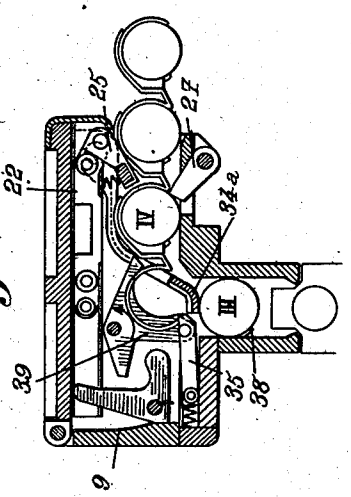


Fig. 19



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Patented July 7, 1953 2,644,365

UNITED STATES PATENT OFFICE

2,644,365

FEED MECHANISM FOR AUTOMATIC FIREARMS CARTRIDGE BELT FEED TYPE

Bernard Maillard, Geneva, Switzerland, assignor to Society Brevets Aero-Mecaniques, S. A., Geneva, Switzerland, a society of Switzerland

Application November 10, 1950, Serial No. 194,996
In Luxembourg November 18, 1949

4 Claims. (Cl. 89—33)

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The present invention relates to feed mechanisms for automatic firearms in which the cartridges are mounted on a belt, the expression "feed mechanism" applying to any mechanism capable of conveying the cartridges toward the arm during firing. My invention is more particularly concerned with automatic firearms the breechblock of which is controlled through means other than recoil, for instance through a gas tap control system.

The object of my invention is to provide a mechanism of this kind which is better adapted to meet the requirements of practice than those existing at the present time.

According to my invention, the feed mechanism in question includes an elastic device operative by the reciprocating displacements of said firearm with respect to its support for storing up recoil energy during a portion of each of said reciprocating displacements, instead of letting it be transmitted directly to the cartridges, and means actuated by said elastic device for applying the energy thus stored up to the feed of at least one cartridge, during a subsequent portion of said reciprocating displacement.

According to a feature of my invention, the elastic device receives energy during at least a portion of the recoil stroke of the firearm with respect to its support and restores it to the cartridge belt, to propel it in a direction transverse to the barrel axis, during a portion of the frontward return stroke of said firearm.

According to another feature of my invention, in a firearm of the indirect feed type, i. e. where every cartridge, upon being detached from the cartridge belt, is to undergo a further translatory displacement, in a direction transverse to the belt, to come into position preparatory to its introduction into the cartridge chamber, the elastic device receives energy from the belt feed mechanism, during each step of the feed movement of the belt, and restores it to the cartridge detached from the belt to give it said translatory displacement as a preceding cartridge is being moved into the cartridge chamber.

Preferred embodiments of my invention will be hereinafter described with reference to the accompanying drawings, given merely by way of example and in which:

Fig. 1 is an elevational view of a firearm of the indirect feed type provided with a feed mechanism according to my invention;

Figs. 2 to 5 show this feed mechanism on a larger scale, respectively in longitudinal section on the line II—II of Fig. 3, in horizontal section

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on the line III—III of Fig. 2 and in cross sections on the line IV—IV and V—V of Fig. 2, the feed belt being removed;

Figs. 6 to 8 are diagrammatical views showing three different relative positions of some elements of Fig. 3;

Fig. 9 is a diagrammatical view showing the arrangement of a feed mechanism of this kind for a firearm of the direct feed type;

Figs. 10 to 12 are diagrammatical views showing (in section on V—V of Fig. 2 for Figs. 10 and 11 and IV—IV of Fig. 2 for Fig. 12) three different relative positions of the parts for detaching the cartridges from the belt and bringing them into position of introduction in the case of a feed device as shown by Figs. 1 to 4;

Fig. 13 shows the position of the same parts and of the last cartridge when the belt is at its end (section view on V—V of Fig. 2);

Figs. 14 to 19 are diagrammatical views showing different relative positions of the parts of a mechanism for detaching the cartridges from the belt and bringing them into position of introduction, according to an embodiment of my invention different from that shown by Figs. 10 to 12;

Fig. 20 shows, similarly to Fig. 13 but in the case of the mechanism illustrated by Figs. 14 to 19, the position of the parts of this mechanism when the belt is at its end.

The automatic firearm shown by the drawing (Fig. 1) essentially includes a barrel 1 carrying, at the rear end thereof, a breech casing 2 in which moves a breechblock 3 urged toward the front by a recuperator spring 4 and controlled, for release thereof, by a gas top control system 5.

This assembly, which constitutes the firearm proper, is mounted slidable in a fixed support or cradle 6 with the interposition of an elastic system 7 for absorbing part of the recoil of the arm with respect to its support and ensuring return thereof toward the front.

Rigid with support 6 there is provided a plate 8 intended to receive the feed mechanism and for instance secured to support 6 through an arm 10, so that the upper edge of the breech casing slides along this plate during the reciprocating movement of the firearm.

Of course, plate 8 is provided with means for detachably fixing feed mechanism 9, and constituted, for instance, at the front by a mortise and tenon device 11 and at the rear by a retractable locking finger 12.

According to a conventional arrangement, the feed mechanism 9 is operated by the recoil

stroke of the firearm with respect to its support and to the feed mechanism carrier plate 8 rigid with said support, said feed mechanism including for this purpose a system interposed between the arm proper and the belt B to be propelled for transmitting the recoil energy to the belt feed means.

According to my invention, I combine with this transmission system an elastic device whereby at least a portion of the recoil energy is temporarily stored up, instead of being used directly to move cartridge belt B forward, and means actuated by this elastic device for applying the energy thus stored up to the drive of the belt, after the recoil stroke of the arm has taken place and during the beginning of its return stroke.

If the transmission system is of the type including an oscillating lever actuating a belt driving sliding member, the elastic device may be arranged to cooperate with the part which acts upon said lever when the firearm recoils so as temporarily to limit the amplitude of oscillation of the lever in question, the remainder of the oscillation of which then takes place, after the end of the firearm recoil stroke, under the effect of the energy restored by said elastic device.

By way of example, it will be supposed that the transmission system essentially comprises the following elements:

(*a*) A lever 13 pivoted about a pin 14 carried by a cover plate 15 provided at the top of the feed mechanism, this lever carrying at its front end a roller 16 acted upon, during the firearm recoil motion, by a cam 17 mounted on this firearm to pivot this lever 13 in the direction corresponding to a feed of belt B, against the action of return means constituted by a push-piece 18 subjected to the action of a spring 19 housed in the casing of the feed mechanism; lever 13 further carries, at its rear end, an operating finger 20 engaged in a longitudinal slot 21 of a sliding member 22 movable transversely (with respect to the axis of barrel 1);

(*b*) Sliding member 22, provided with rollers 23 running on guideways 24 rigid with cover plate 15, this sliding member acting as support for pawls 25 intended to push the belt forward and urged toward their active positions by springs 26; and

(*c*) Holding pawls 27 pivoted to the casing of feed mechanism 9 and opposing return movement of belt B.

The elastic system intended temporarily to store up a portion of the recoil energy is constituted by a push-piece 28 provided with a spring 29 and mounted in the casing of feed mechanism 9 in such manner that it is pushed back by a roller 17*a* carried by cam 17, when this cam tends to pivot oscillating lever 13.

Thus, the amplitude of pivoting of said lever, during the recoil stroke of the firearm, will depend, among other factors, upon the strength of spring 29, said amplitude being the smaller as this strength is lower.

However, it should be noted that the strength of spring 29 must be sufficiently high for causing, upon return of the arm toward the front and while cam 17 is still engaged under roller 16, push-piece 28 to return to its initial position. Thus, the full displacement of lever 13 will take place before cam 17 is withdrawn (i. e. before the end of the return movement of the firearm toward the front).

Advantageously, the amplitude of the displacements of push-pieces 18 and 28 will be limited to the maximum values admissible during operation of the mechanism, which can be obtained by means of projecting abutments 30 carried by the casing of the feed mechanism and engaged in elongated slots provided in the walls of the push-pieces.

In order to transmit the upward thrust of push-piece 28 to the roller 16 of lever 13 during the beginning of the return stroke of the firearm, the connection between cam 17 and the part 31, rigid with breach casing 2, by which it is carried, is constituted by a link arrangement acting as follows:

When the firearm is moving in the rearward direction, part 31 comes into contact with the heel of cam 17 and compels the active end thereof to engage between roller 16 and push-piece 28.

When the arm is returning toward the front, cam 17 is first held back between said roller 16 and push-piece 28 so as to act as a thrust transmitting means between these two parts, after which it is disengaged so as to enable lever 13 to return to its initial position.

It seems particularly advantageous to make use, for this purpose, of the embodiment illustrated by Fig. 3.

The rear part of cam 17 (the active end of which bears upon push-piece 28) is pivotally connected to the end 32*a* of a lever 32 pivoted at its middle part 32*b* to support 31, the other end of this lever being subjected to the action of return spring means 33 so as to urge the head of said cam 17 toward said support 31.

The active end of cam 17 carries a small projection 17*b* capable, once it has moved past roller 16, of holding back said cam so that, at the beginning of the frontward return stroke of the firearm, the cam lags behind it.

I will now explain how the belt feed mechanism above described operates.

In order to facilitate understanding of this operation, I have shown, on Figs. 6 to 8, three relative positions successively occupied by cam 17, lever 13 and push-pieces 18 and 28.

When a shot is fired, these various elements are in the positions shown by Figs. 3 and 6, i. e. support 31 strikes the heel of cam 17 and the end of this cam rests, through roller 17*a*, upon push-piece 28 without however having yet come into contact with the roller 16 of lever 13. As soon as the arm has moved backward sufficiently far for achieving this contact, cam 17 engages between roller 16 and push-piece 28, which is the more depressed, against the action of spring 29, as the resistance of the belt to its forward movement is higher. At the end of the recoil stroke of the firearm, projection 17*b* of cam 17 runs beyond roller 16 (position shown by Fig. 7) and, when the firearm is returning toward the front, this projection holds back cam 17 the heel of which ceases to be in contact with support 31. This cam then acts as connecting member between lever 13 and push-piece 28, which restores to said lever the energy stored up during the recoil stroke of the arm (position shown by Fig. 8). The energy thus restored causes lever 13 to complete its clockwise pivoting movement and sliding member 22, actuated by this lever, terminates its transverse stroke, the whole of which ensures, through pawls 25, one forward step of belt B. During the end of the frontward movement of the firearm, cam 17 is disengaged due to the fact that it has reached, with respect to piece 31, the maximum displacement permitted by link 32, elastic means 33 again applying the heel of said

cam against said support 31 (position shown by Fig. 6). From this time on, the various elements have returned to their initial positions and are ready to reproduce the same cycle as soon as the next shot is fired.

Such a feed mechanism has, from the point of view of the belt forward movement system, many advantages with respect to the known types of feed mechanisms.

First, the elastic device which plays the part of temporary energy accumulator gives some flexibility to the transmission of movement to belt B.

Secondly, owing to the delayed transmission of a portion of the recoil energy, the forward movement of belt B can be made to extend over a portion of the period during which the firearm returns toward the front after its recoil, which is advantageous in view of the inertia of said belt.

Thirdly, the various elements of the feed mechanism are readily accessible, owing to the fact that cover 15 can be lifted, and the insertion of a fresh cartridge belt does not require preliminary tensioning of any spring.

I will now describe how the cartridges are unfastened from the clips which constitute the belt elements for bringing them into position of introduction into the firearm barrel.

It should first be noted that all that has been stated above concerning the belt feed mechanism would remain true in the case of a direct feed firearm where, as shown by Fig. 9, the first cartridge I to be introduced would be brought, by the step-by-step feed displacement of belt B, across the path of travel of the nose 3a provided on the breechblock for driving the cartridge, said cartridge being then unfastened from the belt during the substantially axial displacement thereof which introduces it into the cartridge chamber of the firearm.

It will now be supposed that the firearm is of the indirect feed type, i. e. that the cartridge is unfastened from the belt in a position, hereinafter called "unfastening position," from which it must be fed to the position of introduction (where it is caught by the breechblock nose), and this whatever be the feed system adopted for feeding the cartridge belt through the firearm.

According to my invention, these operations of unfastening the cartridges and feeding them from unfastening position into position of introduction are performed, at least partly, by an elastic device which stores up energy supplied by the belt feed mechanism during the step which brings the cartridges successively into unfastening position, and gives back this energy when a cartridge has reached this position both to unfasten this cartridge from the belt and to move a cartridge into introduction position.

It will first be supposed that this elastic device is to achieve this result wholly by itself.

I constitute said elastic device by V-shaped springs 34 of sufficient strength (Figs. 10 to 13) one branch of which is fixed to the cover plate 15 of the feed mechanism and the other branch of which bears upon the cartridge which is being moved toward unfastening position, said springs being preferably disposed on either side of the slideway of sliding member 22.

I dispose, on the side toward which the clips of belt B are ejected, two elastic abutments 35 the noses of which project (Fig. 4), under the action of their springs 36, above the vertical passage 37 through which the cartridges are successively fed from unfastening position to introduction position, these noses acting as abutments for the front edges of the belt clips while springs 34 push out the cartridges from said clips.

I provide, inside passage 37, a spring 38 adapted to retract as long as the cartridges which pass through said passage undergo a downward thrust from the extraction springs 34, said spring 38 being intended to hold back the last cartridge of the belt (Fig. 13).

Such a mechanism works as follows, as illustrated by Figs. 10 to 12.

The cover plate of the belt feed mechanism having been lifted, the cartridge belt is inserted in such manner that the first cartridge (cartridge III on Fig. 10) is positioned beyond retaining pawls 27. Two cartridges I and II previously extracted by hand from their respective belt clips are then engaged into passage 37. The cover plate is closed back and springs 34 exert their thrust upon cartridge II. The breechblock being then supposed to be locked in rear position, when the trigger is depressed the breechblock is released and its driving nose catches, as it is moving frontward, cartridge I, introduces it into the cartridge chamber and fires it. Simultaneously, there has been a downward movement of cartridge II under the action of springs 34 until it is stopped by spring 38 (Fig. 11). As soon as cartridge I is fired, the cartridge belt feed mechanism is actuated by the recoil and cartridge III is thus moved forward transversely into contact with the top of springs 38 and above the introduction passage 37, in a position where it bears upon cartridge II (Fig. 12) and pushes it into contact with the top surface of the breechblock. In the course of this movement, cartridge III pushes back abutments 35 and deflects extraction springs 34 upwardly. At the end of the recoil stroke of the breechblock, the energy thus stored up in springs 34 serves to push cartridge II into introduction position while unfastening cartridge III from its belt clip, said clip being prevented from moving down with cartridge III both by abutments 35 and by the next cartridge of the belt. The three first cartridges to be introduced into the barrel are now in the same relative positions as shown by Fig. 10.

When the last cartridge of the belt is engaged into passage 37, springs 34 are no longer deflected upwardly and said last cartridge is held back by spring 38 (Fig. 13) in a position such that it is not caught by the breechblock nose when said breechblock moves frontward.

Such a system for feeding the cartridges from unfastening position to position of introduction has the advantage of dispensing the cartridge belt feed mechanism from the necessity of exerting any sudden increase of work, the energy required for unfastening and moving down the cartridges (deflection of springs 34) being stored up gradually during the period of time for which the belt makes one step. Furthermore, once this energy has been accumulated and the first cartridge has reached the unfastening position, the pressure which serves to unfasten said cartridge is independent of the pulling effort exerted upon the belt.

I will now describe, with reference to Figs. 14 to 20, a construction in which the elastic device which accumulates energy supplied by the forward movement of the belt only participates in the operation of unfastening the cartridges from their respective belt clips and this operation is

positively controlled by at least one extractor member operated by the belt feed mechanism.

The feed mechanism is of the same general construction as above described but springs 34*a* are weaker than the springs 34 of the preceding example, being insufficient to extract a cartridge from its clip.

This operation is positively controlled by a pair of three-arm levers 39 pivoted about a pin 40 carried by the casing of the feed mechanism, the central arm 39*a* of each lever being hinged at 41 to the free end of the corresponding elastic abutment 35, whereas the notch 39*b* existing between said central arm 39*a* and front arm 39*c* (the end 39*d* of which constitutes a lifting nose) is of rounded shape so as to accommodate the first cartridge coming to introduction passage 37.

The oscillating movement of each extractor lever 39 is transmitted thereto by a crank lever 42 pivoted about a pin 43 rigid with casing 9, one of the branches 42*a* of this lever 42 being located on the end portion of the path of travel of sliding member 22, whereas the other branch 42*b* is engaged in the interval separating the central arm 39*a* from the rear arm 39*e* of extractor lever 39, whereby, when said branch 42*b* pivots in the direction indicated by the arrow, it acts upon arm 39*a* and causes lever 39 to pivot so as to unfasten from its clip the cartridge housed in notch 39*b*.

Such a cartridge feed device operates as follows:

As a preliminary operation, two cartridges I and II previously removed from their respective belt clips are inserted into passage 37. The breechblock being in the rear position, cartridge I rests upon the lips or lower edges of said passage whereas cartridge II is applied against said cartridge I by springs 34*a*. The first cartridge III of the belt is engaged toward the left beyond pawl 27. This relative positioning of the parts is illustrated by Fig. 14.

When the breechblock is released, it catches, on its frontward stroke, cartridge I, introduces it into the cartridge chamber and fires it. The arm recoils and causes sliding member 22 to move from right to left while the breechblock moves back to come under cartridge II, which is held at a distance above said breechblock by spring 38. The forward (leftward) movement of the cartridge belt, caused by the displacement of sliding member 22, brings, on the one hand, cartridge III into notch 39*b* and, on the other hand, the free end of each elastic abutment 35 under the edge of the belt clip of cartridge III, lever 39 having pivoted slightly, in the direction indicated by the arrow of Fig. 15, due to the thrust exerted by the nose 39*d* of lever 39 on said cartridge III. The positions of the parts at the end of this second step of the operation are shown by Fig. 15.

As sliding member 22 keeps moving toward the left, cartridge III tends to pivot lever 39 in the cartridge unfastening direction (indicated by the arrow on Fig. 16), this movement being further positively caused by lever 42 the branch 42*a* of which has come into contact with said sliding member near the end of its movement and the other branch, 42*b*, of which then acts upon the rear arm 39*e* of the extractor lever. The edge of the belt clip of cartridge III is supported by the ends of elastic abutments 35 and this cartridge is being pushed out from said clip (Fig. 16).

Sliding member 22 keeps moving toward the left and cartridge III is wholly freed from its clip and brought into contact with cartridge II, which is still being held back by spring 38 (Fig. 17).

At the end of the pivoting movement of extractor lever 39, cartridge III is detached from the belt and spring 34*a*, which is still pressing down cartridge III and then exerts an effort higher than that of spring 38, compels cartridges II and III to move down in the passage 37 until cartridge II comes to rest upon the upper face of the breechblock (positions of cartridges II and III shown in solid lines on Fig. 18), then upon the lips of said passage when the breechblock has moved a sufficient distance to the rear (positions of cartridges II and III shown in dotted lines on Fig. 18). When the breechblock moves back toward the front, cartridge II is caught by said breechblock while cartridge III is held back by spring 38 (springs 34*a* being now practically without tension).

Sliding member 22 remains in the position shown by Fig. 18 until the firearm has moved back in the frontward direction a distance equal to more than one half of its total stroke, after which said sliding member starts back in the opposite direction, compelling pawls 25 to pass above cartridge IV (position shown by Fig. 19), the cartridge belt being held stationary, during this time, by retaining pawls 27. In the meantime, under the thrust of elastic abutments 35, extractor lever 39 has returned to its initial position by pivoting in a direction indicated by the arrow on said Fig. 19. The various elements of the feed mechanism are then substantially in the same position as in Fig. 15 and the same cycle of operations is now repeated.

Fig. 20 shows the position of the various parts once the last cartridge X of the belt has been unfastened and held back by spring 38, this figure also showing the travel of the empty belt clips.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of my invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the accompanying claims.

What I claim is:

1. For use in connection with an automatic firearm of the type in which the cartridges to be brought into a position of introduction into said firearm are detachably assembled together in the form of a cartridge belt, this firearm being mounted to reciprocate with respect to its support in a direction parallel to the line of fire, rearwardly under the effect of recoil and frontwardly under the effect of elastic return means, a feed mechanism which comprises, in combination, a reciprocating sliding member movable in said support transversely to said line of fire, means carried by said member for driving said cartridge belt together with said member in one direction, an oscillating lever pivoted to said support operatively connected with said sliding member for driving it, elastic energy storing means carried by said support including a part movable with respect to said support and means for elastically opposing movement of said part with respect to said support, wedge means operatively connected with said firearm for rearward movement together therewith arranged to engage between said part and said lever during the end of the rearward stroke of said fire arm to drive said part and said lever away from each other, whereby energy is imparted to said energy storing means and said sliding member is actuated, link means between

said piece and said firearm arranged to enable said piece to lag between said firearm during a portion of the frontward return stroke thereof, and means for temporarily holding said piece between said lever and said energy storing means during a portion of the firearm return stroke to enable said energy storing means to transmit through said piece a further pivoting displacement to said lever by restoring thereto the energy stored up in said energy storing means.

2. For use in connection with an automatic firearm of the type in which the cartridges to be brought into a position of introduction into said firearm are detachably assembled together in the form of a cartridge belt, this firearm being mounted to reciprocate with respect to its support in a direction parallel to the line of fire, rearwardly under the effect of recoil and frontwardly under the effect of elastic return means, a feed mechanism which comprises, in combination, a reciprocating sliding member movable in said support transversely to said line of fire, pawl means carried by said member for driving said cartridge belt together with said member in one direction, an oscillating lever pivoted to said support operatively connected with said sliding member for driving it, a spring push-piece movably guided in said support, a cam adapted to engage between said oscillating lever and said push-piece so as to be able to cooperate with both, link means between said cam and said firearm for causing said cam both to compress said push-piece and to pivot said lever during the recoil stroke of the firearm, said link means being arranged to leave said cam interposed between said

lever and said push-piece during a portion of the frontward return stroke of the firearm, and means for temporarily keeping said cam between said lever and said push-piece during a portion of the firearm return stroke to enable said push-piece to transmit through said cam a further pivoting displacement to said lever by restoring thereto the energy stored up in said push-piece.

3. A feed mechanism according to claim 2 in which the means for keeping the cam between said push-piece and said lever consist of a projection carried by said cam and adapted to cooperate with said lever.

4. A feed mechanism according to claim 2 in which said cam includes a heel portion adapted to bear against a part of the firearm proper, said link means including a lever pivoted in its intermediate part to said firearm and hinged at one end to said cam, spring means being interposed between the other end of said lever and said firearm.

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