BELT FEED MECHANISMS FOR AUTOMATIC FIREARMS

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Claims priority, application Luxembourg March 27, 1951

The present application, which is a division of my prior application Ser. No. 278,349, filed March 25, 1952, now Pat. No. 2,750,845, relates to belt feed mechanisms for automatic firearms to which ammunition is fed in the form of cartridge belts. The term "belt feed mechanism" is meant to include any mechanism capable of moving toward the firearm the cartridges assembled together to form a belt and of feeding them successively thereto during firing. My invention is more especially, but not exclusively, concerned with firearms the breechblock of which is released through means other than the recoil of the arm, for instance by a gas tap.

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

For this purpose, according to my invention, a first element, actuated by a power device supplying a power impulse of an amplitude corresponding to one pitch (distance by which the belt is to be moved forward for every shot) every time a shot is fired, is connected with a second element, or rotor, which drives the belt step by step and in which the successive cartridges are detached from the belt, the transmission system between said first and second elements being arranged to provide for a limited lost motion opposed by resilient means, the amplitude of said lost motion being less than the amplitude of movement of said second mentioned element for every step thereof, the amplitude of said lost motion and the means for passing the cartridges detached from the belt to the firearm breech case being adjusted to prevent any contact between said second mentioned element and a cartridge stopped in waiting position before introduction into the firearm barrel when said resilient means are eliminating said lost motion at the end of every step of said second mentioned element, whereby each a cartridge in waiting position is not subjected to a thrust from said resilient means.

Other features of my invention will become apparent in the course of the following detailed description of an embodiment thereof with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a general elevational view of a firearm of the kind with which the present invention is concerned;
Fig. 2 is a sectional view of the belt feed mechanism according to my invention, on the line II—II of Fig. 9;
Fig. 3 is a sectional view on the line III—III of Fig. 9;
Fig. 4, 5 and 6 are three sectional views on the line IV—IV of Fig. 9, showing three successive relative positions of the parts, respectively;
Fig. 7 is a sectional view on the line VII—VII of Fig. 9;
Fig. 8 shows a detail of Fig. 4;
Fig. 9 is a vertical view a portion of which shows a section on the line IXa—IXa of Fig. 2 and another portion a section on the line IXb—IXb of Fig. 2;
Fig. 10 is a horizontal view a portion of which shows a section on the line Xa—Xa of Fig. 2 and another portion a section on the line Xb—Xb of Fig. 2;

Fig. 11 is a perspective view showing the essential elements of the belt feed mechanism, separately from the other parts.

The firearm with which my invention is concerned includes a barrel 1 rigid at the rear with the breech case 2 in which reciprocates a breech block 3 urged forwardly by a recuperator spring 4 and controlled, concerning its release, by a gas tap system 5.

The whole of these elements, which constitutes the firearm proper, is slideable in a fixed support or cradle 6, an elastic system 7 being interposed to absorb the recoil of the firearm with respect to its support and to return it forwardly.

Rigid with support 6 there is provided a plate 8 (magazine carrier) intended to receive the belt feed mechanism 9 which will be hereinafter described. For instance, as shown, this plate 8 is linked to support 6 by an arm 10 and the upper edge of the breech case slides on the undersurface of said plate during the reciprocating movements of the firearm.

Plate 8 is provided with means for securing the belt feed mechanism thereto in a detachable fashion, such means being for instance constituted at the front by a tenon-and-mortise connection 11 and at the rear by a retractable locking finger 12.

According to a conventional arrangement, shown by way of example, the belt feed mechanism is operated by the displacement of the firearm proper during a portion (hereinafter called active portion) of its recoil with respect to support 6, this displacement being imparted to the belt through a transmission which will now be described.

The belt feed mechanism 9 frame essentially includes two transverse plates 13 and 14 (Fig. 9) located respectively at the front and at the rear of this mechanism, with suitable rods interconnecting them.

The front plate 13 carries a mechanism cooperating with a device which participates in the recoil movement of the firearm to rotate a shaft element 15 (Figs. 2, 3, 10 and 11) parallel to the direction of fire, through a given angle every time a shot is fired, this shaft element 15 being journaled in said front plate 13.

This last mentioned mechanism includes the following elements (Figs. 2, 3 and 9):

Front plate 13 carries a vertically sliding member 16, urged downwardly by a spring 17 interposed between a horizontally projecting flange of member 16 and a horizontally projecting flange 13c of plate 13, this sliding member 16 carrying a spindle 18 parallel to shaft element 15 and on which a pinion 19 is freely journaled.

The front portion of the firearm breech casing carries, pivoted about a horizontal axis 21, a longitudinal arm 20 the rear end of which carries, projecting from its underside, a roller 22 arranged to cooperate with a ramp 23 advantageously carried by a plate 13* rigid with plate 13 and which forms the front wall of the belt feed mechanism body. During at least a portion of the recoil movement of the firearm, the rear end of arm 20 is moved upwardly against the action of a return spring.

The top face of this rear end of arm 20 forms a ramp 24 arranged to cooperate with a roller 25 carried by sliding member 16 so that, during at least a portion of the recoil stroke of the firearm, this sliding member 16 is pushed upwardly against the thrust of spring 17, under the simultaneous effects of the upward movement of the rear end of arm 20 and of the slope of ramp 24, which produces a supplementary upward movement of roller 25.

On either side of sliding member 16 (Fig. 3), and respectively on shaft element 15 and on a spindle 26 parallel thereto and freely journaled in plates 13 and 13*,
I provide two pinions 27 and 28. That is, to be both of the same diameter as pinion 19, in mesh therewith.

These pinions 27 and 28 are rigid with ratchet wheels 29 and 30 respectively (Fig. 2), these ratchet wheels cooperating with respective pawls 31 and 31' arranged so that, while sliding member 16 is moving upwardly, pinion 28 is prevented from rotating; and pinion 27 is rotated whereas, when sliding member 16 is moving downwardly, pinion 27 is prevented from rotating whereas pinion 28 turns freely.

Such a mechanism will therefore impart a rotary movement of a given amplitude to pinion 27 upon every recoil displacement of the firearm, this movement taking place during the active portion of the recoil recoil, which portion is advantageously limited to that corresponding to the minimum amplitude recoil.

I shall now describe how this movement is transmitted to the cartridge driving means of the belt feed mechanism.

So-called driving" means include a shaft 32 (Figs. 9, 10, and 11) substantially parallel to the direction of firing and journaled in plates 13 and 14. This shaft carries, fixed thereon, a plurality of (three in the present example) toothed wheels 32a which constitute what will be hereinafter called the rotor of the belt feed mechanism. The teeth of said rotor wheels are arranged to engage between the campieces of the belt, so as to drive this belt. Shaft 32 is preferably positioned so that the cartridge belt, which enters the mechanism horizontally, as shown by Figs. 4, 5, and 6, is deflected downwardly, at about 90° to its initial direction, toward the feed or introduction passage 33 of the firearm.

Shaft element 15 is connected to shaft 32 as follows:

In a tubular sleeve 34 (Fig. 10) extending between plates 13 and 14 and parallel to shaft 32 are mounted, in end to end relation to each other, two sleeves 35 and 36 (Figs. 10 and 11) the respective ends of which adjacent to each other are provided with cooperating dogs or projections 37-38 such that a lost motion, or relative angular displacement of a maximum amplitude equal to a is possible between these said sleeves 35 and 36.

The free end of sleeve 35 is integral with or fixed to pinion 27, and therefore rotated together with shaft element 15.

The free end of sleeve 36 is integral with or fixed to a pinion 39 disposed close to the rear end plate 14, this pinion 39 being fixed on a shaft element 40 journaled in said plate 14.

I interpose between shaft elements 15 and 40, inside sleeves 35 and 36, a torsional spring 41 initially stressed so that it urges shaft 40 to rotate with respect to shaft 15 in the same direction as said shaft 15 is itself driven by its pinion 27 during the active portion of the recoil movement of the firearm (this direction of rotation is indicated on Fig. 11 by the arrow adjacent to pinion 27).

I journal in plate 14, coaxially with shaft 32 (which is tubular) a pinion 42, for instance identical to pinion 39, this pinion 42 being fixed in rotation on a shaft element 43.

Inside the front portion of hollow shaft 32 and rigid therewith, there is provided a shaft element 44.

The rear end of hollow shaft 32 and the edge of the tubular hub of pinion 42 adjacent to this shaft end are provided with cooperating dogs or projections 45, 46, respectively, such that a lost motion or relative angular displacement of a maximum amplitude equal to b is possible between pinion 42 and shaft 32 (which carries the rotor wheels such as 32a).

Pinions 39 and 42 are interconnected by a pinion 48 in mesh with both of them.

I interpose between shaft elements 43 and 44, inside shaft 32, a torsional spring 47 initially stressed so that it tends to rotate shaft 32 with respect to pinion 42 in the direction in which said pinion 42 is itself driven by pinion 48 (this direction is indicated by arrow f).

The successive cartridges must be separated from the links 49 by means of which they are assembled together to form the belt, and subsequently engaged downwardly into the active portion of the introduction passage 33 (Figs. 4 to 6).

The rotor wheel has five teeth, etc. forms five circular notches for five successive cartridges of the belt.

The mechanism includes guiding surfaces or ramps 62 in the form of circular arcs forming the geometrical envelopes of the cross sections of the cartridges engaged by the rotor wheel 32a.

The first link 49 is pulled off from the cartridge to be released (which cartridge is being held radially by ramps 62) by means of a pulling hook carried by a lever 50 and arranged in such manner that, at the beginning of every feed step of the mechanism, its nose 51 meets the front end of the link 49 to be pulled off. At this time, said lever 50 is still engaged on the cartridge which, at the end of this feed step, is to be disengaged from said link and engaged in the top end of introduction passage 33.

This lever 50 is disposed substantially vertically and is L-shaped so that its horizontal branch, which carries nose 51 at its free end, is deflected downwardly at the beginning of every feed step of the mechanism, as shown by Fig. 4 (lever 50 being then applied against abutment 56 which limits its movements in the anti-clockwise direction) into contact with the case of the cartridge engaged link 49, nose 51 engaging under the end of said link.

The upper edge 52 (Fig. 8) of this horizontal branch of lever 50 is so shaped that under the effect of the rotation of the rotor, the cartridge (held radially by surfaces 62) slides on this edge while pushing lever 50 to rotate it about its axis 53, against the action of a return spring 54, away from the rotor. In the course of this movement, nose 51 pulls the end r of link 49 away from its cartridge, so that finally (Fig. 7) the front loop of link 49 is disengaged from the cartridge around which it was fitted. This cartridge is further driven by the rotor downwardly until, at the end of the feed step (Fig. 6), it is engaged between the upper edges of introduction passage 33.

The nose 51 of lever 50 extends downwardly toward the left (as visible in Figs. 4, 5, 6 and 8) to form an inclined surface 55 which, in the course of the feed step of the rotor, gradually guides the front end of link 49 farther and farther away from the rotor axis so that, at the end of the rotation of lever 50 toward the left, this inclined surface 55 has brought the end of link 49 to the top of a fixed evacuation sloping surface 56 along which the link is to be guided.

Retractile fingers 60 are freely pivotable about shaft 32 and subjected to the return action of springs 61 let the cartridges drop into passage 33 and, under the action of said springs exert a downward thrust on said cartridges.

The movements of pinion 27 are transmitted to rotor wheels 32a as follows:

Since ratchet wheel 29 has five teeth, one pitch corresponds to rotation of pinion 27.

But every impulse movement of pinion 19 imparts to pinion 27a a rotation through an angle greater than 72°, say 86°, α = b = 60°.

At the start (Fig. 11), the front edges of projections 38 and 45 are applied by springs 41 and 47 against the rear edges of projections 37 and 46.

Every time a shot is fired pinion 27 starts rotating in the direction indicated by the arrow.

Initially, springs 41 and 47 yield and rotor wheel 32a does not rotate, its position being then that shown by Fig. 4.

Rotor wheel 32a starts rotating only when the front edges of projections 37 and 46 are nearly in contact with
the rear edges of projections 38 and 45 respectively, i.e. when a rigid drive is going to be provided between pinion 27 and rotor wheel 32a.

If of these last mentioned elements (27 and 32a) rotate together for a short time, then pinion 27 stops when it reaches the end of the forward rotation (86°) imparted thereto by pinion 19 (which then starts moving in the downward direction, under the effect of spring 17).

Under the effect of springs 41 and 47, pinion 27 and rotor wheel 32a are urged in opposed directions. Wheel 27 can move backward through only a small angle (86° — 72° = 14°) after which it is stopped by the engagement of ratchet wheel 29 with pawl 31. But rotor wheel 32a, after a temporary slowing down and short stopping (which coincides with this backward rotation of pinion 27) moves forwardly under the effect of the expansion of said springs 41 — 47 until the front edges of projections 38 and 45 are again stopped against the rear edges of projections 37 and 46 respectively.

In the meantime, the parts associated with the rotor wheel 32a have passed through the respective positions shown by Fig. 5.

At the end of one step, that is to say when springs 41 — 47 have restored contact between the front edges of projections 38 and 45 and the rear edges of projections 37 and 46 respectively, the parts associated with rotor wheel 32a are in the position illustrated by Fig. 6.

This figure shows that the rotor wheel is then stopped in a position where it is out of contact with the stationary cartridge designated by reference letter a, itself resting upon the cartridge designated by b. Consequently, these cartridges are not subjected to any thrust from the resilient means (springs 41 — 47) included in the transmission between pinion 27 and rotor wheel 32a.

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. A belt feed mechanism for an automatic firearm including a breech case which comprises, in combination, power means for supplying a power impulse in response to every shot fired by this arm, a cartridge belt constituted by a plurality of cartridges and links for interconnecting them, means for guiding said cartridge belt with respect to said firearm, a frame rigid with said guiding means, a rotary member journaled with respect to said frame about an axis parallel to the direction of firing of said firearm, means operatively connected with said rotary member for imparting to said rotary member, in response to the successive rotations of said member a step by step rotation of said rotary member of an amplitude equal to one pitch of said belt, said transmission mechanism including at least two elements interconnected with a limited play between them, the total lost motion in said transmission means being smaller than the amplitude of every step of said rotor, initially stressed spring means between said two elements for tending to maintain said play between them, means operatively connected with said rotor wheel for detaching said cartridges from said belt successively as they are leaving said rotor wheel, means interposed between said rotor wheel and said firearm for feeding the cartridges detached from said belt to said firearm, the sum of the two above mentioned plays being smaller than the rotation of said rotary member on every step.

2. A belt feed mechanism for an automatic firearm including a breech case which comprises, in combination, power means for supplying a power impulse in response to every shot fired by this arm, a cartridge belt constituted by a plurality of cartridges and links for interconnecting them, means for guiding said cartridge belt with respect to said firearm, a frame rigid with said guiding means, a rotary member journaled with respect to said frame about an axis parallel to the direction of firing of said firearm, means operatively by said power means for rotating said rotary member step by step in one direction with a given angular amplitude, a toothed rotor wheel journaled with respect to said frame about an axis parallel to the direction of firing of said firearm, means for feeding the cartridges detached from said belt successively as they are leaving said rotor wheel, means interposed between said rotor wheel and said firearm for feeding said cartridges detached from said belt to said firearm, the sum of the two above mentioned plays being smaller than the rotation of said rotary member on every step.

3. In combination with an automatic firearm system including a fixed support and a firearm properly longitudinally with respect to said support under the effect of recoil, with elastic means for returning said firearm proper in the forward direction after every recoil thereof, said firearm including a breech case, a belt feed mechanism for said firearm which comprises, in combination, a cartridge belt constituted by a plurality of cartridges and links for interconnecting them, means for guiding said cartridge belt with respect to said firearm, a frame rigid with said guiding means, a rotary member journaled with respect to said frame about an axis parallel to the direction of firing of said firearm, means operatively by the recoil displacements of said firearm with respect to its support for rotating said rotary member step by step in one direction with a given angular amplitude, a toothed rotor wheel journaled with respect to said frame about an axis parallel to the first mentioned one, the teeth of said rotor wheel being adapted to engage between said rotary member and said rotor for imparting to said rotor, in response to the successive rotations of said member a step by step rotation of said rotor of an amplitude equal to one pitch of said belt, said transmission means including two pinions operatively connected together, means rigid with said rotary member and one of said pinions respectively interconnected with a given limited angular play, an initially stressed torsion spring interposed between said member and said pinion so as to tend to take up this play, means rigid with said rotor and the other pinion respectively interconnected with a given limited angular play and an initially stressed torsion spring interposed between said rotor and said second mentioned pinion so as to tend to take up said last mentioned play, the sum of the two above mentioned plays being smaller than the rotation of said rotary member on every step.
thereof, means operatively connected with said rotor wheel for detaching said cartridges from said belt successively as they are leaving said rotor wheel, means interposed between said rotor wheel and said firearm for feeding the cartridges detached from said belt to said breech case, said feeding means being arranged temporarily to stop said detached cartridges in given positions, said plays and said feeding means being adjusted to prevent any contact between said rotor wheel and cartridges stopped in said positions when said torsion springs are taking up said plays at the ends of every movement of said rotary member, whereby said plays are integrally taken up after the firing of every shot.

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