

JIRI CERMAK ET AL

AUTOMATIC FIREARM WITH RETARDED BLOW-BACK BREECH MECHANISM

Filed June 8, 1967

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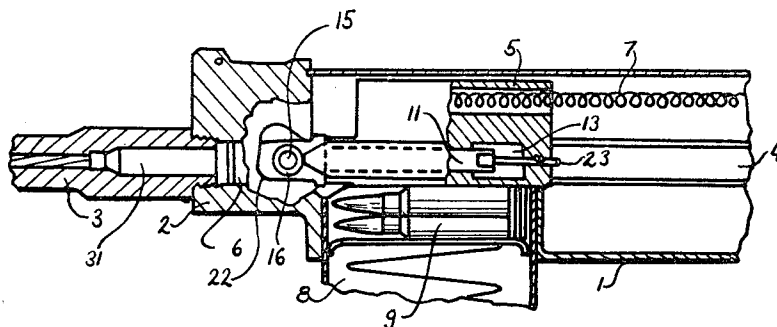


Fig. 1

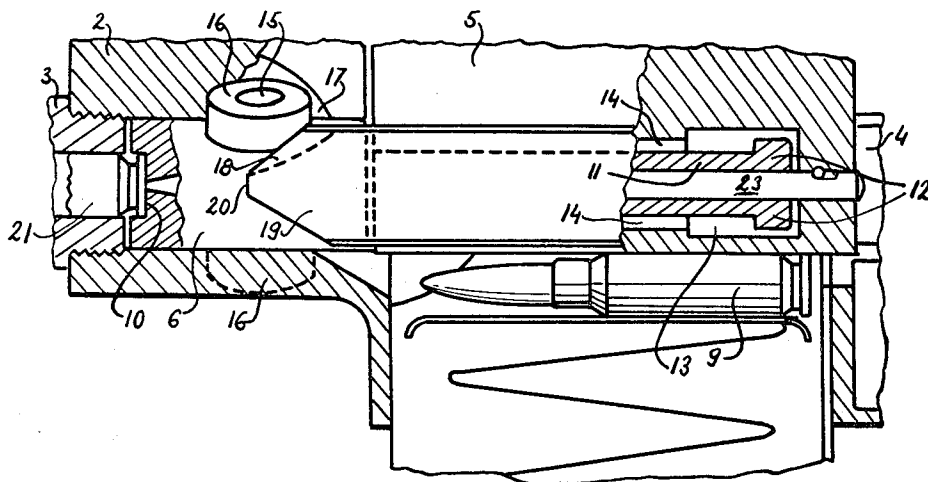


Fig. 2

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3 Sheets-Sheet 2

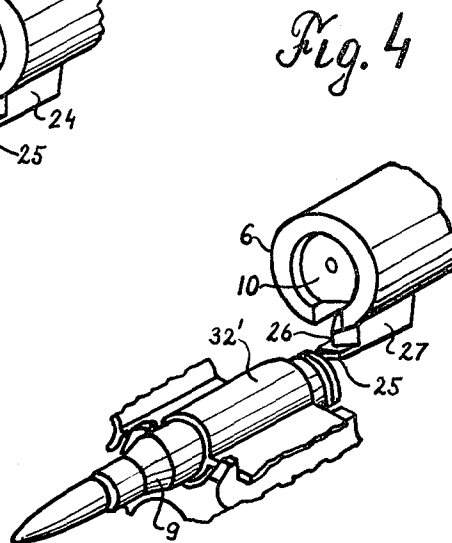
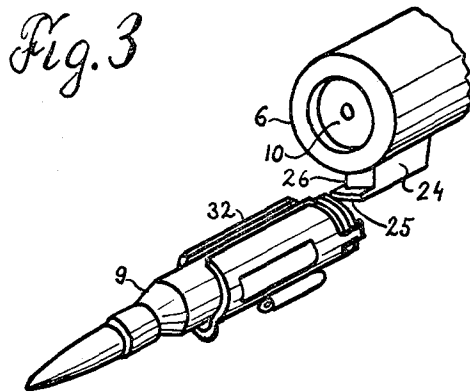
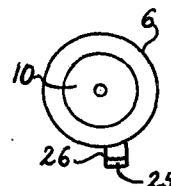
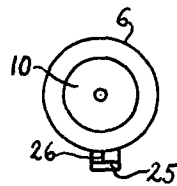
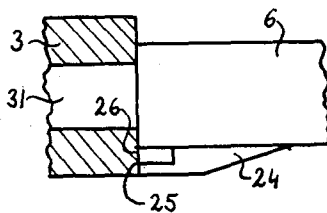


Fig. 5

Fig. 6

Fig. 7



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3 Sheets-Sheet 3

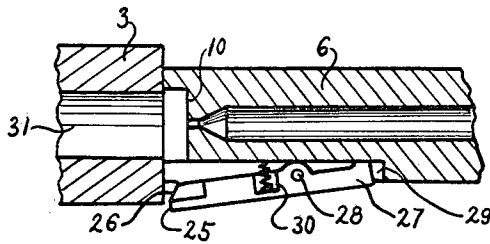


Fig. 8

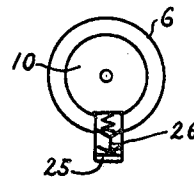


Fig. 9

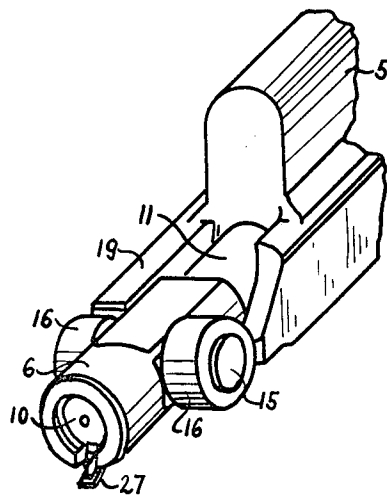


Fig. 10

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AUTOMATIC FIREARM WITH RETARDED BLOW-BACK BREECH MECHANISM

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ABSTRACT OF THE DISCLOSURE

An automatic firearm with retarded blow-back breech mechanism comprising a cylindrical breech bolt carrying a pair of rollers adapted for cooperation with helical surfaces in the receiver and in the breech bolt carrier, to accelerate the latter during the first part of the recoil movement, whereupon the rollers engage supporting faces on said carrier. Before termination of the forward movement at least one roller strikes a cam surface, initiating thereby rotation of the breech bolt into firing position. When used with a belt feed, a feed piece with a cutting edge is provided, adapted to expand or cut the belt link.

Background of the invention

The present invention relates to an automatic firearm with retarded blow-back breech mechanism and deals in particular with firearms of the aforementioned type, in which the cartridges are fed either from a magazine or from a cartridge belt, the links of which are either of the expandable or closed type, and upon expulsion of the cartridge from the belt are either expanded or cut, respectively.

The heretofore known types of firearms, equipped with a retarded blow-back breech mechanism, usually comprise a breech bolt provided with two pairs of helical surfaces, the front pair being adapted to slide on corresponding surfaces provided in the receiver under the pressure of the cartridge case in the cartridge chamber, while the other pair, as a rule the rear one, serves to accelerate the breech bolt carrier to its required ultimate speed. The drawback of such designs is the occurrence of sliding friction between cooperating surfaces, and a further drawback is the labor consuming production of helical surfaces on the breech bolt.

Another known firearm design has a breech bolt adapted to bear on two symmetrically mounted rollers which, in turn, bear on oblique surfaces provided in the receiver, the rollers being supported by a wedge-shaped breech bolt carrier extension protruding between said rollers. Under the outward pressure of the cartridge case the rollers travel along the oblique surfaces of the receiver towards the breech bolt axis, thereby forcing back the wedge-shaped extension of the breech bolt carrier together with the breech bolt carrier, until the latter gains the required speed.

The disadvantage of such designs lies in the considerable complexity of the breech mechanism and in the fact, that during the major portion of their forward travel the rollers are pressed apart by the wedge-shaped carrier extension, whereby undesirable friction is produced.

Breech bolts of the aforementioned type are adapted during their forward travel to expel the cartridge from the feed member, which may comprise either a magazine or a cartridge belt, and to introduce the cartridge into the barrel chamber. The cartridge may, alternatively, be pushed out of the member by another part of the breech mechanism, such as by a feed-piece provided on the breech bolt or breech bolt carrier. Known breech mechanisms are sometimes equipped with cartridge feed pieces comprising

usually one or two generally rectangular lugs, which are either fixed or tiltable, as required by the ability of the cartridge to yield or not to yield in the feeding space during the rearward travel of the breech mechanism or whether the cartridge enters the feeding space only after the breech mechanism has left said space, or as required by any particular design.

It is a disadvantage of known feed pieces that—with the exception of magazines with open mouthpieces—they are able to introduce a cartridge into the barrel from such feeding spaces only, as they resemble a magazine mouth-piece or from cartridge belt links, which surround the cartridge only partially. When using closed cartridge belt links, fully surrounding the cartridges, each cartridge first has to be pulled out of the belt to the rear, then transferred so as to be in line with the cartridge chamber and only then pushed forward into the cartridge chamber.

Summary of the invention

The main object of the present invention is to provide an automatic firearm with retarded blow-back breech mechanism, in which rolling friction is substituted for sliding friction between the locking and unlocking surfaces of the breech mechanism, in order to reduce passive resistances and to increase the reliability of the firearm.

Another object of the invention is to provide a firearm of the aforementioned type wherein friction in the guiding grooves of the receiver is reduced due to the fact that the breech bolt carrier and the breech bolt are acted upon by inertia only during the major part of their rearward travel and by the force of the recoil spring during their forward travel.

A further object of the invention is to provide a firearm of the above disclosed type, which is easy to produce due to the simplicity of the breech mechanism, consisting of two assembly units only, the surfaces of which are less complex than those of known breech mechanisms.

Still another object of the invention is to provide a firearm of the aforementioned type, whose breech bolt or any other part of the breech mechanism is equipped with a cartridge feed piece having its front part or front face provided with a cutting edge for the purpose of expanding or cutting an expandable or a closed link of the cartridge belt, when such a belt is used.

A still further object of the invention is to provide a firearm of the aforementioned type equipped with a cartridge feed piece, enabling a cartridge to be pushed in a simple and efficient manner from a closed belt link directly into the cartridge chamber of the barrel.

Another object of the invention is to provide a firearm of the above type equipped with a cartridge feed piece which is of simple design and may be readily and economically produced.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims, and can be briefly summarized as follows:

The automatic firearm, to which the invention relates, comprises a breech bolt of substantially cylindrical shape, provided with two symmetrically located pins, carrying rotatable rollers for periodic engagement with first helical surfaces arranged in the block of the receiver and also for periodical engagement with at least one cam surface arranged in said block, the breech bolt carrier being provided with two symmetrically located projections having second helical surfaces and terminating in supporting faces, which are substantially perpendicular to the longitudinal axis of the breech bolt carrier, both the second helical surfaces and the supporting faces being adapted for periodic engagement with said rotatable rollers. When a feed belt is used, a fixed or tiltable feed piece is arranged on the breech mechanism, the front part

of said feed piece being provided with a cutting edge adapted to expand or cut the link of the cartridge belt.

In order that the invention may be clearly understood and readily carried into effect, the same will now be described with reference to and by aid of the accompanying drawings.

Brief description of the drawings

The accompanying drawings illustrate diagrammatically a fire arm incorporating the invention.

FIGURE 1 is a fragmentary longitudinal section of the firearm, showing the breech mechanism before it is locked,

FIGURE 2 is a similar view, on a larger scale, showing the breech mechanism in locked position,

FIGURE 3 is a fragmentary perspective view of the breech mechanism equipped with a fixed feed piece in a position before pushing out a cartridge,

FIGURE 4 is a similar view of the breech mechanism with a tiltable feed piece in the same position,

FIGURE 5 is an elevation view of the breech mechanism provided with a fixed feed piece.

FIGURE 6 is a corresponding end view of the breech mechanism provided with a fixed feed piece,

FIGURE 7 is a view similar to FIG. 6, showing a modified arrangement of the fixed feed piece,

FIGURE 8 is a longitudinal fragmentary section of the breech mechanism equipped with a tiltable feed piece,

FIGURE 9 is the corresponding end view of the breech mechanism provided with a tiltable feed piece, and

FIGURE 10 is a perspective view showing the front part of the breech mechanism at an enlarged scale.

Description of preferred embodiments

Referring first to FIGS. 1 and 2, the reference character 1 denotes a receiver, carrying a block 2 secured thereto by welding or in any other suitable way. A barrel 3 is fixed to the block 2, for instance by threading.

Provided in the receiver 1 is a guide 4 in which a breech bolt carrier 5 with a breech bolt 6 is mounted for sliding movement. A recoil spring 7 bears, with one of its ends, on the breech bolt carrier 5 and with its other end on a suitable support, for instance a rear wall (not shown) of the receiver 1. A magazine 8 with cartridges 9 is inserted into the receiver 1 below the breech bolt carrier 5. The breech bolt 6 has a substantially cylindrical form, and one end of it is provided with a recess having a center hole, communicating with a bore, housing a striker pin 23 adapted for sliding movement. The opposite or rear end of the breech bolt 6 is extended to form a stem 11 mounted for rotary and sliding movement in the breech bolt carrier 5. The rear end of the stem 11 carries lugs 12 which are accommodated in a cylindrical cavity 13 in the breech bolt carrier 5 which permits rotation of the stem 11 with the lugs 12 and, at the same time, its axial movement to a limited extent. Two symmetrical longitudinal grooves 14, having a profile identical with that of the lugs 12, are formed in the breech bolt carrier 5 alongside the stem 11. The cylindrical part of the breech bolt 6 is equipped with two symmetrically positioned pins 15 carrying freely rotatable rollers 16, adapted for engagement with helical surfaces 17, which hereinafter will be called "first helical surfaces 17," provided in the block 2 as well as with helical surfaces 18, called "second helical surfaces 18," provided on two projections 19 protruding symmetrically at both sides of the breech bolt 6 from the front end of the breech bolt carrier 5. The front ends of projections 19 have supporting faces 20, which are substantially perpendicular to the longitudinal axis of the breech bolt carrier 5 and are adapted for engagement with the corresponding rollers 16. Formed in the block 2 is at least one cam surface 22 for engagement with one of the two rollers 16. The cam surface 22 is positioned relative to the barrel 3 in such a way, that the roller 16 engages the cam surface 22 just before the breech bolt 6 reaches its extreme forward position, there-

by initiating the first stage of the rotary movement of the breech bolt.

Firing of the cartridge 9 takes place after the latter has been chambered by the breech mechanism and the breech bolt 6 turned in the breech bolt carrier 5 so that its rollers 16 bear on the first helical surfaces 17 in the block 2 as well as on the second helical surfaces 18 provided on the projections 19 of the breech bolt carrier 5, and the striker pin 23 projected forward by a firing mechanism known per se and therefore not shown in the drawing. The explosion pressure of powder gases acting on the base of the cartridge case 21 causes a rearward movement of said cartridge case, and this movement is transmitted to the breech bolt 6.

Besides this movement, a rotary movement is imparted to the breech bolt 6 by rollers 16 rolling along the first helical surfaces 17 in the block 2. At the same time the rollers 16 roll along second helical surfaces 18 provided on the projections 19, causing thereby an accelerated rearward movement of the breech bolt carrier 5 which now moves rearwardly with respect to bolt 6. When the rollers 16 come out of engagement with the first helical surfaces 17, the rotary movement of the breech bolt 6 is stopped. Simultaneously, the rollers 16 are disengaged from the second helical surfaces 18 on the projections 19 and engage the surfaces 20 provided at the front end of said projections 19.

At the same time—within limits of manufacturing tolerances—the lugs 12 on the stem 11 engage the end wall of the cylindrical cavity 13, with the result that the speeds of the breech bolt 6 and of the breech bolt carrier 5 on their rearward travel are gradually equalized and both members travel rearward at the same speed. The lugs 12 also serve to unlock the breech mechanism by hand. During this rearward travel of the breech mechanism the spent cartridge case 21 is ejected out of the weapon by means of an ejector of any known design. Having completed its recoil movement, the breech mechanism travels forward to the barrel 3 by the effect of energy accumulated in the recoil spring 7 during the recoil movement. When moving forward, the breech bolt 6 expels the next cartridge 9 from the magazine 8 and feeds it into the chamber of the barrel 3. Just before the breech bolt 6 reaches its extreme forward position, under the action of the breech bolt carrier 5, whose surfaces 20 are in engagement with the rollers 16, at least one of the rollers 16 strikes against the cam surface 22, with the result that the rollers 16 slide off the surfaces 20 on the projections 19, imparting a partial rotary movement to the breech bolt 6. The rotary movement of the breech bolt 6 and, at the same time, its forward movement are terminated by the action of the second helical surfaces 18 cooperating with rollers 16 under the influence of the recoil spring 7. Having completed these 2 movements, the breech bolt 6 bears on the barrel 3 and, simultaneously—within limits of manufacturing tolerances—at its rollers 16 on the first helical surfaces 17 on the block 2. At the same time the cartridge 9 is fired by means of the striker pin 23, driven forward by a trigger mechanism (not illustrated). Hereupon the whole cycle is repeated.

As mentioned before, the breech mechanism according to the present invention may be used in connection with various automatic firearms and, though the embodiment illustrated in FIGS. 1 and 2 shows a firearm fed from a magazine, it can equally well be employed in connection with a belt-type feed mechanism, and is adapted for both feed types.

FIGS. 3 to 9 show a breech mechanism, according to the present invention in which the cartridges are fed to the barrel from a cartridge belt. The breech bolt 6 of the firearm is, according to FIG. 3, adjacent its front part, provided with a fixed feed piece 24, which faces the cartridge 9 during forward movement of the breech bolt. As shown in FIG. 5, the feed piece 24 has an abutting surface 25, which usually is perpendicular to the axis of the

barrel 3 or slightly inclined and serves to push the cartridge 9 into the chamber 31 of the barrel 3. Provided on the feed piece 24, between said abutting face 25 and the axis of the barrel 3, is a cutting edge 26 which may either be perpendicular to the axis of the barrel 3 or inclined thereto at a required angle, as shown for instance in the embodiment of FIG. 8. When viewing the feed piece from the front, the abutting face 25 together with the cutting edge 26 resemble the letter T or L, as illustrated in FIGS. 6 and 7, respectively, according to the arrangement of the cutting edge 26 either symmetrically in relation to the axis of the feed piece or at one side thereof.

FIG. 8 shows a modified arrangement in which the feed piece 27 is tiltable, being pivotally mounted on a pin 28 in a recess 29 arranged in the breech bolt 6, and acted upon by a spring 30. The location and arrangement of the abutting face 25 and cutting edge 26 are similar to the preceding embodiments.

When the breech bolt 6 with the feed piece 24 or 27 travels forward in the direction towards the cartridge chamber 31 of the barrel 3, the abutting face 25, arranged in the front part of the feed piece 24 or 27, strikes the base of the cartridge accommodated in a belt link 32 and feeds the cartridge 9 into the cartridge chamber 31 of the barrel 3. If the links 32 forming the cartridge belt are of the expandable type, the cutting edge 26 of the feed piece 24 or 27 will gradually force apart the adjoining edges or lips of the link and push the cartridge forward. In case the cartridge belt link 32 is of the fully coherent type i.e. enclosing the cartridge along its full circumference and made e.g. from a metal of relatively low strength or from a plastic, the cutting edge 26 of the feed piece will cut the cartridge belt link 32; thereby enabling the feed piece to propel the cartridge 9 directly into the barrel chamber 31. Although the feed piece has in the preceding disclosure been described as arranged on the breech bolt, it may well be arranged on any other suitable part of the breech mechanism.

It will thus be seen that the breech bolt 6, which is of a generally cylindrical configuration, is supported for rotary movement about its axis and for longitudinal sliding movement along its axis by a carrier means formed by the carrier 5 which has the helical surface 18 which extends helically with respect to the breech bolt axis and which coacts with a roller 16 which is carried for free rotation by the breech bolt 6. The receiver means 1 supports the carrier means 5 for reciprocating movement along the axis of the breech bolt, the recoil spring means 7 serving to propel the carrier means 5 forwardly to the position thereof shown in FIG. 2. The block means formed by the block 2 is also formed with a helical surface 17, and between this first helical surface 17 and the second helical surface 18, in the locked position of the breech mechanism shown in FIG. 2, is formed a space which receives the roller 16, this construction of course being symmetrically duplicated at the other side of the breech bolt. The helical surface 18 of the carrier means terminates in its front end face 20 which extends substantially perpendicularly with respect to the breech bolt axis so that when the breech bolt is driven rearwardly it will turn at its rollers 16 along the surfaces 17 and 18 while displacing the carrier means 5 rearwardly with respect to the breech bolt until the rollers 16 move away from the surfaces 17 and into engagement with the end surfaces 20, the parts then having a position such as that shown in FIG. 1 with respect to each other. During the forward movement under the action of the recoil spring 7, just before the bolt 6 reaches the end of its forward movement one of its rollers 16 will engage the cam surface 22 of the block means 2 so that the bolt 6 will be cammed thereby around its axis back into engagement with the surface 17, permitting the carrier means 5 to continue its forward movement to the position shown in FIG. 2 where each roller 16 is again received in the space between the first helical surface 17 and the second helical surface 18.

The parts 24 and 27 form a feed means for feeding a cartridge into the firing position, and this feed means terminates in a front end face 25 which engages the rear end of the cartridge and has the cutting edge 26 which extends perpendicularly with respect to the front end face substantially radially with respect to the axis of the bolt 6, as is apparent from FIGS. 6 and 7.

It is to be understood that the invention is not limited to the form shown in any of the accompanying drawings and described herein, inasmuch as the invention as defined in the appended claims may be embodied in various forms and may be utilized in connection with various types of fire arms, in particular heavy duty fire arms of small and medium calibers.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

1. In an automatic fire arm having a retarded blow-back breech mechanism, an elongated breech bolt of substantially cylindrical configuration, breech bolt carrier means carrying said bolt and supporting the latter for rotary movement about its axis and for longitudinal sliding movement along its axis, said carrier means having at least one exterior helical surface which extends helically with respect to said breech bolt axis, receiver means supporting said carrier means for reciprocal movement with respect to said breech bolt axis, block means fixed to said receiver means in front of said carrier means and also having a helical surface which extends helically with respect to said breech bolt axis, said helical surface of said carrier means terminating in a front end face which extends substantially perpendicularly with respect to said axis and said bolt carrying for free rotation a roller which engages both of said helical surfaces in a locked position of said breech mechanism, said block means having forwardly of said end face of said carrier means a camming surface to be engaged by said roller during forward movement of said bolt for camming said bolt away from said end face to said helical surface of said block means, whereby upon rearward driving of said bolt by the explosive gases of a cartridge said roller turns along said helical surface of said block means to engage said helical surface of said carrier means for driving the latter rearwardly with respect to said bolt until said roller is displaced from said helical surface of said block means into engagement with said end face of said carrier means, and whereby during forward movement of said bolt said roller thereof will engage said camming surface of said block means to be swung thereby away from said end face of said carrier means and to be returned during rotary movement of said bolt into engagement with said helical surface of said block means while said carrier means continues to move forwardly to situate said roller between both of said helical surfaces in a forward end position of said carrier means.

2. The combination of claim 1 and wherein a recoil spring means coacts with said carrier means for propelling the latter forwardly together with said bolt.

3. The combination of claim 2 and wherein a barrel is carried by said block means in front of said bolt.

4. The combination of claim 1 and wherein said block means is formed with a pair of said helical surfaces symmetrically arranged with respect to said bolt and wherein said carrier means also is formed with a pair of said helical surfaces symmetrically arranged with respect to said bolt, said bolt having a pair of symmetrically arranged rollers for coacting with said helical surfaces.

5. The combination of claim 1 and wherein a feed means is carried by said bolt for feeding a cartridge to a firing position, said means having a front end for engaging a rear end of the cartridge which is to be fed and having adjacent said front end a forwardly directed cutting edge which extends from said front end of said feed means between the latter and said bolt substantially radially with respect to the axis thereof.

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6. The combination of claim 5 and wherein said feed means is fixed to said bolt.

7. The combination of claim 5 and wherein said feed means is pivotally carried by said bolt.

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