June 1, 1943. N. L. BREWER 2,320,403

FEED MECHANISM FOR FIREARMS

Filed March 24, 1939 3 Sheets-Sheet 1

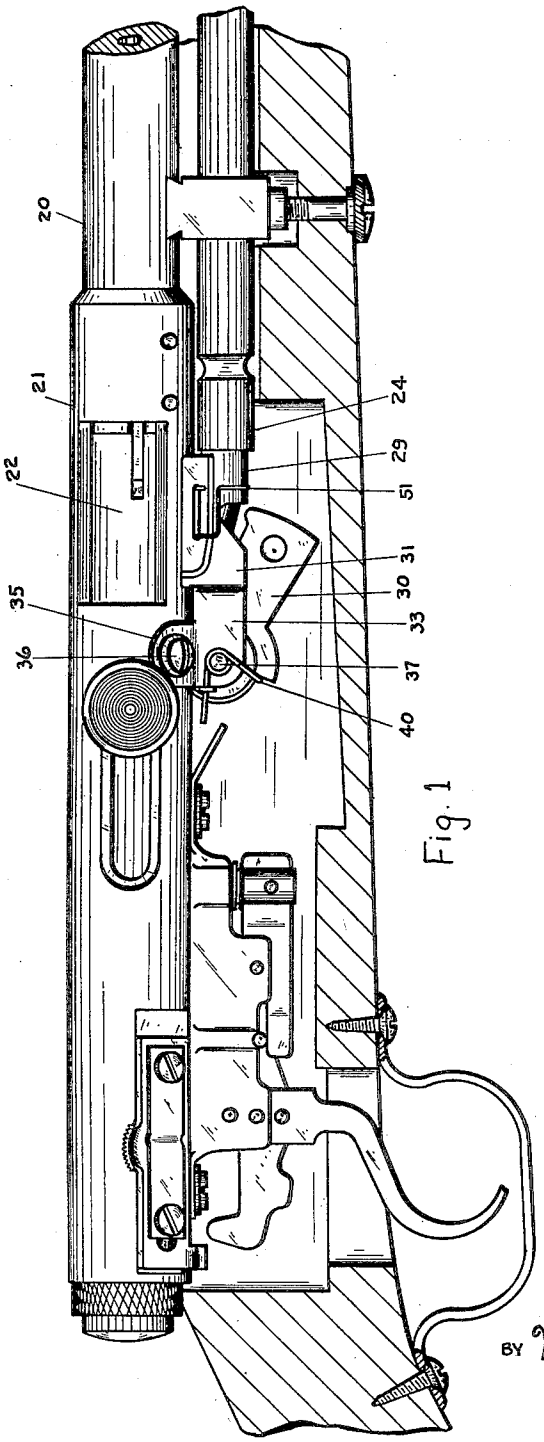

Fig. 1

INVENTOR
NICHOLAS L. BREWER
BY Martin & Rendell
ATTORNEYS

June 1, 1943. N. L. BREWER 2,320,403

FEED MECHANISM FOR FIREARMS

Filed March 24, 1939 3 Sheets-Sheet 2

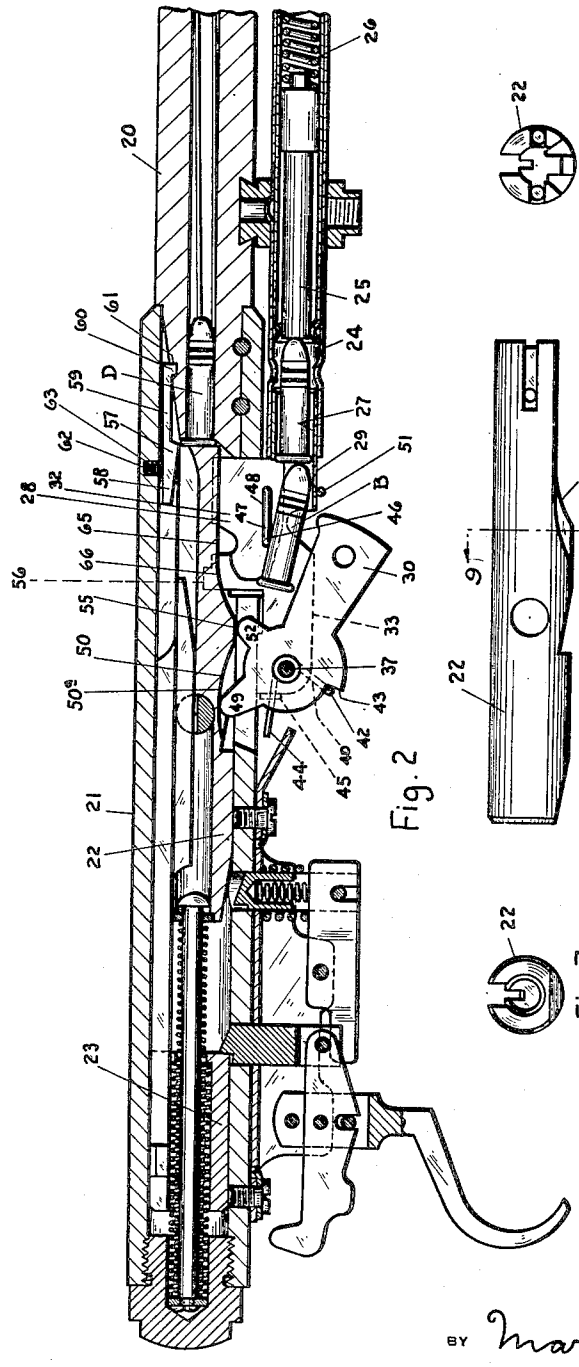

Fig. 2

Fig. 4

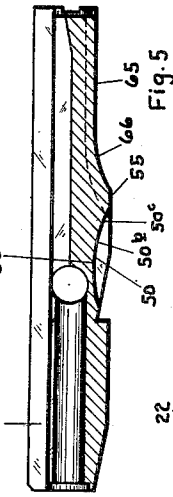

Fig. 5

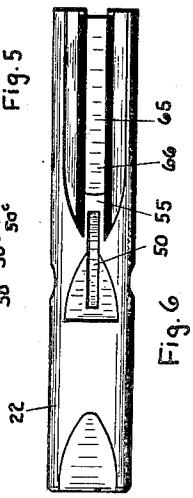

Fig. 6

Fig. 7

Fig. 8

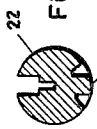

Fig. 9

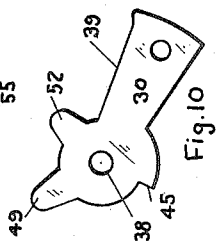

Fig. 10

INVENTOR

NICHOLAS L. BREWER

BY Martin & Rendell

ATTORNEYS

June 1, 1943. N. L. BREWER 2,320,403

FEED MECHANISM FOR FIREARMS

Filed March 24, 1939 3 Sheets-Sheet 3

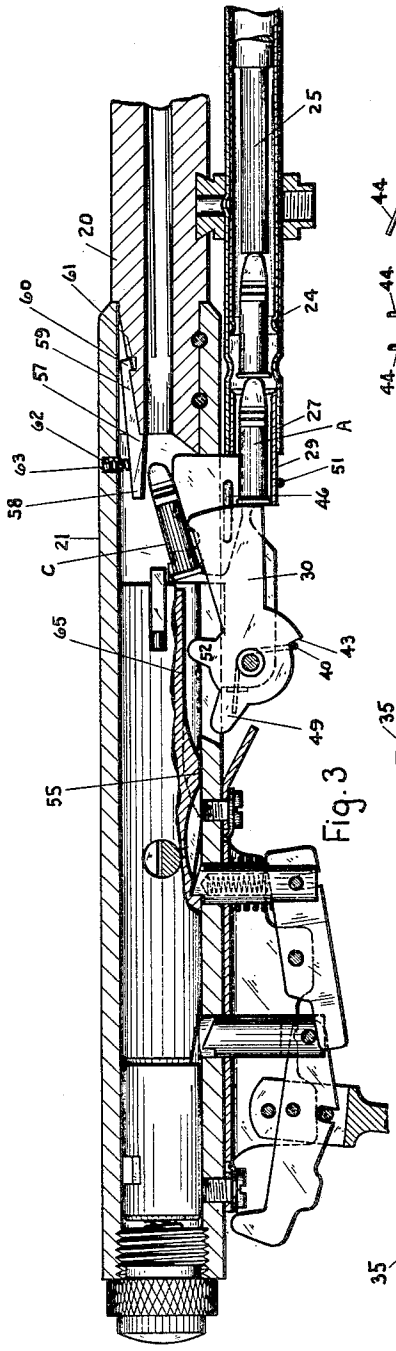

Fig. 3

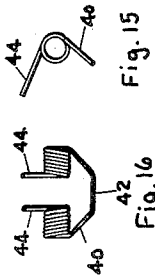

Fig. 15

Fig. 16

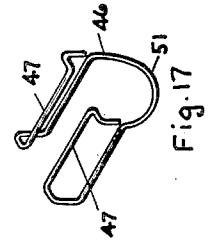

Fig. 17

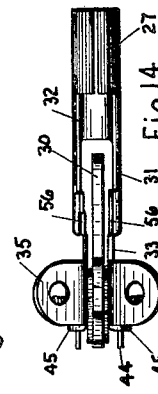

Fig. 14

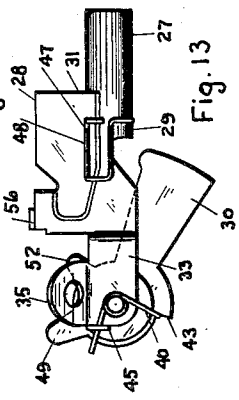

Fig. 13

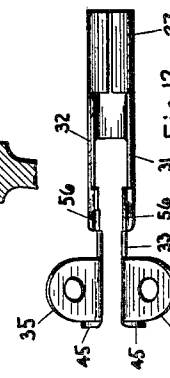

Fig. 12

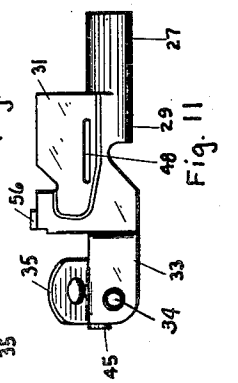

Fig. 11

INVENTOR
NICHOLAS L. BREWER

BY Martin & Rendell

ATTORNEYS

Patented June 1, 1943

2,320,403

UNITED STATES PATENT OFFICE

2,320,403

FEED MECHANISM FOR FIREARMS

Nicholas L. Brewer, North Agawam, Mass., assignor to Savage Arms Corporation, New York, N. Y., a corporation of Delaware

Application March 24, 1939, Serial No. 263,959

2 Claims. (Cl. 42—17)

This invention relates to firearms and particularly to the feed mechanism of repeating firearms, especially of the full automatic and semi-automatic types.

The purposes of my present invention are to provide a firearm of the class described of new and improved construction and operation and one which is economical and simple in construction, durable and effective in use and not liable to get out of order; particularly to provide a new and improved feed mechanism in and combined with such a firearm, and particularly to provide a semi-automatic firearm which combines and incorporates the advantages and especially the simplicity of a box magazine repeater with the advantages and especially the capacity of a tubular magazine repeater; to provide a construction in such a semi-automatic gun or rifle that includes a simple lifter mechanism and magazine box located to the rear end of the tubular magazine whereby the power from the firing of the gun can be safely and effectively used to raise a cartridge without deformation or misplacement from the rear of the tubular magazine up through the magazine box into position where it may be ultimately moved into the bore of the barrel by the returning forward movement of the breech bolt.

In my prior Patent No. 2,094,577, issued October 5, 1937, I showed a feed mechanism including a magazine box so connecting the rear end of the tubular magazine to the chamber of the receiver of a hand-operated repeating rifle of the bolt action type. The feed mechanism shown in that patent was entirely satisfactory for a hand-operated repeating rifle but is not satisfactory or proper nor durable for the greater power and the sudden application of power in the mechanism of a semi-automatic rifle or gun. The purpose of this present application is to improve the feed mechanism of that gun so that it will be properly adapted for operation in a semi-automatic gun, and also in a full automatic gun, and also adapted for use in a manually-operated repeating gun.

A further purpose is to provide a feed mechanism that is particularly adapted for use in a semi-automatic rifle or gun and particularly to provide a feed mechanism construction where the very rapid rearward movement given to the breech bolt is applied gradually enough to the lifter to prevent deformation or misplacement of the cartridge that is to be lifted into the receiver and also to provide for slowly decelerating the upward movement of the cartridge so that there will not be undesirable deformation of the cartridge when its upward movement is brought to an end.

Further purposes and advantages of this invention will appear from the specification and claims herein.

Fig. 1 is a side elevation of a blow-back type of semi-automatic rifle embodying the present invention, the material part of the rifle being shown as a right hand side elevation and the adjacent portion of the stock being shown in vertical section. The parts of the rifle are shown in the position they occupy when the rifle is cocked.

Fig. 2 is a central longitudinal section of the part of the rifle shown in Fig. 1 and with the rifle still cocked but with the stock omitted.

Fig. 3 is a view of the parts shown in Fig. 2 but with the parts in the position they occupy when the hammer and breech bolt have been driven back as by the firing of the gun and with the hammer and breech bolt still in rearward position, the barrel, receiver and tubular magazine and the lower forward part of the breech bolt and the housing for the trigger and release mechanism being in central longitudinal vertical section, but with the rest of the breech bolt in right side elevation as also are the hammer, the feed mechanism lifter and the trigger and release mechanism.

Fig. 4 is a right hand side elevation of the breech bolt and Fig. 5 is a central longitudinal vertical sectional view of said breech bolt.

Fig. 6 is a view of said breech bolt as seen from below.

Fig. 7 is a rear elevation of the breech bolt and Fig. 8 is a front elevation.

Fig. 9 is a vertical sectional view of the breech bolt on line 9—9 of Fig. 4.

Fig. 10 is a right side elevation of the lifter of the feed mechanism.

Figs. 11 and 12 are respectively right hand side elevation and top or plan views of the magazine box.

Figs. 13 and 14 are right hand side elevation and top or plan views of the magazine box, the stop spring, the lifter and its spring assembled, with the lifter in a downward position.

Fig. 15 is a side elevation and Fig. 16 is a front elevation of the lifter spring 40.

Fig. 17 is a perspective view of the stop spring 46.

Referring to the drawings in a more particular description it will be seen that the firearm illustrated is of the semi-automatic type of rifle and

of the blow-back form, that is, where the breech bolt is driven back directly by the gases of explosion from the cartridge in the barrel. Most combinations of this invention, however, are applicable to other forms of semi-automatic guns and also to full automatic and manually operated repeating arms and it will be understood that the illustration and description of my invention with a blow-back type of operation is only for the purpose of illustration and definiteness in description.

The barrel **20** is of usual form and has mounted immediately to the rear of its breech end a chambered receiver **21** in which are reciprocatingly mounted the breech bolt **22** and the hammer **23** both of generally cylindrical form. Located close to the barrel and substantially parallel thereto and generally below the barrel, there is located the tubular magazine **24** with yieldingly tensioned means therein for urging the cartridges towards the rear of the said magazine, such means commonly including a plunger **25** immediately contacting the nose of the most forward cartridge and with said plunger urged rearwardly by the usual helical spring **26**.

There projects into the rear end of the tubular magazine the forwardly projecting tubular extension **27** of the magazine box **28**. The magazine box that I have shown in this application follows in general form the magazine box of my said prior patent and is conveniently formed of suitable sheet metal formed by suitable steps to produce the shape particularly shown in the side elevation thereof, Fig. 11, and in top or plan view thereof, Fig. 12. The said forward extension **27** is of a diameter to receive therein a cartridge of the desired size in lengthwise position and to the rear of said extension the magazine has a semi-circular part **29** into which extends the rearward part of the cartridge when the parts of the gun are in the position as shown in Fig. 3, that is with the lifter **30** in upward position with its front curved edge forming a stop for the cartridge in the part **29** of said magazine. From the semi-circular part **29** the box is extended upwardly and to the rear of said part forming two main sides **31** and **32** at the right and left hand of the gun. The upper portion of these sides **31** and **32** project upwardly through an opening in the lower wall of the receiver into the chamber of the receiver and form the passageway for the pivoted lifter **30** to lift or carry the cartridges from the lower level of the magazine box upwardly into the chamber of the receiver more or less to the position of the cartridge denominated C in Fig. 3. Practically also the magazine box has formed integrally therewith two rearwardly extending arms **33** each having towards its rear end an aperture **34** and each also having at its upper rear edge outwardly curved ears **35** which fit against the under surface of the receiver and are fastened thereto as by screws **36** extending through suitable holes in said ears **35**. These ears and the fit of the forwardly extending tubular extension **27** in the tubular magazine serve to hold the magazine box in position. The apertures **34** in arms **33** serve for supporting the lifter pin **37**.

A separate plan view or right side elevation of this lifter is shown in Fig. 10. Roughly, the rear half of the lifter is in the form of a disk having at its center the pivot hole **38** whereby the rear end of said lifter by means of the lifter pin **37** is pivotally mounted in the two rearward arms **33** of the magazine box and thus in effect the lifter is pivotally mounted with regard not only to the magazine box but to the receiver. The forward half of the lifter has its upper edge **39** function as the edge of the lifter which engages the lower side of the cartridge as seen in the second contact position in Fig. 2 by the cartridge B after this cartridge has been pushed rearwardly along through the bottom portion of the magazine box with the rim of said cartridge sliding along the said upper edge **39** of the lifter when the lifter is in depressed position as shown in said Fig. 2. A lifter spring **40** of which a separate side elevation is shown in Fig. 15 and a front elevation is shown in Fig. 16, has its two separate coiled portions **41** so formed as to place tension upon the lifter through the central portion **42** of said spring bearing against the rearwardly facing shoulder **43** of the lifter, while the rearwardly extending ends **44** of said spring are held in place by passing through apertures in the small ears **45** outwardly projecting from the rearward arms **33**. This lifter spring is so proportioned in regard to the lifter and the magazine box that it tends to lift the forward end of the lifter particularly after the forward end of the lifter has been depressed to the downward position of said lifter as shown in Figs. 1 and 2.

Preferably the magazine box of this rifle is provided with a stop spring **46** of which a perspective view is shown in Fig. 17. As this stop spring is substantially like the similar part shown and described in detail in my previous invention, it need not be described in detail here further than to say that said spring has two inwardly directed loops **47** normally projecting through two oppositely disposed slots provided in the sides of the magazine box so that these loops will engage the upper portion of a cartridge in the position in said box of the cartridge B in Fig. 2 and yieldingly hold a cartridge in that position from upward movement simply from casual movement of the rifle and also from the upward urge imparted to the lifter by the lifter spring. Said inwardly projecting loops **47**, however, will be cammed outwardly from their respective sides far enough to let the cartridge go up thereby when the forward end of the lifter receives a positive upward movement through said lifter being rotated on its pin by the positive movement of said lifter by the rearwardly directed, upwardly extending actuating arm **49** of said lifter being engaged by the cam **50** on the breech bolt. It will be seen from the side view of the stop spring **46** as shown in Fig. 1 that said stop spring has parts that engage the sides of the box and particularly an underlying loop **51** on said spring which loop goes below the semi-circular part **29** at the bottom of the magazine box so that said stop spring **46** is mounted by its own shape and its own resilience upon said magazine box with said loops **47** urged inward through said slots **48** but adapted to yield outwardly partly through said slots when the cartridge is cammed upward therepast by positive movement of said lifter.

In my previously issued patent above mentioned the actuating arm upon the lifter extended substantially straight up when the lifter was in downward position and was engaged by a substantially vertical rearwardly directed shoulder upon the lower side of the breech bolt when the breech bolt was being retracted. The engagement for these two parts took place some considerable time after the rearward movement of the breech bolt was initiated so that the shooter

of the gun had the advantage of the momentum thus imparted to the breech bolt to perform part of the necessary functions of the breech bolt on its rearward movement in suitable succession. Upon attempting to utilize the general feed mechanism of my previous patent in a semi-automatic gun it became apparent that the much greater speed with which the breech bolt was driven back in a semi-automatic gun as compared to the hand-operated repeating rifle of my previous patent that the lifter was started in its upward movement with too great speed so that it would strike the cartridge with such force as to deform the cartridge and render it unadapted to freely go into the bore of the barrel or would deform the cartridge sufficiently to render it difficult to pass properly through the upper portion of the magazine box. The very sharp initiation of upward movement thus communicated to the lifter would also impart so much power or speed to the cartridge that it under certain circumstances might be projected up against the top of the receiver or that the cartridge might be dislocated from its required position of being in an angular position pointing towards the rear end of the bore of the barrel. In my present invention I have overcome these objections and some others that arose by providing for a co-operation between the lifter and the rearwardly moving breech bolt that will ensure a gradual starting and substantially uniform acceleration of the lifter so that it will impart its lifting action gradually and gently enough to the cartridge to prevent distortion of the cartridge and to prevent too violent upward movement of the cartridge in its lifting movement. These results I attain by providing that the rear or main actuating arm **49** upon the lifter shall slant appreciably rearward even when it begins to be engaged by the concavely curved surface of the rearward and main cam **50** of the breech bolt, and further that the said cam **50** is relatively long and will have a gentle and gradually increasing camming action upon the upper curved end of the arm **49** so that the initial actuation of the arm **49** takes place very slowly during the first portion of the backward travel of the breech bolt. The whole angular displacement of the actuating arm is brought about with uniform angular acceleration. It will be noticed that the portion of the curved cam initially engaged by said arm when the breech bolt begins its rearward movement is parallel with the path of travel of the breech bolt and thereafter said cam curves downward as it goes forwardly with continuously increasing downward slope so that the actuation of the arm **49** takes place with uniform increments in its angular displacement for uniform amounts of rearward movement of the breech bolt. In other words, the angular movement of the arm starts smoothly from the position of rest and attains its maximum rate of movement perfectly gradually and without interruptions or abrupt changes in movement of any sort. As will be seen, this is the gentlest way in which the required angular displacement of the lifter can be effected in any given interval of time or for any given amount of rearward travel of the breech bolt. After engaging the most forward part of the curved cam **50**, the substantially horizontal face **55** upon the curved bottom of the breech bolt in front of the cam **50** where for a short distance as seen in Fig. 2 and especially in Fig. 5 the breech bolt is left at its full rounded periphery on its lower side, passes over the said actuating arm and the positive actuation of the lifter by the breech bolt is finished. As the rearward travel of the breech bolt brings the last or forwardmost part of the cam **50** past the rearward arm **49**, the cartridge has been pushed past the stop spring **46** and thereafter its last upward movement towards the position of the cartridge C in Fig. 3 will be accomplished by movement of said lifter under the tension of its lifter spring **40** and by the momentum already imparted to the lifter and cartridge.

This further counter-clockwise rotation of the lifter by its momentum and the tension of the lifter spring obviously moves the integral arm **49** down further from engagement with the breech bolt to the position of the lifter shown in Fig. 3 and meanwhile the breech bolt has moved further to the rear to the position shown in Fig. 3.

During the latter part of the upward movement of the lifter and the cartridge carried thereby as just described there is a tendency for the forward or bullet end of the cartridge to swing upward from the top edge of the lifter and towards the top of the receiver. This tendency is caused by the cartridge being first arrested in its upward movement by the cartridge at some part of its rear half coming into contact with the front corners of the inturned upper parts of the rear portions **56** of the sides **31** and **32** of the magazine box. If this upward swing of the forward end of the cartridge about these points of contact were allowed to take place unchecked it would place a severe bending strain upon the portions **56** of the magazine box and would cause distortion of the cartridge and would hold the cartridge in such a position that it could not be fed into the barrel. To overcome these difficulties and to control this swinging tendency of the cartridge there is provided a spring-tensioned bumper **57** of which a side view in its two positions appear in Figs. 2 and 3 of the drawings. The rearward and cartridge-engaging part **58** of the bumper is located in the upper forward portion of the chamber of the receiver and it is held in position by a forward extension **59** which is let into a slot formed in the rear upper side of the barrel. This extension has at its front lower side a downwardly extending ear **60** which projects into a further small downwardly extending recess **61** in the barrel. The extension **59** has its lower side so shaped and the upper face of the long recess in the barrel is correspondingly shaped so as to allow the spring bumper to move from its upward position shown in Fig. 2 where its upper part is practically flat against the upper inner surface of the receiver to the position shown in Fig. 3 where the lower and cartridge-engaging face of the rearward portion **58** of the bumper without interruption meets the upper level of the bore of the barrel, so as to form an unbroken guide for the bullet. This bumper is yieldingly pushed down to this depressed position by a small coiled spring **62** having its upper end fitting into a socket **63** extending from the chamber of the receiver into the wall of the receiver and with the lower end of the spring bearing against the upper edge of the rearward part **58** of the bumper. It will now be seen that when a cartridge under its tendency to swing as just above described does so swing upwardly about its point of contact with the portions **56** of the magazine box, the bullet of the cartridge will come into contact with the lower face of the rearward part of this spring-

tensioned bumper and such upward swinging motion will be gradually and gently stopped without distortion of the cartridge. As the forward end of the cartridge so swung up from the position of the cartridge denoted C in Fig. 3 comes into contact with the bumper, the rear end of the cartridge as it were pried the lifter downward against its lifter spring tension. As soon as the upward swing of the front end of the cartridge is stopped by the bumper, the force of the lifter spring transmitted through the lifter against the rearward end of the cartridge swings the cartridge from its contact with the bumper down again to the normal position of cartridge C in Fig. 3. Thereafter the bumper will be held in its lower position by the spring **62** and with its lower face approximately in line with the upper level of the bore of the barrel in which position it thereafter forms a guide by means of which the end of the bullet may enter the bore of the barrel without interference from the upper rear corner formed by the junction of the upper part of the bore of the barrel and the back face of the barrel. This lower face of the bumper thereby provides a guide for the smooth entry of the bullet into the bore of the barrel in spite of any tendency there may be for the bullet to rise above this position by any tipping of the cartridge.

It will be understood that upon the rearward movement of the breech bolt either by manual retraction thereof as for the first firing of the gun, but always upon rearward movement of the breech bolt from a firing of the gun, such rearward movement of the breech bolt will compress the breech bolt spring. The force of this breech bolt spring tends to urge the breech bolt forward and when the proper time comes, the breech bolt will move forward engaging on its forward movement the rearward upper end of a cartridge and push it forward first disengaging it from the inturned upper edges of the portions **56** of the magazine box and then as the cartridge is free from those inturned edges to move upward, the spring-tensioned lifter will raise the cartridge further practically into line with the bore of the barrel and the forward moving breech bolt will carry the cartridge into its position in the bore of the barrel. Towards the latter part of this forward travel by the breech bolt the rearward part **58** of this bumper is brought into the recess at the upper side of the breech bolt forward of the front end of the firing pin and is raised by camming engagement with a part of the breech bolt from the position shown in Fig. 3 to its upper position as shown in Fig. 2 so that the bumper has been raised far enough to allow the flange of the cartridge to come against the rear face of the barrel as shown in said Fig. 2.

During this forward travel of the breech bolt the lifter has been swung down from its position above that shown in Fig. 3 to its downward position as shown in Fig. 2 by means of the camming engagement of a forward, actuating arm **52** provided upon the disk portion of the lifter against the cam face **66** on said bottom of the breech bolt. Just prior to this camming action the arm **52** has cleared or passed below the long horizontal face **65** on the bottom of the breech bolt leading to the cam face **66**. The cam face **66** is slanted or curved downwardly as it extends rearwardly so as to gradually rotate the lifter in a clockwise direction until it is brought to its downward position as shown in Fig. 2 and is held in that downward position by the last forward movement of the breech bolt, bringing the horizontal face **55** directly over and in contact with the upper end of the forward actuating or operating arm **52**.

During the latter part of this clockwise rotation of the lifter the rear end of a cartridge has been pressing against the forward slightly curved edge of the lifter and as the lifter comes almost to its final downward position this forward edge of the lifter is moved beyond or below the cartridge's rear end and said cartridge then under the tension of the tubular magazine spring moves to the rear and along the upper edge of the lifter proper substantially to the position shown by the cartridge denominated B in Fig. 2. This completes a full cycle of operation of the feed mechanism constituting the subject-matter of this application.

It will be understood that in all semi-automatic or fully automatic firearms there will be provided some form of trigger and release mechanism to hold the hammer when it and the breech bolt are brought to rearward position. I have illustrated as used with this rifle the trigger and release mechanism and the breech bolt control mechanism which forms the subject-matter of a separate patent application to the United States Patent Office filed by me on the 14th day of March, 1939, as Serial No. 261,804, now Patent Number 2,223,093, dated November 26, 1940. It will be understood, however, that the using of that trigger and release mechanism and the breech bolt control mechanism is simply for the use of illustration and definiteness in providing a completely operating rifle in this application and that neither the feed mechanism of this application is limited to use with my form of trigger and release mechanism nor the breech bolt control mechanism shown in said other application of mine. Also it will be understood that the breech bolt control mechanism and the trigger and release mechanism shown in my other said application is not limited to its use with the feed mechanism that forms the subject-matter of this application.

It should also be understood that this feed mechanism while intended primarily for use in semi-automatic or fully automatic guns can also be well used to good advantage in manually operated repeating guns since the elements of reliability incorporated for satisfactory service under the very severe operating conditions of the semi-automatic and fully automatic guns are also elements of added reliability in the somewhat easier service conditions of manually operated repeating guns.

In a semi-automatic gun especially of the "blow-back" type, it is generally recognized that the breech bolt or breech member achieves its acceleration from the firing of the gun within a very short space of time and in an exceedingly short extent of travel and that thereafter and for the main length of travel the breech bolt continues its rearward travel at substantially a uniform rate of travel or speed. After the initial acceleration the rate of travel or speed of the breech bolt is so close to theoretical uniformity of speed that for all practical uses, the speed for the main rearward movement of the breech bolt may be considered uniform and I have so considered it in several of the claims where I have assumed that the speed or rate of rearward travel of the breech bolt is uniform and that the feed mechanism is so constructed that this uniform rearward speed of the breech bolt will impart a substantial uniform angular acceleration to the

upward movement of the forward part of the lifter and thereby a like movement to the cartridge, which uniform angular acceleration is the most gentle way to produce high speed in the upward movement of the cartridge and without deformation thereof.

What I claim as new and desire to secure by Letters Patent is:

1. In a semi-automatic gun having a barrel, a receiver to the rear thereof and a magazine adapted to deliver cartridges to the receiver, a breech bolt mounted in the receiver for reciprocating movement only and driven back directly by the firing of a cartridge, said breech bolt having on its bottom a downwardly facing, lengthwise extending cam, said cam beginning substantially tangent to a line parallel with the path of movement of the breech bolt and extending forwardly and slanting downwardly in a concave curve, and a cartridge lifter located below said breech bolt and pivotally mounted near its rear end on an axis transversely of said breech bolt and having a long forwardly extending portion adapted to receive a cartridge on its upper edge and lift it upwardly as the said front end is swung upwardly, said lifter having on its rearward portion an upwardly projecting operating arm projecting rearwardly relative to the vertical plane of the axis of the lifter and, when the breech bolt is in closed position, lying closely adjacent to the rearward portion of said cam that begins on a line substantially parallel with the path of movement of said breech bolt, and engaged by the said cam from the start of rearward movement of the breech bolt and causing a gently beginning and gradually increasing angular movement of the front end of the lifter.

2. In a semi-automatic gun, a breech bolt mounted for and requiring reciprocating movement only and driven back directly by the firing of a cartridge, said breech bolt having on its bottom a downwardly facing, lengthwise extending cam, said cam beginning substantially tangent to a line parallel with the path of movement of the breech bolt and extending forwardly and slanting downwardly in a concave curve at a constantly increasing angle, and a cartridge lifter located below said breech bolt and pivotally mounted near its rear end on an axis transverse of said breech bolt and having a long forwardly extending portion adapted to receive a cartridge on its upper edge and lift it upwardly as the said front end is swung upwardly, said lifter having on its rearward portion an upwardly projecting operating arm, said arm projecting rearwardly relative to the vertical plane of the axis of the lifter and, when the breech bolt is in forward position, lying closely adjacent the rear part of said cam where the cam begins substantially tangent to a line parallel to the path of movement of the breech bolt, and engaged by the said breech bolt cam from the start of rearward movement of the breech bolt and causing a gentle beginning and a gradually increasing angular movement of the front end of the lifter.

NICHOLAS L. BREWER.