Dec. 23, 1958 R. MARSH 2,865,255

FIREARM WITH TRANSVERSELY MOVABLE BARREL CHAMBER

Filed Aug. 3, 1955 7 Sheets-Sheet 1

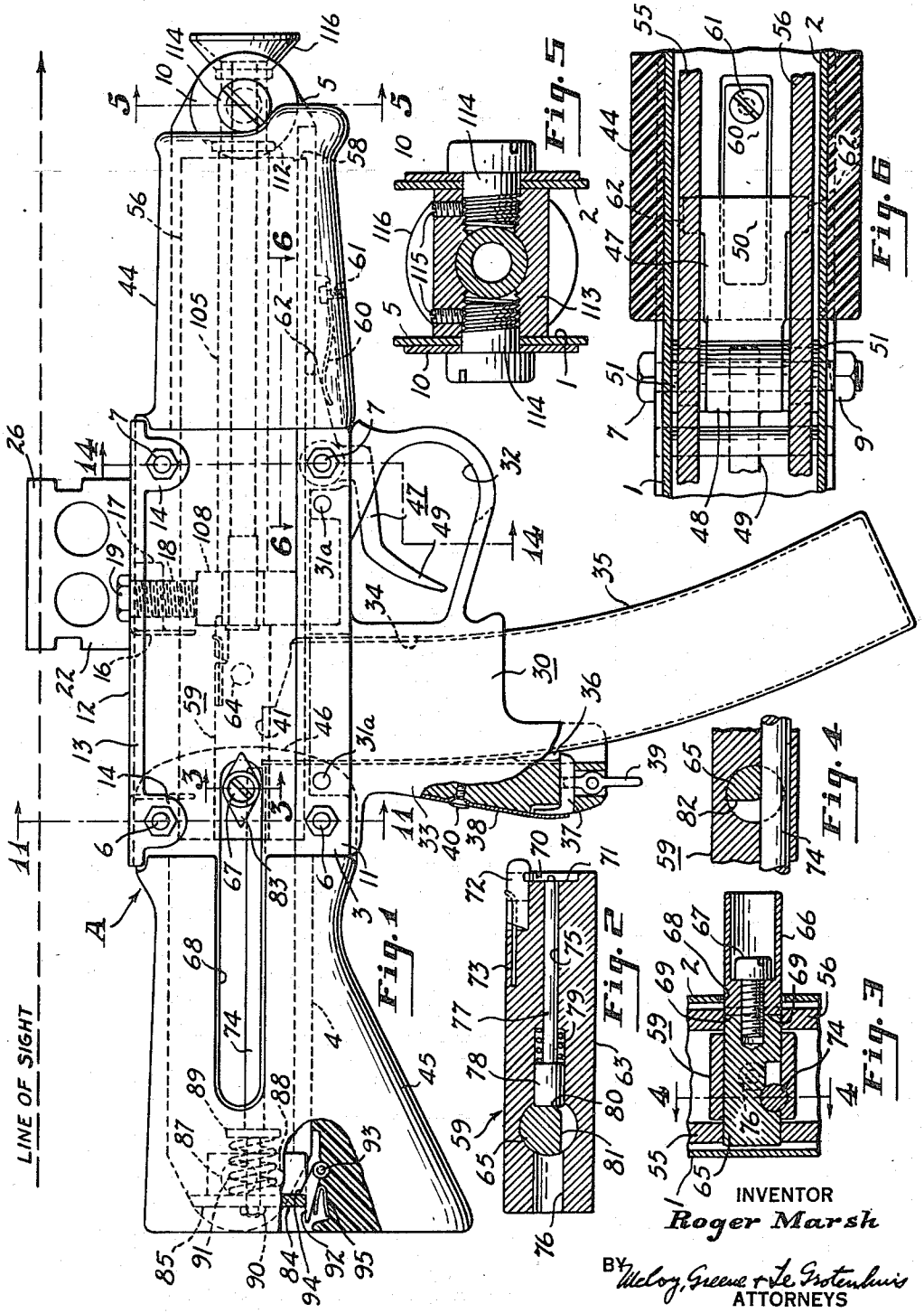


Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

INVENTOR
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BY Meloy, Greene & Le Grotenhuis
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Dec. 23, 1958 R. MARSH 2,865,255

FIREARM WITH TRANSVERSELY MOVABLE BARREL CHAMBER

Filed Aug. 3, 1955 7 Sheets-Sheet 2

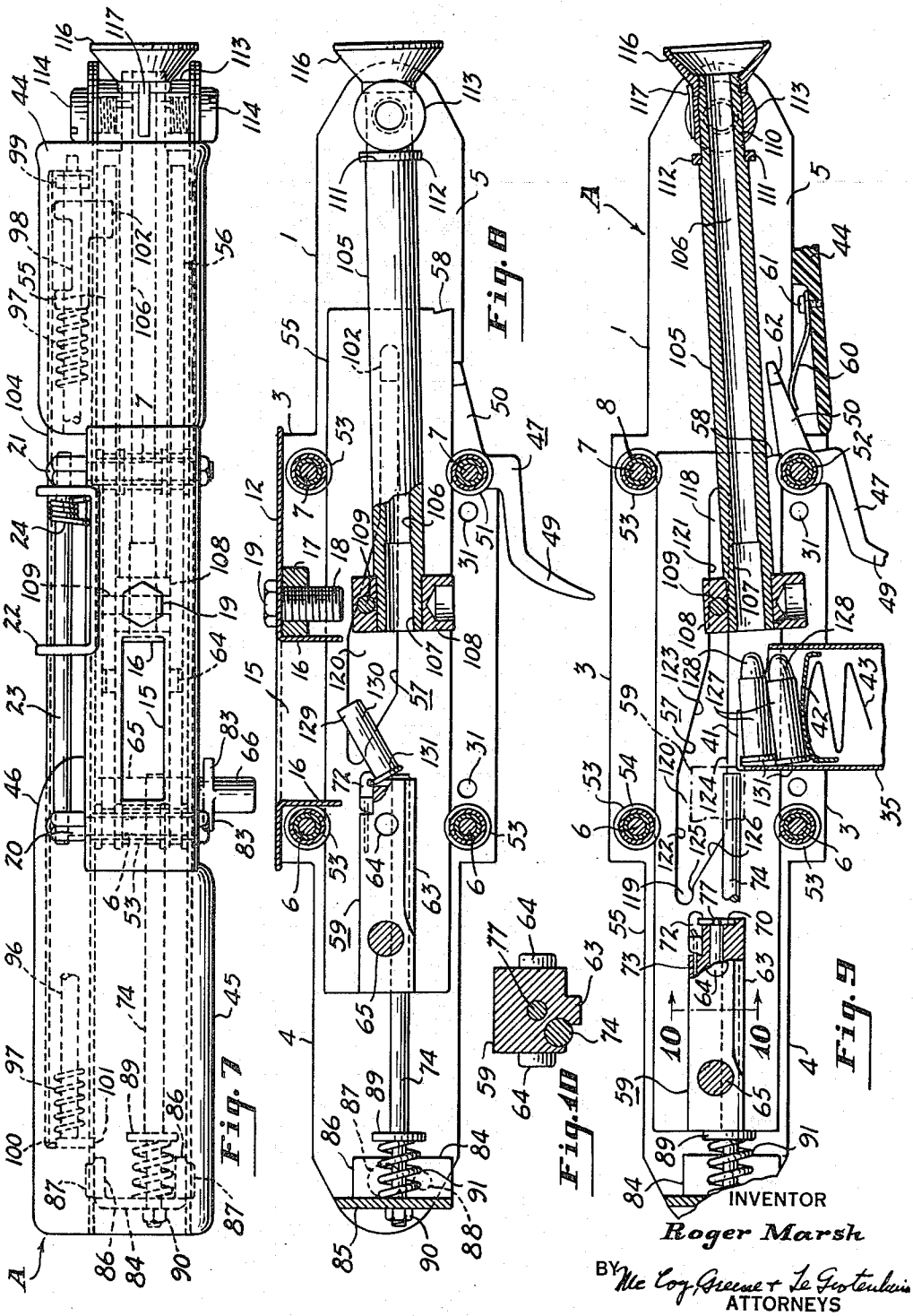


Fig. 7

Fig. 8

Fig. 10

Fig. 9

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Dec. 23, 1958 R. MARSH 2,865,255

FIREARM WITH TRANSVERSELY MOVABLE BARREL CHAMBER

Filed Aug. 3, 1955 7 Sheets-Sheet 3

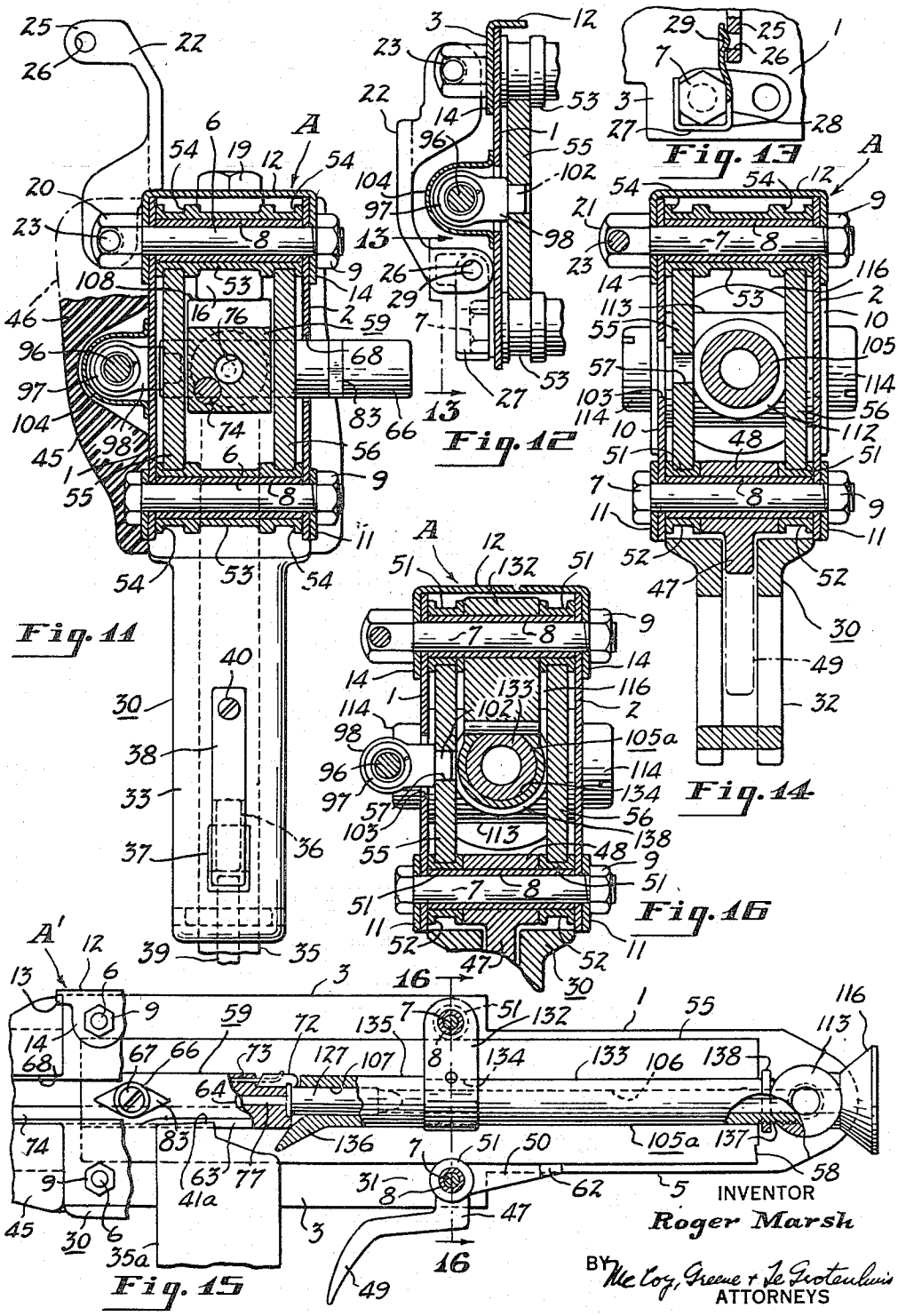


Fig. 11

Fig. 12

Fig. 13

Fig. 14

Fig. 15

Fig. 16

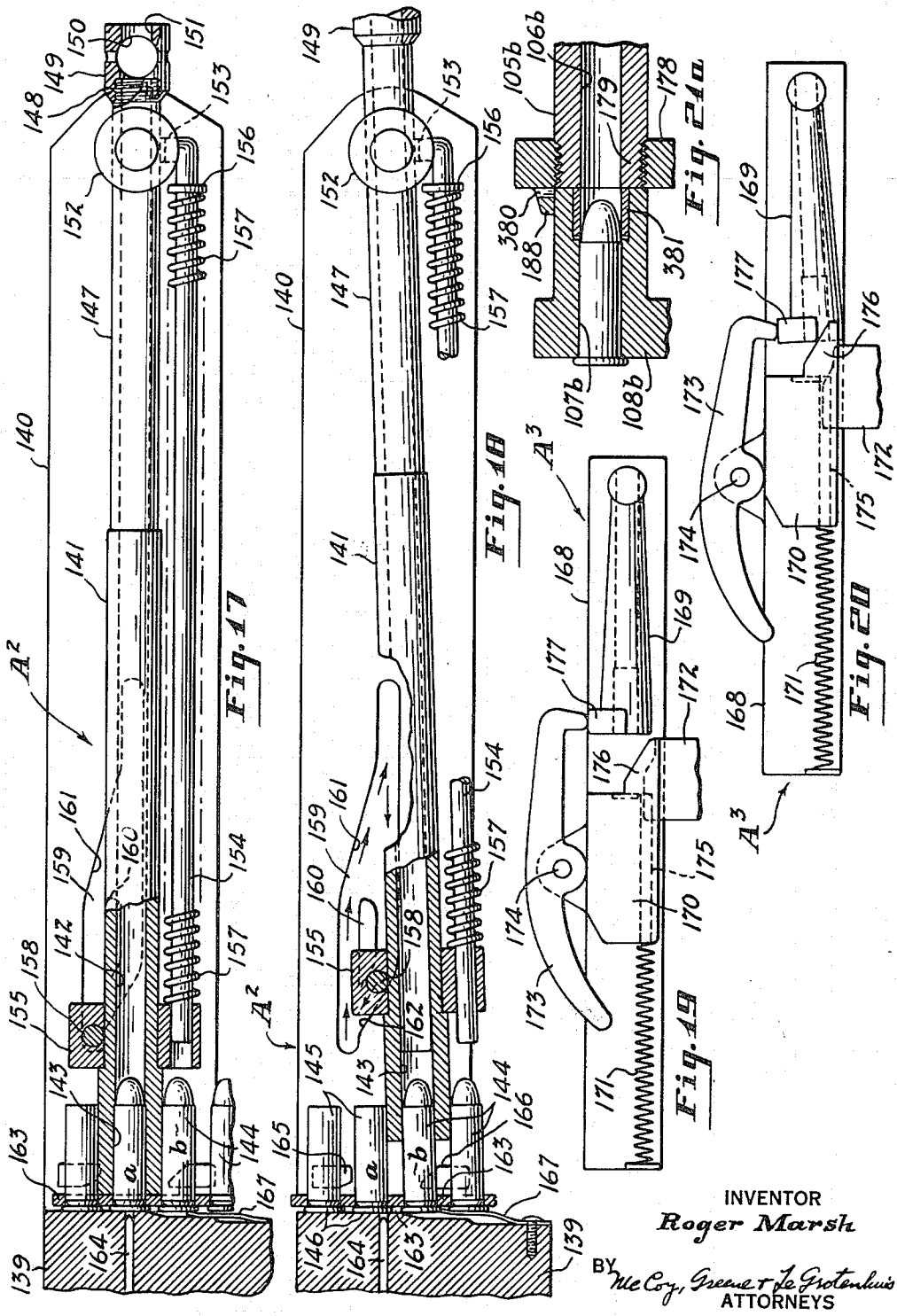
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Dec. 23, 1958 R. MARSH 2,865,255

FIREARM WITH TRANSVERSELY MOVABLE BARREL CHAMBER

Filed Aug. 3, 1955 7 Sheets-Sheet 4



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Dec. 23, 1958 R. MARSH 2,865,255

FIREARM WITH TRANSVERSELY MOVABLE BARREL CHAMBER

Filed Aug. 3, 1955 7 Sheets-Sheet 5

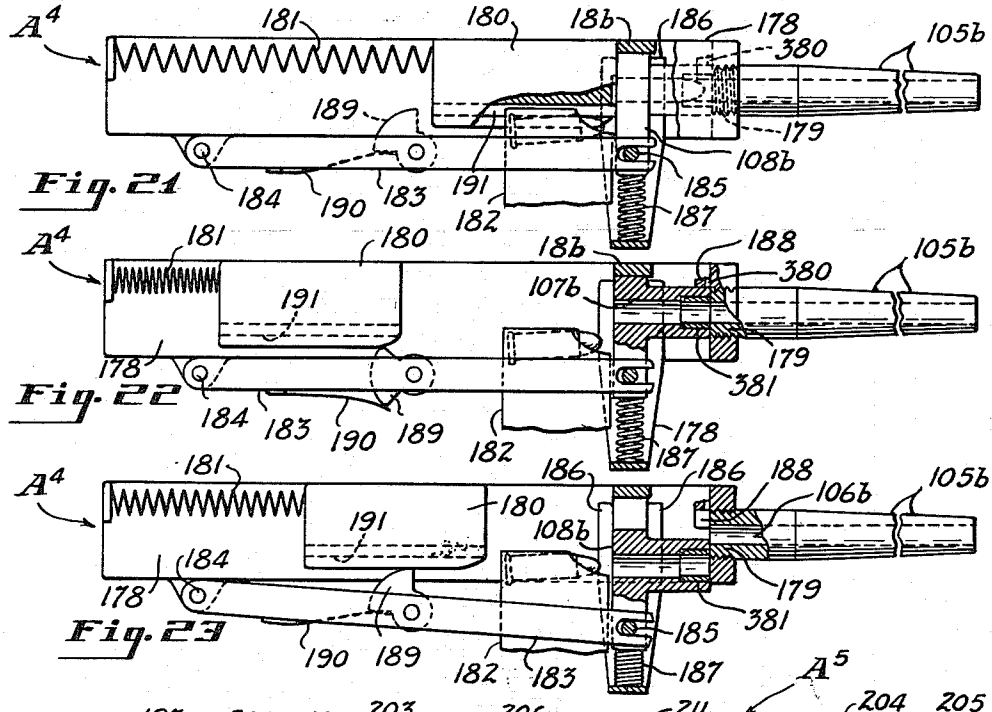


Fig. 21

Fig. 22

Fig. 23

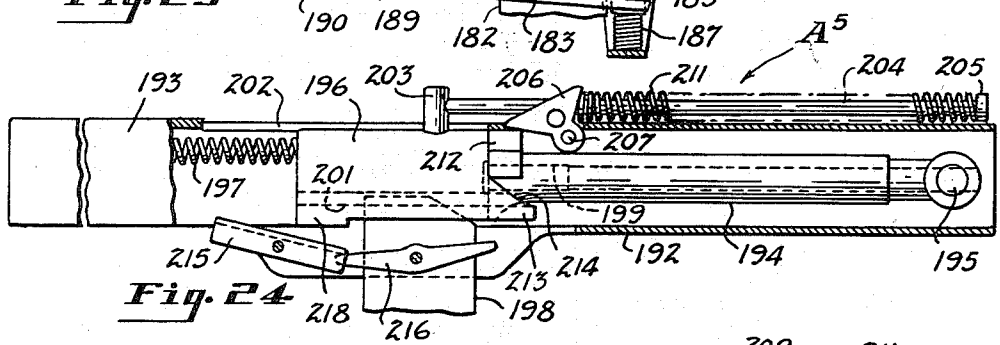


Fig. 24

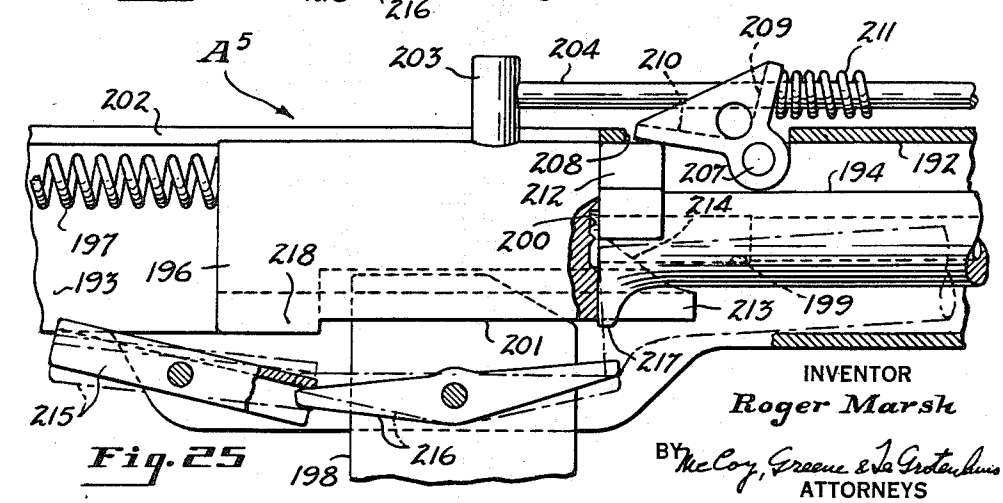


Fig. 25

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Dec. 23, 1958 R. MARSH 2,865,255

FIREARM WITH TRANSVERSELY MOVABLE BARREL CHAMBER

Filed Aug. 3, 1955 7 Sheets-Sheet 6

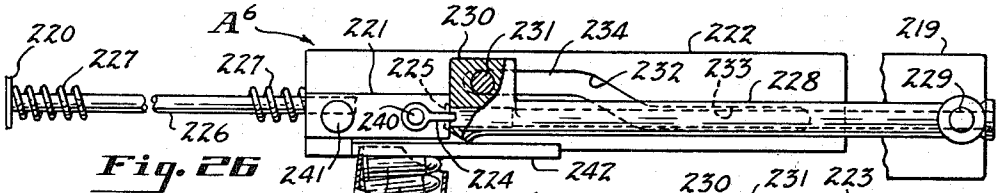


Fig. 26

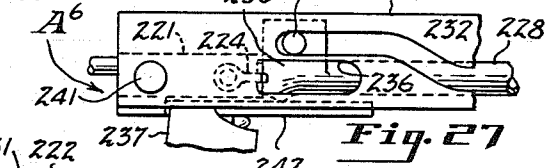


Fig. 27

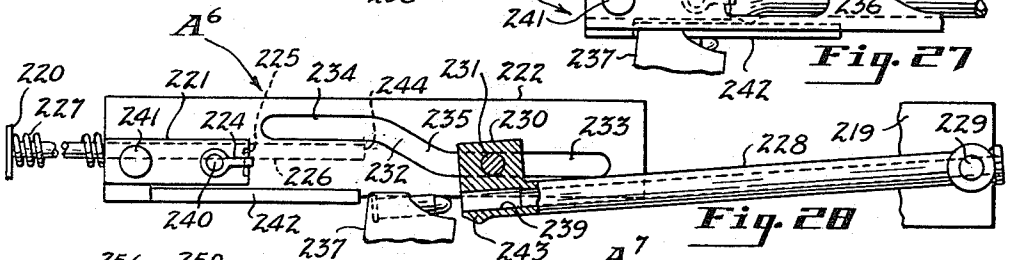


Fig. 28

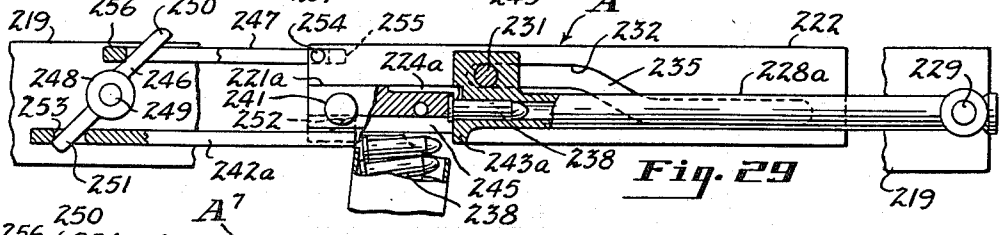


Fig. 29

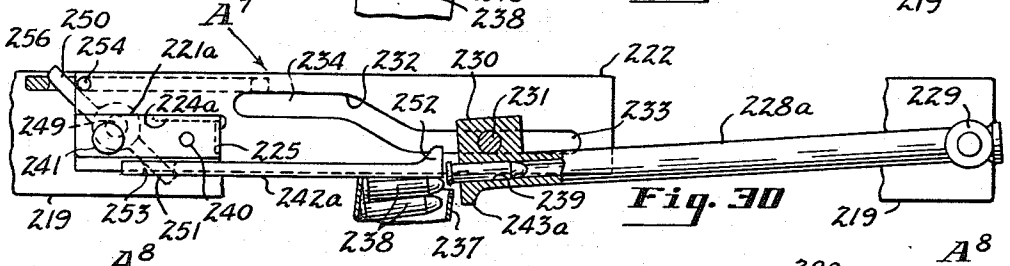


Fig. 30

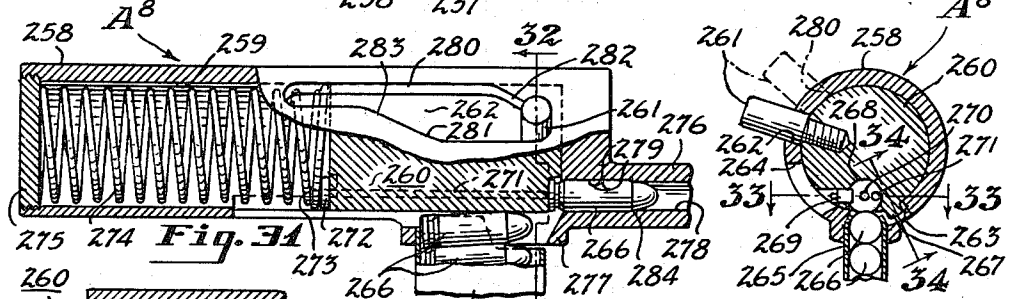


Fig. 31

Fig. 32

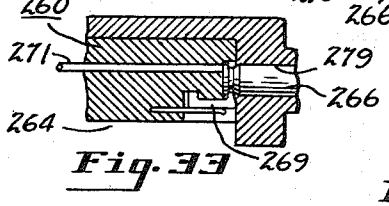


Fig. 33

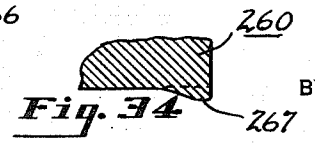


Fig. 34

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FIREARM WITH TRANSVERSELY MOVABLE BARREL CHAMBER

Filed Aug. 3, 1955 7 Sheets-Sheet 7

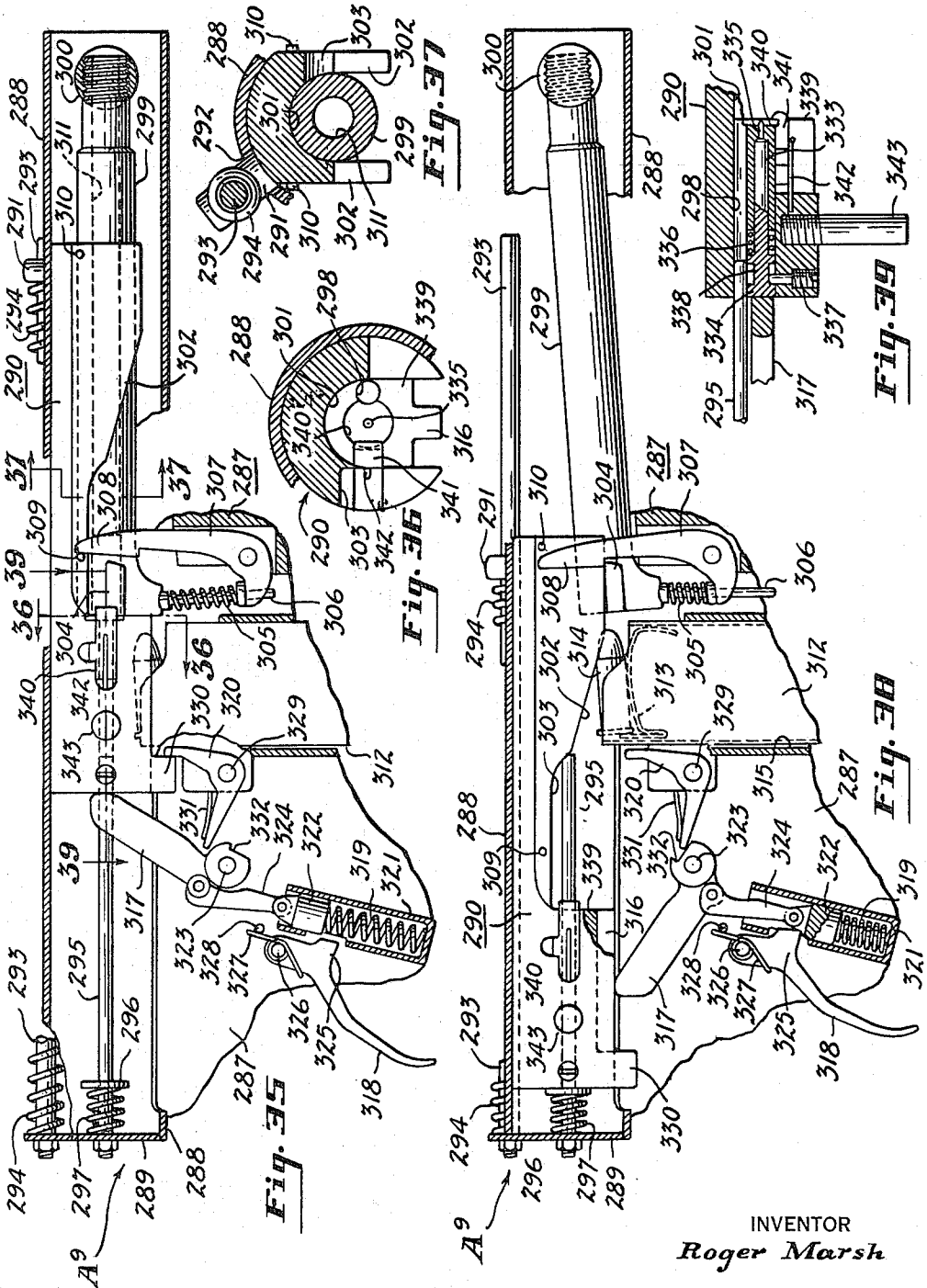


Fig. 35

Fig. 36

Fig. 37

Fig. 38

Fig. 39

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United States Patent Office

2,865,255

Patented Dec. 23, 1958

2,865,255

FIREARM WITH TRANSVERSELY MOVABLE BARREL CHAMBER

Roger Marsh, Hudson, Ohio, assignor to Weapons, Inc., Hudson, Ohio, a corporation of Ohio

Application August 3, 1955, Serial No. 526,172

19 Claims. (Cl. 89—163)

The present invention relates to a firearm wherein the cartridge-receiving chamber at the rear of the barrel and a portion of the breech closure member are mounted for relative longitudinal and transverse movement and more particularly to a firearm wherein the means forming the cartridge-receiving chamber at the breech end of the barrel is mounted for movement to shift said chamber transversely to a loading position in register with a cartridge presented for feeding before said cartridge is fed to said chamber.

According to the present invention the breech closure member or breech bolt and the cartridge-receiving means at the breech end of the barrel are mounted for movement longitudinally relative to each other and are mounted so that there is relative transverse movement between the cartridge-receiving chamber or barrel chamber and the firing pin carried by the breech closure member. The firing pin and chamber are moved transversely relative to each other so that the firing pin is out of alinement with the axis of the chamber during feeding of a cartridge into the chamber and until the cartridge is almost all the way in the chamber.

The firearm may, for example, be constructed so that the firing pin is out of alinement with the primer of the cartridge in the chamber until the cartridge is within a small fraction of an inch of complete chambering. Such a construction reduces the chances of firing a round before it is chambered and is particularly advantageous in a firearm employing a fixed firing pin on the breech bolt. Premature firing, which often occurs in ordinary firearms employing fixed firing pins when movement of a cartridge into the chamber is abruptly arrested during the feeding stroke, can be avoided by keeping the firing pin out of alinement with the primer of a cartridge during feeding of the cartridge.

The desired transverse movement between the breech closure member and the cartridge-receiving chamber at the breech end of the barrel may be obtained by mounting all or a portion of the barrel or the breech closure member or the means forming said chamber to rotate, swing, tilt or otherwise move so as to swing said chamber transversely relative to a portion of the breech closure member. Either the cartridge-receiving chamber or the breech closure member may be mounted for transverse movement, and any suitable mechanism may be provided to obtain the desired sequence of operations. Where the chamber is integral with the barrel, the entire barrel may be mounted to move transversely.

The firearm of the present invention is preferably constructed so that there is relative transverse movement between one chamber at the rear of the barrel and the cartridge to be fed to said chamber, whereby said cartridge is substantially alined with said chamber before being fed thereto. For example, one or more cartridge-receiving chambers may be provided at the breech end of the barrel to swing transversely into alinement with a cartridge presented for feeding. The chamber-forming means and/or the barrel may be rotatably mounted or

may be pivotally mounted near the front or rear of the gun to tilt about an axis to a position wherein the chamber is in alinement with the nose of a cartridge presented for feeding. The cartridge-receiving chamber may be located within a barrel block at the breech end of the barrel that is movable transversely relative to the breech closure member independently of or in unison with the barrel. Such barrel block may be separate from the barrel but is preferably fixed to the rear portion of the barrel for movement therewith. Cam means or other suitable means may be associated with the barrel block to shift the cartridge-receiving chamber transversely between a firing position and a loading position.

Moving of the cartridge-receiving chamber at the breech end of the barrel substantially into alinement with or in register with the front portion of a cartridge presented for feeding prior to feeding of the cartridge into the barrel provides many advantages. Since the cartridge does not have to move around corners, the chamber can be shaped substantially the same as the outside of the cartridge case without any taper or cuts at the rear end to facilitate entry of the nose of the cartridge, and the firearm need not have a complicated feed mechanism with special feed ramps. The improved chamber design permits the use of more powerful cartridges with higher pressure loadings.

Since the cartridges move straight into the chamber of the barrel without engaging a ramp and without having to move around corners, it is practicable to employ a cartridge in which the nose is "sensitive," such as a cartridge with a high explosive incendiary or other special projectile, or a cartridge wherein the projectile or bullet deforms or comes apart easily, such as an ordinary revolver cartridge having a lead bullet which tends to deform and shave off in a conventional feed system. It is also practicable to employ shotgun shells, which have no "feed noses" at the front, and "wadcutter" or flat-nosed-bullet ammunition, which feed very poorly or not at all in conventional arms. The firearm of the present invention may also employ "paper" shot shells with a multi-projectile charge or other ammunition with non-metallic cartridge cases.

Similarly, this superior feeding system confers advantages if consumable or frangible cartridge cases are used which are comparatively delicate and subject to deformation while passing through the feed mechanisms of conventional firearms. A further advantage of this system, when using such ammunition, is that the chamber and round to be fired are, at the instant of firing, out of register with and separated by a considerable lateral distance from the remaining cartridges in the feeding device, thus minimizing the likelihood of ignition of the reserve ammunition in the event of any leakage of propellant gases in firing.

A very simple feed system may be used in the firearm of the present invention due to the fact that each cartridge is moved straight into the chamber of the barrel. Such a feed system may have very few parts so that there is little chance of malfunction due to improper feeding.

Another advantage of the present invention is that it permits an improved bolt design. In an ordinary blow-back firearm wherein a cartridge is stripped from a box magazine and moved upwardly and forwardly into the chamber of the barrel, it is necessary to have the top cartridge and thus the magazine lips as high as possible, which makes necessary material removal of metal from the underside of the breach bolt. The present invention permits the use of a stronger and more massive bolt since the magazine may be offset considerably from the centerline of the barrel in firing position. In a conventional bolt, cutting away of the metal to accommodate the mag-

azine or other feed means may make it difficult or even practically impossible to provide a separate movable firing pin since there may not be enough metal left to accommodate it. In such a conventional bolt it may therefore be necessary to provide an integral fixed firing pin. Here, again, the system of the present invention offers distinct advantages if consumable cartridge cases are used, also if cartridges of the type in which the propellant carrier is integral with the projectile and is discharged from the muzzle are used, since the type of bolt closure required with such ammunition is generally expected to function as an obturation device (a function normally assigned to the cartridge case in conventional ammunition) and must therefore have a minimum of essentially longitudinal passages or channels such as are found in the configurations of conventional bolts but which may be virtually eliminated in firearms of the proposed design.

While a firearm with a fixed firing pin has the advantage of simplicity, it also has some disadvantages. The "slam-firing" arrangement of letting the bolt jab a protruding portion of the breech face into the cartridge primer results not only in an unpleasant firing action due to long delay between trigger pull and firing while the bolt moves forward and due to disturbance of aim by the reciprocating bolt mass but also in lack of dependability under adverse conditions. Dirt in the firearm, weakening of the driving spring, firing with the muzzle elevated, and/or firing of weak or low-power cartridges may slow down movement of the bolt and its firing pin so as to cause a misfire. In a firearm with a fixed firing pin it often becomes necessary, in order to assure even partly dependable operation, to increase the stiffness or pressure of the bolt driving spring beyond that required simply to close the action satisfactorily, which sometimes results in failure of low-power cartridges to operate the firearm. Where the high pressure driving spring is employed as indicated above, malfunctions due to variation in the "actuating power" or "actuating energy" of the cartridge may be reduced by employing a booster piston of the type disclosed in my copending application Serial No. 494,754, filed March 16, 1955, or a compensating device of the type disclosed in my copending application Serial No. 461,999, filed October 13, 1954.

However, the integral fixed firing pin also has disadvantages in a dependable gun. There is, of course, the danger of premature firing if the firing pin strikes the primer before the cartridge is chambered sufficiently. With a fixed firing pin, a person cannot simply shove the bolt closed by hand when the action balks, since the cartridge might fire prematurely or the bolt handle might injure said person's hand upon firing. The improved bolt design of the present invention permits the use of a separate firing pin and retraction of the pin so that the bolt may be shoved home without firing the cartridge and with no danger of premature firing. Since the firearm of the present invention may have a more massive bolt, it is possible to employ a separate firing pin together with a hammer mechanism or a spring-actuated striker mechanism and to obtain all the advantages of the separate firing pin.

Various means may be employed in the firearm of the present invention to shift the cartridge-receiving chamber of the barrel and the firing pin laterally or transversely relative to each other and/or to move said chamber transversely into alinement with a cartridge. Such a lateral or transverse shift is usually effected automatically using energy from the propellant gases in the barrel and is preferably effected in response to firing of a cartridge and/or in response to movement of the barrel and breech closure member longitudinally relative to each other. The transverse movement may be obtained by a yieldable means, a positive-acting means, or any other suitable means. The positive-acting means preferably operates in response to relative longitudinal movement between the barrel and the breech closure member and may include cams, levers, bell cranks, links, or the like.

The yieldable means may also include cams, levers or the like but usually includes a spring or other yieldable means which precludes a positive action.

The means employed to obtain the desired lateral movement in the gun of the present invention usually is one of four basic types. In the first type, positive-acting means are employed to move the cartridge-receiving chamber of the barrel transversely to the loading position substantially in alignment with a cartridge before said cartridge enters said chamber and positive-acting means are employed to move the chamber transversely from the loading position to the firing position. In the second type, transverse movement of the chamber to the loading position is effected by yieldable or spring means and transverse movement to the firing position is effected by positive-acting means (see Figs 24 and 25). The second type has the advantage that the gun is less bulky. In the third type, the chamber is moved transversely to the loading position by positive-acting means and to the firing position by yieldable or spring means (see Figs 21 to 23 and 35 to 39). In the fourth type the chamber is moved transversely to the loading position by yieldable means and to the firing position by yieldable means. The firearm of the present invention usually includes one of the above four types or a variation thereof.

When cams are employed as the positive-acting means, the first and second types are quite satisfactory for any gun in which the cartridge has sufficient length so that it projects a substantial distance into the chamber before the cams start to move the chamber out of its loading position whereby the cartridge does not tip or jam as the chamber moves laterally. However, operation with such cams in the first and second types is unsatisfactory for extremely short cartridges since it is difficult to get enough of the cartridge into the chamber before the chamber is moved transversely. The third and fourth types, in which the chamber of the barrel is moved from the loading to the firing position by a spring or other yieldable means, are useful with very short cartridges since they permit building of a gun in which the bolt pushes the cartridge all the way into the chamber before the barrel even starts to move out of its loading position. Thus, the firearm shown in Figs. 1 to 14, which includes positive-acting means of the first type, may be designed for standard .38 Special or .357 Magnum ammunition or anything longer. However, it would be extremely difficult to obtain satisfactory operation in this type of gun with .32 S & W short or .38 S & W short cartridges or other short cartridges unless special means are provided to push the cartridge all the way into the chamber before the cam moves the barrel, for example as in the guns of Figs. 26 to 30. Figures 21 to 23 and 35 to 39 show the third type of mechanism which would be satisfactory for these short cartridges.

The operating energy for the firearm of the present invention may be supplied from some external source, as is the case with manually-operated firearms and with firearms driven by auxiliary motors or the like, but is preferably supplied initially by the propellant which drives the projectile or projectiles, as is the case with self-actuating firearms. Many of the advantages of the present invention may be obtained with manually-operated firearms and firearms driven with auxiliary motors, but the invention is particularly applicable to self-actuating firearms such as semi-automatic rifles, machine guns, machine cannons, submachine guns, so-called "automatic" pistols, automatic rifles, and other automatic or semi-automatic firearms including magazine fed revolvers and the like. As indicated in said copending applications Serial Nos. 461,999 and 494,754, self-actuating firearms are usually classified as blowback firearms, blowforward firearms, locked-breech gas-operated firearms, locked-breech recoil-operated firearms, gas-operated firearms or a combination of one or more of these main types. In a self-actuating firearm, actuating means responsive to

the "actuating power" or "actuating energy" of each round of ammunition (a portion of the energy released by combustion of the propellant) is provided for automatically performing one or more of the actions of the functioning cycle, such as feeding, locking, firing, extracting, cocking, ejecting, or the like.

According to the present invention, the cartridge-receiving chamber at the rear of the barrel is moved laterally or transversely after extraction to a loading position to receive a new cartridge, is held in the loading position until the new cartridge has entered the chamber, and is moved transversely to a firing position before firing of the new cartridge. It will be apparent that this cycle of operations can be performed on a locked-breech firearm, a gas-operated firearm, or various other self-actuating firearms. The cycle of operations of a locked-breech weapon of course includes locking and unlocking movements; but any gun, once the breech is unlocked functions during extraction, ejection, feeding and loading as if it were a non-locked weapon. The present invention therefore obviously applies to both locked and unlocked-breech firearms.

Where the firearm of the present invention is employed only to fire ammunition wherein the cartridge case is designed to be destroyed or consumed in firing or else to be ejected from the muzzle, either separately or with or as the projectile, the cartridge-receiving chamber and a portion of the breech closure member or bolt may be displaced transversely relative to each other toward a loading position almost as soon as the separation of the barrel or chamber from the breech closure or bolt is begun. However, where other ammunition is also to be employed so that an extraction stage is necessary in the cycle of operations to permit removal of the empty cartridge case after firing, an "extraction dwell" is provided in the cycle during the initial separating movement of the barrel or chamber and the breech closure or bolt, the chamber remaining substantially in its firing position until extraction of the empty cartridge case is completed.

Where the cartridge case is ejected from the firearm of the present invention, it may be ejected out the top or side of the firearm or in any other suitable manner, even including downwardly, behind the magazine and in the same plane as the magazine. Conventional means of various types may be employed to extract or eject the cartridge case.

The firearm of the present invention may be adapted to handle almost any kind or shape of cartridge and may be designed to operate with a belt feed, a drum or pan feed, a magazine feed, or various other cartridge feeding means including indexing comparted boxes, feed strips, clips, chargers, solid link belts, stripout link belts, or the like.

According to one embodiment of the present invention the breech bolt is mounted between a pair of parallel cam plates which are mounted for reciprocation on a series of antifriction rollers. The rollers are mounted on transverse frame bolts or rods which extend between parallel side plates of the frame and provide the sole support for the cam plates.

The breech bolt is provided with a separate firing pin and with a rotatable safety spindle for positioning the primer-engaging nose of the firing pin in a retracted position behind the cartridge-head recess of the bolt or an advanced firing position in said recess. Any suitable means may be employed for rotating the safety spindle to position the firing pin in its advanced or retracted position. Such means preferably comprises a rotatable bolt handle operably connected to the safety spindle. When the firing pin is moved to its advanced position by rotating the bolt handle, said pin acts like a conventional fixed firing pin.

An object of the present invention is to provide a firearm with an improved feeding action so as to avoid ma'f

functions and premature firing during feeding of a cartridge to the chamber of the barrel.

A further object of the invention is to provide a firearm that operates satisfactorily with special cartridges which cannot be handled by ordinary firearms.

Another object of the invention is to provide a firearm which permits offsetting of the magazine from the bolt and permits the use of a more massive bolt with a separate firing pin.

A still further object of the invention is to provide a breech bolt with a retractable firing pin which functions like a fixed firing pin during firing of the gun and which may be moved to a safe non-firing position relative to the bolt.

Another object of the invention is to provide a simple firearm which is economical to manufacture, easy to assemble and disassemble, and reliable in operation.

A further object of the invention is to provide a firearm with an improved means for mounting the breech bolt.

Another object of the invention is to provide an improved firearm with novel means for shifting the cartridge-receiving chamber transversely relative to the breech bolt.

Other objects, uses and advantages of the present invention will become apparent from the following description and claims and from the drawings in which:

Figure 1 is a side elevational view with parts broken away and shown in section showing on a reduced scale a blowback firearm constructed according to the present invention;

Figure 2 is a longitudinal vertical sectional view of the breech bolt of Fig. 1 on a larger scale;

Figure 3 is a fragmentary transverse vertical sectional view taken substantially on the line **3—3** of Fig. 1 and on a larger scale;

Figure 4 is a fragmentary longitudinal vertical sectional view taken substantially on the line **4—4** of Fig. 3 and on the same scale;

Figure 5 is a transverse vertical sectional view taken substantially on the line **5—5** of Fig. 1 and on a larger scale;

Figure 6 is a fragmentary horizontal sectional view taken substantially on the line **6—6** of Fig. 1 and on a larger scale;

Figure 7 is a top plan view of the firearm of Fig. 1 and on the same scale;

Figure 8 is a longitudinal vertical sectional view with parts omitted and with parts broken away and shown in section illustrating the position of the parts after extraction and at the beginning of ejection;

Figure 9 is a longitudinal vertical sectional view with parts omitted and with parts broken away and shown in section showing the position of the parts when the breech bolt is in its rearmost position;

Figure 10 is a transverse vertical sectional view of the breech bolt taken substantially on the line **10—10** of Fig. 9 and on a larger scale;

Figure 11 is a transverse vertical sectional view taken substantially on the line **11—11** of Fig. 1 and on a larger scale;

Figure 12 is a fragmentary transverse vertical sectional view with parts omitted similar to Fig. 11 and on the same scale showing the lowered position of the sight;

Figure 13 is a fragmentary side elevational view with parts broken away and shown in section taken substantially on the line **13—13** of Fig. 12 and on the same scale;

Figure 14 is a transverse vertical sectional view with parts omitted taken substantially on the line **14—14** of Fig. 1 and on the same scale as Figs. 11 to 13;

Figure 15 is a fragmentary side elevational view on a reduced scale of a modified form of the invention with parts omitted and with parts broken away and shown in section;

Figure 16 is a fragmentary transverse vertical sectional view with parts omitted taken substantially on the line **16—16** of Fig. 15 and on a larger scale;

Figure 17 is a fragmentary schematic side elevational view with parts broken away and shown in section showing a modified blowforward firearm constructed according to the present invention, the parts being shown in their positions just prior to firing;

Figure 18 is a fragmentary side elevational view similar to Fig. 17 and showing the position of the parts as the barrel moves rearwardly and transversely to index the cartridges;

Figure 19 is a schematic side elevational view showing a modified form of the present invention on a reduced scale, the barrel being shown in its uppermost position after firing;

Figure 20 is a schematic view of the gun of Figure 19 showing the position of the parts just before the barrel is elevated;

Figure 21 is a schematic side elevational view on a reduced scale with parts broken away and shown in section showing another modified firearm according to the present invention, the parts being shown in their positions at the instant of firing;

Figure 21*a* is a fragmentary vertical sectional view showing a portion of the firearm of Fig. 21 on a larger scale;

Figure 22 is a schematic side elevational view of the firearm of Fig. 21 showing the position of the parts after ejection and during rearward movement of the breech bolt;

Figure 23 is a schematic view similar to Figs. 21 and 22 showing the position of the parts during forward movement of the breech bolt and before the bolt engages the base of the cartridge;

Figure 24 is a schematic side elevational view with parts broken away and with parts shown in section showing another modified form of the invention, the parts of the firearm being shown in their positions just prior to firing;

Figure 25 is a fragmentary side elevational view of the gun of Fig. 24 on a larger scale and with parts broken away and shown in section, the position of the parts when the barrel is in its lowermost position being shown in dot-dash lines;

Figure 26 is a fragmentary schematic side elevational view of another modified form of the invention on a reduced scale and with parts omitted and parts broken away, the parts being shown in their positions just prior to firing;

Figure 27 is a fragmentary schematic side elevational view of the firearm of Fig. 26 with the side plates omitted;

Figure 28 is a schematic view similar to Fig. 26 and showing the position of the parts just prior to feeding of a cartridge to the barrel;

Figure 29 is a fragmentary schematic side elevational view with parts omitted and with parts broken away and shown in section showing another modified firearm, the parts being shown in their positions at the instant of firing;

Figure 30 is a schematic view similar to Fig. 29 showing the position of the parts of the firearm as the breech bolt approaches its rearmost position;

Figure 31 is a fragmentary side elevational view with parts broken away and shown in section showing another modified form of the present invention;

Figure 32 is a fragmentary transverse vertical sectional view taken substantially on the line 32—32 of Fig. 31 and on the same scale, the position of the bolt handle when the bolt is fully retracted being shown in dot-dash lines;

Figure 33 is a fragmentary horizontal sectional view taken substantially on the line 33—33 of Fig. 32 and on the same scale;

Figure 34 is a fragmentary longitudinal sectional view of the breech bolt taken substantially on the line 34—34 of Fig. 32 and on the same scale;

Figure 35 is a side elevational view with parts omitted and parts broken away and in section showing on a reduced scale another modified form of the invention, the parts being shown in their positions at the instant of firing;

Figure 36 is a transverse vertical sectional view with parts omitted of the breech bolt taken substantially on the line 36—36 of Fig. 35 and on a larger scale.

Figure 37 is a transverse vertical sectional view of the breech bolt with parts omitted taken substantially on the line 37—37 of Fig. 35 and on the same scale as Fig. 36;

Figure 38 is a fragmentary side elevational view similar to Fig. 35 and on the same scale and showing the position of the parts as the breech bolt approaches its rearmost position; and

Figure 39 is a fragmentary horizontal sectional view with parts omitted taken substantially on the line indicated at 39—39 in Fig. 35 and on the same scale.

Referring more particularly to the drawings in which like parts are identified by the same numerals throughout the several views, Figures 1 to 14 show a blowback firearm A having a rigid frame including a pair of flat vertical parallel longitudinal side plates 1 and 2 of thin sheet metal each having a wide intermediate portion 3 of rectangular shape and opposite end portions 4 and 5 of substantially the same shape. The side plates may be of identical construction and may be symmetrical about their longitudinal and transverse center lines as shown in the drawings. The side plates are held in parallel relation by two vertically alined pairs of parallel frame bolts or connecting bolts 6 and 7 and cylindrical spacing sleeves 8 which fit on the frame bolts and extend between the inside faces of the side plates. Each of the frame bolts is threaded at one end to receive a self-locking hexagonal nut 9 which holds the side plates against the spacer sleeves as shown in Figs. 11 and 14. Each of the side plates is provided with a rigid circular reinforcing collar 10 at its forward end and a rigid longitudinally elongated reinforcing plate 11 along its lower margin. A cover plate 12 is mounted across the top of the side plates and has downwardly turned flanges 13 at its opposite sides. Each of said flanges has a pair of ears 14 near the front and rear edges of the intermediate portion 3. The frame bolts 6 and 7 are longitudinally alined and extend through the reinforcing plates 11 and the ears 14 to hold the frame together. The cover plate 12 is cut away to provide a central rectangular ejection opening 15 and a pair of downwardly turned vertical flanges 16 at the front and rear margins of said opening. A metal bumper block 17 is welded to or otherwise rigidly connected to the cover plate 12 and is internally threaded to receive an externally threaded bumper plug 18 having a hexagonal head 19 above the cover plate.

The upper frame bolts 6 and 7 are provided with axially enlarged rectangular heads 20 and 21. A peep sight 22 is pivotally mounted on a spindle 23 that extends between the bolt heads 20 and 21. Longitudinally alined circular holes are provided in the heads 20 and 21 to receive opposite ends of the spindle 23 and to permit rotation of the spindle about longitudinal axis. If desired one end of the spindle may be provided with an axially movable plunger or the like to permit removal of the spindle and the sight from the frame of the gun without removing the frame bolts. The sight assembly is provided with a lifter spring 24 which biases the sight toward a vertical position as shown in Fig. 11.

The sight is shown herein as being a one-piece metal sheet having lateral flanges 25 at its opposite ends. Said flanges have longitudinally alined sight apertures 26 which define the line of sight of the firearm. A sight latch 27 is mounted on the lower frame bolt 7 as shown in Figure 13. Said latch is in the form of a sheet metal spring having a vertical portion 28 with a stud 29 which enters the front sight aperture 26 to hold the sight in its lower position as shown in Fig. 12. A cast aluminum grip 30 is mounted between the side plates 1 and 2 at the lower portion of the frame. The grip may be mounted on the side plates in any suitable manner, but as herein

shown the grip and the side plates are provided with alined circular openings 31 to receive a pair of longitudinally alined horizontal pins 31*a*. Said pins may be "Spirol" pins, "Rollpins" (supplied by Elastic Stop Nut Corporation of America, Union, N. J.), or other commercial spring pin fasteners of the dowel pin type which will fit tightly in the side plates. The grip includes a divided trigger guard 32 at its forward end and an upright hand grip portion 33 rearwardly of said trigger guard. The hand grip portion is of generally rectangular cross section and has a magazine opening 34 of substantially rectangular cross section for receiving a conventional box magazine 35.

Any suitable means may be provided for holding the magazine in a predetermined fixed position in the firearm. As herein shown the magazine 35 is provided with a projection or magazine catch 36 and the hand grip portion 33 is provided with a magazine latch slide 37 which is movable longitudinally into and out of the path of movement of the projection 36. The slide is biased forwardly by a magazine latch spring 38 on the rear face of the hand grip and may be moved longitudinally by a magazine latch trip 39 which is pivotally mounted in the hand grip. The spring 38 is connected to the hand grip by a screw 40 and arranged so that the pressure of the band on the hand grip assists the spring in holding the slide 37 in its forward position.

The magazine 35 may be of the type disclosed in my copending application Serial No. 505,885, filed May 4, 1955, or may be of any other suitable type. As herein shown the magazine 35 is a single-row box magazine of rectangular cross section having inturned flanges or lips 41 that extent axially from the rear wall of the magazine substantially to the middle of the magazine and having a platform 42 that is biased toward said lips by a compression spring 43. The spring 43 presses the cartridges in the magazine upwardly toward the lips 41 and holds the uppermost cartridge in a predetermined discharge position at the top of the magazine. The upper front portion of the magazine is cut away in a conventional manner forwardly of the lips 41 so that the upper edge of the front wall of the magazine is below the uppermost cartridge and will not interfere with movement of said cartridge horizontally out of the magazine.

A high strength plastic sleeve 44 of a size to fit on the front portions 5 of the side plates is mounted on said side plates and surrounds the forward portion of the frame as best shown in Figs. 1, 6 and 7. A high strength plastic buttstock 45 of a size to fit on the rear portions 4 of the side plates are mounted on said plates and extend from the rear edge of the intermediate portions 3 to the rear of the frame as best shown in Figs. 1 and 7. The buttstock has an integral cheek piece 46 on the left side of the gun which extends forwardly over the heads of the bolts 6 to protect the face of the person firing the gun. The plastic sleeve 44 and the buttock 45 are readily assembled on the frame by sliding them axially over the side plates.

The trigger guard 32 is shaped to receive a trigger 47 having a central hub 48, a finger piece 49 rearwardly of said hub, and a T-shaped portion 50 extending forwardly from said hub. The hub 48 is mounted on the central portion of the sleeve 8 carried by the lower frame bolt 7 for swinging movements about the axis of said bolt. A pair of spools or rollers 51 are mounted on the sleeve 8 between the side plates 1 and 2 on opposite sides of the hub 48 as best shown in Fig. 14. Each of the rollers is provided with a circumferential groove 52 of uniform width and depth near one of the side plates. Spools or rollers 53, each having an internally cylindrical surface with a diameter corresponding substantially to the external diameter of the externally cylindrical sleeves 8 are mounted on the sleeve of the uppermost frame bolt 7 and the sleeves of the frame bolts 6 for rotation about the axes of the frame bolts. Each of the rollers 53 extends axially from one side plate to the other and has a pair of circumferential grooves 54 of the same size and shape as the grooves 52. The side faces of the grooves 54 are located in the same longitudinal vertical planes as the side faces of the grooves 52 as shown in Figs. 11 and 14.

A pair of flat metal cam plates 55 and 56 of uniform thickness and uniform height are mounted in the grooves 52 and 54 with their side faces substantially in said longitudinal vertical planes. As shown herein the cam plates are rectangular and are of substantially identical construction, each cam plate being provided with a longitudinally elongated cam slot 57 and a trigger notch 58 at its front corner. A breech bolt 59 is mounted between the cam plates and reciprocates longitudinally in unison with said plates. The rollers 51 and 53 provide the sole support for the cam plates and guide said plates longitudinally while preventing transverse or tilting movements of the plates relative to the longitudinal axis of the gun. The side faces of the grooves 52 and 54 hold the cam plates 55 and 56 in parallel relation and parallel to the side plates 1 and 2 during reciprocation of the bolt.

The front portion 50 and of the trigger 47 is biased upwardly by a leaf spring 60 which is connected to the plastic sleeve 44 by a screw 61. When the finger piece 49 is released the spring moves the portion 50 upwardly as shown in Fig. 9 to a position wherein the laterally extending portions 62 of the trigger are in the path of movement of the cam plates 55 and 56. The portions 62 enter the notches 58 of the cam plates as the breech bolt is moved forwardly, but if the finger piece 49 is pulled rearwardly the portion 62 will be lowered out of the path of movement of the cam plates to permit firing of the gun.

The breech bolt 59 is shown herein as being substantially rectangular in transverse cross section and having an integral, centrally located, feed rib 63 of substantially rectangular cross section extending axially along the bottom of the bolt for movement between the magazine lips 41 during reciprocation of the bolt to feed a cartridge from the magazine. A pair of laterally alined studs 64 project from the opposite sides of the bolt and fit in laterally alined circular openings in the cam plates 55 and 56 to prevent axial movement of said plates relative to the bolt. An externally cylindrical safety spindle or stop member 65 is mounted for rotation in the bolt 59 about a transverse horizontal axis and extends into alined circular openings in the cam plates 55 and 56 to prevent swinging of the bolt about the axis of the alined studs 64 and to fix the bolt with respect to the cam plates.

A bolt handle 66 is detachably connected to the spindle 65 for movement therewith by means of a screw 67 as best shown in Fig. 3. The bolt handle projects horizontally through a longitudinally elongated horizontal slot 68 in the right side plate 2 which permits movement of the bolt from its foremost to its rearmost position. When the screw 67 and the handle 66 are removed, the bolt and the cam plates may be removed through the rear of the gun. As herein shown, the bolt handle is provided with a pair of lugs 69 which fit in grooves in the safety spindle 65 to prevent rotation of the handle relative to said spindle.

A circular cartridge-head recess 70 having a flat vertical cartridge-base-engaging face 71 is provided at the front of the bolt for receiving the head of a cartridge as it is fired. A conventional extractor 72 is mounted on the bolt at the top of the bolt recess 70 to catch the rim of a cartridge as it enters said recess, a cantilever spring 73 being provided to bias the front of the extractor toward the center of the recess in the conventional manner. The bolt is also provided with a laterally offset longitudinal cylindrical bore of a size to receive an externally cylindrical ejector rod 74 near the left side of the feed rib 63 as shown in Figs. 3 and 10.

The bolt also has a cylindrical bore 75 of small diameter and a counterbore 76 with a horizontal longitudinal axis that passes through the center of the bolt recess 70 and

the axis of the safety spindle 65 as best shown in Figs. 2 and 3. A separate longitudinal two-position firing pin 77 is mounted for axial movement in the bore 75 and has an enlarged externally cylindrical piston-like head 78 mounted in the counter-bore 76 between the spindle 65 and the bore 75 and biased toward said spindle by a helical compression spring 79 surrounding said firing pin.

The safety spindle 65 is cut to provide a flat face 80 and a flat face 81 substantially perpendicular to the face 80, the face 81 being closer to the axis of the spindle. The portion of the spindle 65 adjacent the ejector rod 74 is cut away to form a slot or groove 82 as shown in Fig. 4 which permits rotation of the spindle from a "safe" position wherein the face 81 engages the head 78 to a "fire" position as shown in Fig. 2 wherein the face 80 engages the head 78. The nose of the firing pin 77 projects forwardly beyond the bolt face 71 when the spindle is in the "fire" position so that the firing pin will function the same as a fixed firing pin. When the spindle is in the "safe" position, however, said nose is retracted to a position behind the face 71 so that it cannot strike the primer of a cartridge in the recess 70.

Since it is dangerous to push the bolt forward by hand when the spindle is in "fire" position, it is desirable to provide means on the bolt handle to indicate the position of the firing pin and the spindle. As herein shown, the bolt handle 66 is provided with a pair of pointed lugs or ears 83 which are pointed in the horizontal direction as shown in Fig. 1 whenever the safety spindle is in "fire" position and are pointed vertically whenever the spindle is in the safe position. The sharp projection on the bolt handle will give a warning and discourage anyone from pushing the bolt handle forwardly with the palm of the hand when the ears 83 are pointed horizontally.

A substantially U-shaped metal back plate or bracket 84 is mounted between the side plates 1 and 2 at the rear end of the firearm A. The back plate has a flat transverse portion 85 and forwardly extending side portions 86 that are provided with vertically spaced laterally projecting studs 87 and 88. The studs fit in laterally alined circular openings in the side plates 1 and 2 to prevent axial movement of the back plate relative to said plates. The transverse portion 85 is provided with a small circular opening of a size to receive the ejector rod. The ejector rod is provided with an integral circular collar 89 and is threaded at its rear end to receive a nut 90. A helical buffer spring 91 is mounted on the ejector rod between the collar 89 and the transverse portion 85 of the back plate to bias the ejector rod forwardly and to cushion rearward movement of the bolt. As the bolt approaches its rearmost position as shown in Fig. 9, the rear face of the bolt engages the collar 89 to compress the buffer spring and to move the nut 90 rearwardly away from the back plate.

Connecting bolts or any other suitable means may be provided to prevent the buttstock 45 from sliding off the rear of the gun. As herein shown, a stock latch 92 is mounted for pivotal movement on a horizontal pivot pin 93 and has an upwardly projecting catch portion 94 for engaging the front face of the transverse portion 85 as shown in Fig. 1 to prevent rearward movement of the buttstock. A spring 95 is provided for holding the catch portion 94 in a position to engage the back plate. The portion of the latch 92 rearwardly of the back plate may be depressed by hand to release the latch whenever it is desired to remove the buttstock.

The cam plates 55 and 56 of the breech bolt 59 carried thereby may be biased forwardly in any suitable manner. As herein shown, a recoil spring assembly is mounted on the left side of the firearm A externally of the side plate 1 and includes a horizontal recoil spring guide rod 96, a helical recoil spring or driving spring 97, and a breech bolt actuating member 98. The front end of the guide rod 96 is externally threaded to receive a hexagonal nut 99 which prevents movement of the bolt actuating member forwardly off the end of said rod. A small vertical plate 100 is welded to the rear end of the guide rod perpendicular to the axis of said rod to limit rearward movement of the recoil spring 97, said plate having a lug 101 that projects into a small opening in the side plate 1 to prevent rearward movement of the guide rod relative to said side plate. The bolt actuator 98 has an internally cylindrical surface with a diameter substantially equal to the external diameter of the guide rod 96 and is mounted on said rod to slide longitudinally in unison with the bolt 59, the rear face of said actuator engaging the spring 97 to compress said spring between said face and the front face of the plate 100 during rearward movement of the bolt. The bolt actuator has an integral lug 102 that projects laterally through the side plate 1 and fits in the front portion of the cam slot 57 of the cam plate 55 as shown in Figs. 7 and 8. A horizontal slot 103, similar to the bolt handle slot 68 of the side plate 2, is provided in the side plate 1 to receive the lug 102, said slot having sufficient length so that the plate 1 does not interfere with movement of the lug as the bolt is moved from its foremost to its rearmost position. An intermediate sheet metal cover 104 of substantially U-shaped cross section is provided to cover the recoil spring assembly. The opposite end portions of the cover project under the plastic members 44 and 45 and are held thereby in a fixed position against the side plate 1 as shown in Fig. 11. The sight 22 is shaped to extend around the cover 104 as shown in Fig. 12.

A barrel may be mounted on the firearm A in any suitable manner to swing the cartridge-receiving chamber of the barrel transversely relative to the breech bolt. As herein shown, the firearm is provided with a generally cylindrical barrel 105 having a longitudinally extending bore 106 through which travels a bullet fired from a cartridge and having a counterbore or chamber 107 of circular cross section at its breech end coaxial with said bore for receiving the case of a cartridge to be fired. The bore 106 is preferably provided with conventional rifling. A barrel block 108 is rigidly connected to the rear portion of the barrel for movement in unison therewith and is drilled to receive a horizontal cylindrical cam follower or pin 109 which projects into the cam slot 57. Where the slot 57 is provided in both of the plates 55 and 56, the cam pin 109 projects all the way through the barrel block 108 to engage the marginal surfaces of both slots. As herein shown, the cam pin 109 is rigidly connected to the barrel block and projects laterally into the cam slot 57 of the cam plate 55 for engagement with the marginal surfaces of said slot to raise and lower the breech end of the barrel.

The barrel has an externally cylindrical front portion 110 of reduced diameter and an annular shoulder 111. An annular collar 112 is mounted on said front portion and against said shoulder. The front portion of the barrel may be pivotally mounted on the frame of the gun A in any suitable manner. As herein shown, a generally cylindrical trunnion block 113 with an axial length substantially equal to that of the spacing sleeves 8 is pivotally mounted between the front portions 5 of the side plates for swinging movements about a horizontal axis perpendicular to said side plates. The trunnion block is internally threaded to receive a pair of laterally alined trunnion screws 114 which have cylindrical portions that extend through alined circular openings in the reinforcing collars 10 and the side plates 1 and 2 to provide a pivot about which the block swings. The screws 114 have radially enlarged heads which engage the outer face of the collars 10 to hold the side plates against the trunnion block. If desired, set screws 115 may be provided to prevent accidental loosening of the trunnion screws.

The trunnion block 113 is drilled midway between its ends and perpendicular to the pivotal axis of the

trunnions 114 to provide an internally cylindrical bore with a diameter substantially equal to that of the barrel portion 110 for receiving said barrel portion. The front end of the barrel is externally threaded to receive an internally threaded, tapered, muzzle blast cup or flash hider 116. The trunnion block is assembled on the barrel 105 by sliding over the front portion 110 until said block engages the collar 112 and the threaded portion of the barrel projects forwardly from the trunnion block. The muzzle cup 116 is then screwed on the barrel until it engages the trunnion block and forces the collar 112 tightly against the shoulder 111 to hold the barrel in a fixed position relative to the trunnion block.

As herein shown the outer circumferential surface of the cup 116 near the rear end thereof is notched or serrated and a conventional leaf spring or clicker spring 117 is provided for engaging in the notches to prevent accidental rotation of said cup or loosening of the connection between the barrel and its trunnion. When the firearm is assembled, the enlarged heads of the screws 114 engage the front surface of the plastic sleeve 44 to prevent the sleeve from sliding forwardly off the side plates.

It will be noted that the firearm A is of very simple and inexpensive construction and that most of the parts of the firearm may be manufactured employing the simplest molding, machining or forming operations. If desired the side plates 1 and 2 may be identical in construction, and the cam plates 55 and 56 may also be identical.

Assembly and disassembly of the firearm A is also very easy. The barrel may readily be removed by loosening the set screws 115, unscrewing the trunnion screws 114, pulling the barrel forwardly, and disengaging the cam pin 109 from the cam slot 57. Once the screws 114 are removed, the plastic sleeve 44 may readily be slid off the front end of the frame. The rear portion of the firearm may also be disassembled readily without removing the frame bolts 6 and 7 by releasing the buttstock latch 92, sliding the plastic buttstock 45 off the rear end of the frame, springing the side plates off the studs 87 and 88 of the back plate 84, removing the back plate and the ejector rod carried thereby, unscrewing the capscrew 67 to remove the bolt handle 66, and sliding the breach bolt 59 and the cam plates 55 and 56 rearwardly out of the frame. The cast aluminum grip 30 may be removed without disassembling the main frame by knocking out the pins 31*a*, the divided trigger guard 32 permitting removal of the grip without removing the trigger 47. The sight 22 and its spindle 23 may also be removed without disassembling the main frame merely by disconnecting one end of the spindle from the head of the frame bolt.

The cam slot 57 and the cam follower 109 are designed to impart a predetermined transverse swinging movement to the barrel in response to longitudinal movement of the breech bolt 59. As herein shown, the cam slot or cam track 57 has front and rear portions 118 and 119, respectively, with a width substantially equal to the diameter of the cam follower 109, and an enlarged intermediate portion 120. The upper marginal surfaces of the cam slot 57 comprise front and rear straight surfaces 121 and 122, respectively, parallel to the top and bottom horizontal edges of the cam plate 55 and a smooth inclined surface 123 extending upwardly from the flat surface 121 to the flat surface 122. The lower marginal surfaces of the slot comprise front and rear straight surfaces 124 and 125, respectively, parallel to and spaced from the surfaces 121 and 122, and a steeply inclined surface 126 extending upwardly from the flat surface 124 to the surface 125. The surface 126 must be inclined rather steeply, so as to raise the rear end of the barrel from its lowermost position to its uppermost position while the cam plate 55 moves longitudinally a distance substantially less than the length of a cartridge case to be fed to the barrel chamber 107.

Figure 1 shows the position of the parts when the barrel chamber 107 is in firing position and the bolt is at its foremost position. At the instant of firing the bore 106 and the chamber 107 are axially alined with the bolt recess 70 and the front of the bolt is substantially in engagement with the rear face of the breech block 103. At this time the cam follower 109 is located in the front portion 119 of the cam slot. When the breech bolt approaches its rearmost position as shown in Fig. 9 the cam follower 109 is in the front portion 118 of the cam slot and the barrel chamber 107 is in its lowermost loading or feeding position substantially in alinement with the uppermost cartridge in the magazine 35. As herein shown, the chamber 107 is of a size to receive standrd .38 Special or .357 Magnum rimmed cartridges and the bore 106 is of a size to receive the bullets from such cartridges. The magazine 35 is provided with one row of rimmed cartridges 127 having bullets 128 of a size to fit the bore 106 and a cartridge case 129 of a size to fit in the chamber 107. The cartridge case has an externally cylindrical body portion 130 and a radially extending rim 131 with a diameter slightly greater than the internal diameter of the bore 106.

The case has a flat base with a conventional centrally located primer which is engaged by the firing pin 77 when the head of the cartridge enters the bolt recess 70. The magazine lips 41 hold the uppermost cartridge 127 in the magazine 35 in a predetermined discharge position substantially coaxial with the chamber 107 when said chamber is in its loading position as shown in Fig. 9.

If the trigger fingerpiece is released as the breech bolt moves forwardly from its rearmost position, the laterally extending portions 62 of the trigger will engage the trigger notch 58 and halt movement of the breech bolt before it reaches the uppermost cartridge in the magazine. As the fingerpiece is pulled rearwardly the portions 62 will slide downwardly across the front lower edges of the cam plates to release the bolt. The driving spring will then force the bolt forwardly until the feed rib 63 engages the base of the uppermost cartridge in the magazine between the magazine lips 41 to feed the cartridge into the chamber 107. During feeding of the cartridge into the chamber the cam follower 109 remains in engagement with the surface 124 until the cartridge case 129 is a substantial distance in the chamber and the rim 131 is clear of the magazine lips 41.

Upon further forward movement of the bolt, the cam follower 109 engages the surface 126 to raise the chamber 107 and the cartridge 127 therein from the position of Fig. 9 to the firing position of Fig. 1. Before the rim 131 of the cartridge in the chamber 107 enters the bolt recess 70, the cam follower 109 engages the cam surface 125 to position the bolt 59 and the chamber 107 coaxial with the firing pin. In the last twentieth of an inch or so of forward movement of the bolt the movement of the cartridge stops, and the rim 131 engages the rear face of the barrel and begins to enter the bolt recess 70.

At the instant of firing as shown in Fig. 1 the cartridge is fully chambered, the rim 131 is in the bolt recess 70 and the extractor engages the front face of the rim to grip the cartridge case. The pressure produced by the propellant gases in the barrel after firing of the cartridge forces the bullet 128 through the bore and at the same time forces the breech bolt rearwardly to compress the driving spring. During the first portion of the rearward movement of the bolt, the extractor pulls the empty cartridge case out of the barrel, said case holding follower 109 substantially in engagement with the cam surface 122. After the front end of the cartridge case is a substantial distance rearwardly of the barrel the cam follower 109 engages the inclined cam surface 123 to initiate lowering of the chamber 107. During such lowering the front end of the ejector rod 74 engages the

base of the cartridge case as shown in Fig. 8 to eject the case upwardly through the opening 15. As rearward movement continues the cam follower engages the top surface 121 of the cam portion 118 to position the chamber 107 in its lowermost position coaxial with the uppermost cartridge 127 of the magazine.

The energy from the propellant gases after firing is sufficient to move the breech bolt against the collar 89 and to compress the buffer spring 91. Each time the bolt moves rearwardly past the magazine 35, a new cartridge is advanced upwardly by the spring 43 to a discharge position against the magazine lips 41. The energy stored by the driving spring 97 during rearward movement of the bolt is then expended to push the bolt forwardly against the base of the new cartridge and to feed the cartridge into the firing chamber 107. A substantial portion of the cartridge case 129 of the cartridge fed to the firing chamber enters the chamber before the inclined surface 126 engages the cam follower 109 to move the chamber out of its lowermost loading position so that the cartridge will not catch on the magazine lips 41 and will not tip or jam during elevation of the barrel whereby the new cartridge is lifted by the barrel to a position wherein its primer is axially alined with the firing pin 77 before said firing pin strikes said primer. As the chamber 107 arrives at its uppermost firing position, the flat top surface of the barrel block 108 engages the flat bottom surface of the bumper plug 18. It will be noted that the cam follower 109 does not enter the rear portion 119 of the cam slot until the cartridge in the chamber 107 is within a small fraction of an inch of complete chambering so that the firing pin 77 is out of alinement with the primer of the cartridge until said cartridge is almost completely chambered whereby the danger of premature firing is reduced.

It will be noted that the flat horizontal top and bottom surfaces of the cam plates 55 and 56 remain in engagement with the rollers 51 and 53 at the bottoms of the eight circumferential grooves 52 and 54 as the breech bolt 59 moves from its foremost position adjacent the barrel to its rearmost position adjacent the buffer spring. The cam plates are supported and held parallel to the side plates 1 and 2 solely by the rollers 51 and 53 and may be easily removed after removal of the barrel, the back plate 84, and the recoil spring assembly merely by pulling the bolt rearwardly from between the side plates. The roller suspension system employed on the firearm A is simple and has many advantages over conventional systems whether or not the barrel is mounted to move transversely relative to the bolt.

It will be understood that such a roller suspension system including the novel method of mounting the bolt on parallel side plates may be employed in a simple blowback firearm and various other firearms wherein the barrel is held against lateral movement. Figures 15 and 16 show a modified blowback firearm A′ that is substantially identical to the firearm A except that the barrel is not mounted for transverse swinging movements. The firearm A′ may be constructed exactly the same as the firearm A described above except that the bumper block 17 and bumper plug 18 are omitted, the upper front roller 53 is replaced, the box magazine is of slightly different construction, the barrel is of different construction, the barrel is mounted in a different manner, and the cam slot 57 is omitted or does not function. The barrel of the firearm A′ is provided with a trunnion block 113 and trunnion screw 114 like the firearm A and is pivotally mounted on the side plates 1 and 2, but the rear end of the barrel is held against lateral movement by a barrel stirrup 132 mounted on the spacing sleeve 8 of the upper frame bolt 6. A pair of rollers 51 are mounted on said spacing sleeve on opposite sides of the stirrup as shown in Fig. 16 to guide the cam plates 55 and 56. Like the hub portion 48 of the trigger, the upper portion of the stirrup has an internally cylindrical opening of a size to fit the externally cylindrical sleeve 8 and a width to fit between the rollers 51.

As herein shown, the firearm A′ has a barrel 105*a* with an externally cylindrical intermediate portion 133 that fits tightly in an internally cylindrical opening 134 in the stirrup. Rearwardly of the stirrup the barrel has a radially enlarged portion 135 with an external diameter greater than the diameter of the opening 134 and a conventional feed lamp 136 for guiding the nose of a cartridge into the chamber of the barrel. The bore and the chamber of the barrel 105*a* are the same as those of the barrel 105 and the front portion of the barrel 105*a* may be substantially the same as that of the barrel 105. However, as herein shown the barrel 105*a* has a front end portion 137 of reduced diameter and of a size to slide through the trunnion block 113 that is externally threaded throughout its length to receive an internally threaded collar 138 at the rear of the trunnion block and the cup 116 at the front of the trunnion block. Said collar and said cup engage opposite faces of the trunnion block to prevent movement of the barrel relative to said block. Like the collar 112, the collar 138 has a fixed position spaced forwardly from the foremost position of the cam plates 55 and 56 so as not to engage said plates as they reciprocate. The barrel 105*a* may be removed without disturbing the frame bolts 6 and 7 by removing the buttstock 45, the bolt handle 66, and the back plate 84, removing the trunnion screws 114 and the plastic sleeve 44, unscrewing the blast cup 116, removing the trunnion block 113 from the end portion 137 of the barrel, unscrewing the collar 138, and sliding the barrel rearwardly through the opening 134 of the stirrup while removing the breech bolt 59 and the cam plates 55 and 56 rearwardly through the opening at the back of the frame.

The feed ramp 136 of the barrel is necessary since the uppermost cartridge in the magazine is below the axis of the barrel bore. As herein shown, a single-row box magazine 35*a* is provided which is identical to the magazine 35 except that the magazine lips 41*a* are inclined slightly with respect to the horizontal, said lips tilting the noses of the cartridges 127 upwardly for better feeding. As the breech bolt moves forwardly after the finger piece 49 of the trigger 47 is pulled, the feed rib 63 of the bolt passes between the magazine lips 41*a* and engages the base of a cartridge in the magazine to feed the cartridge forwardly. As forward movement of the bolt continues, the nose of the bullet 128 rides up the ramp 136 into the barrel chamber. As soon as the rim 131 of the cartridge in the chamber is alined with the bolt recess 70 and forward movement of the cartridge is arrested, the head of the cartridge enters said recess and the firing pin 77 strikes the primer of the cartridge to ignite the propellant in the cartridge.

As herein shown, the firearm A′ is designed to operate with rimmed cartridges 127, but it will be apparent that such a firearm may readily be designed to operate with rimless cartridges which are more apt to be used in blowforward guns of this general type. However, the firearm A′ cannot be designed to handle as many different types of ammunition as the firearm A due to the tortuous path which must be traveled by each round fed to the barrel. Sensitive-nose cartridges, for example, would be unsuitable for use with the feed ramp 136.

The present invention applies to firearms wherein the breech closure member is stationary as well as to firearms employing movable breech bolts. Figures 17 and 18 show a blowforward firearm A^2 which automatically indexes a feed strip to advance cartridges through the firearm. The firearm includes a fixed breech closure member or breechblock 139, a pair of side plates 140 rigidly connected to the breechblock and extending forwardly therefrom, and a barrel 141 pivotally mounted between the side plates for transverse

swinging movements and longitudinal sliding movements relative to the side plates. The barrel has a conventional longitudinal rifled bore **142** and an internally cylindrical cartridge-receiving chamber **143** coaxial with the bore and shaped to receive a rimmed cartridge **144** having a cartridge case **145** with a radially projecting circular rim **146**. The barrel has an externally cylindrical forward portion **147** and an externally threaded front end portion **148**. An internally threaded muzzle brake **149** may be mounted on said end portion, if desired, to assist in moving the barrel forwardlly. The muzzle brake has radial openings **150** and a front circular opening **151** coaxial with the bore **142** and having a diameter corresponding substantially to that of said bore.

A generally annular trunnion block **152** similar to the block **113** has trunnions journaled in the side plates **140** for swinging movements about an axis perpendicular to the side plates and has an internally cylindrical opening perpendicular to the trunnions of a size for slidably receiving the cylindrical barrel portion **147**. The trunnion block **152** also has a lateral recess for receiving the front end **153** of a recoil spring guide rod **154**. The rear portion of said guide rod is slidably mounted in an internally cylindrical opening in a barrel block **155** which holds the guide rod parallel to the barrel while permitting longitudinal sliding of the barrel relative to said rod. An annular collar **156** is rigidly connected to the rod near the trunnion block, and a helical driving spring or recoil spring **157** is mounted on the rod **154** to be compressed between said collar and the barrel block **155** as the barrel moves forwardly. The barrel block is rigidly mounted on the barrel for movement in unison therewith and is provided with a cam pin or follower **158** which projects laterally into cam slots or cam tracks **159** in the side plates **140**.

The pin and slot **158** and **159** of the firearm A^2 function like the pin **109** and slot **57** of the firearm A to move the barrel chamber transversely in response to relative longitudinal movement between the barrel and the breech closure member. However, a cam island **160** is provided at the center of each cam slot **159** to hold the barrel in its firing position during extraction and to hold the barrel in its loading position during the return stroke of the barrel toward the breechblock. The cam slot **159** has an outer marginal surface shaped like that of the slot **57** and has front and rear inclined marginal surfaces **161** and **162**, respectively, similar to the surfaces **123** and **126**, which engage the cam pin **158** to move the rear end of the barrel transversely as the barrel slides longitudinally.

As herein shown, a series of cartridges **144** are mounted in regularly spaced parallel relation in a metal feed strip or feed plate **163** of uniform thickness having a series of equally spaced alined openings therein of suitable shape for receiving and supporting the cartridge cases **145**, said openings having a diameter less than that of the rims **146** so that said cases are held against forward movement out of the feed strip. The feed strip is placed between the barrel and the breechblock so as to provide a continuous supply of cartridges and is free to move transversely relative to the breechblock between the side plates **140**.

A fixed firing pin or any other suitable firing pin may be mounted in the breechblock **139** to fire the gun. However, in a blowforward firearm it is usually preferable to employ a separate hammer-actuated firing pin or a spring-actuated striker which moves forwardly from the breechblock to strike the primer of the cartridge. As herein shown, a separate longitudinal firing pin **164** is mounted for axial sliding movements in the breechblock **139** and is actuated automatically in a conventional manner to strike the primer of a cartridge **144** in the barrel chamber **143** when said chamber is in firing position coaxial with the firing pin as shown in Fig. 17.

At the instant of firing the cam pin **158** is at the rear of the cam track **159**, the rim **146** of the cartridge case *a* of the cartridge in the chamber **143** engages the flat front surface of the breechblock **139**, and the front and rear faces of the feed strip **163** engage the front of said rim and the flat rear face of the barrel **141** whereby the cartridge is completely chambered. On firing the pressure of the propellant gases forces the bullet from the case *a* through the rifling of the barrel bore **142** and through the muzzle brake **149** to cause forward movement of the barrel and compression of the recoil spring **157**. A pair of stationary laterally alined feed strip ledges or stops **165** and **166** are mounted on the side plates **140** to limit forward longitudinal movement of the feed strip **163** and the cartridges carried thereby with the barrel so that the case *a* is extracted from the chamber **143** as the barrel moves forwardly. The cam island **160** engages the pin **158** to hold the barrel chamber in its uppermost firing position until the barrel is clear of the case *a*. After the cartridge case is fully extracted the pin **158** strikes the inclined surface **161** of the cam track to move the rear end of the barrel laterally towards a loading position. As the recoil spring is further compressed the pin **158** approaches the forward end of the cam track and the barrel chamber **143** is moved to a loading position substantially in longitudinal alinement with the case *b* of the next cartridge **144** in the feed strip. The recoil spring **157** then causes rearward movement of the barrel toward the breechblock **139**, the cam island **160** engaging the pin **158** to hold the rear end of the barrel in its lowermost loading position as the barrel moves rearwardly so that the mouth of the chamber registers with the cartridge case *b* and envelops the mouth of said case as the cartridge enters the barrel. The cam island **160** holds the chamber **143** in its loading position until a substantial portion of the cartridge case *b* enters said chamber.

The feed strip **163** does not move transversely as the barrel moves forwardly and rearwardly from the empty cartridge case *a* to the cartridge case *b* of the next cartridge, but as the cartridge enters the barrel chamber **143**, said feed strip permits slight tilting of the cartridge as it enters the barrel to accommodate barrel angle changes during the stroke of the barrel.

After the case *b* has entered the barrel the cam pin **158** engages the inclined cam surface **162** as shown in Fig. 18 to move the barrel transversely towards its firing position. The transverse movement of the barrel chamber **143** causes transverse movement of the cartridge cases *a* and *b* and the feed strip **163** and automatically indexes the feed strip. As soon as the cam pin **158** reaches the rear of the cam track **159** to return the barrel chamber to its firing position coaxial with the firing pin **164**, said firing pin strikes the primer of the cartridge **144** in said chamber to start another cycle of operations. The blow-forward firearm will fire automatically and will automatically advance the feed strip **163** to supply cartridges to the barrel.

If desired a spring finger **167** may be employed to catch the rim of a cartridge to prevent downward movement of the feed strip while barrel is away from cartridges. Where a fixed firing pin is employed, the spring finger **167** may be employed to hold the feed strip against the feed ledges **165** and **166** so that the cartridges clear the firing pin as the barrel is moved laterally.

While the firearms of Figs. 1 to 14, 17 and 18 employ cams to move the barrel chamber transversely, it will be apparent that other positive-acting means may also be employed. Figures 19 and 20 show in diagrammatic form a simple blowback firearm A^3 constructed according to the present invention and including a rigid frame **168**, a barrel **169** pivotally mounted at its front end on said frame for transverse swinging movement, a breech bolt **170** mounted for longitudinal sliding movement relative to said frame, a driving spring or bolt return spring **171** carried by the frame for yieldably resisting rearward movement of the bolt, a conventional single-row box

magazine 172 for supplying cartridges to be fed to the barrel, and a cam lever 173 mounted for swinging movement on a horizontal pivot pin 174 carried by the frame.

After firing the breech bolt 170 moves rearwardly to extract and eject the empty cartridge case. After the extraction is completed the upper rear portion of the bolt strikes the rear of the lever 173 to swing said lever clockwise whereby the front portion of the lever engages the top of the barrel to lower the barrel chamber to a loading position in longitudinal alinement with the uppermost cartridge in the magazine 172. During forward movement of the bolt a feed rib 175 on the bottom of the bolt passes between the magazine lips and engages the base of the uppermost cartridge in the magazine to feed the cartridge into the chamber of the barrel 169.

After the cartridge has entered the chamber a substantial distance and is clear of the magazine lips, cam horns 176 projecting forwardly from the bolt engage lugs 177 projecting laterally from the barrel to initiate movement of the barrel chamber from the loading to the firing position. The lugs ride up inclined surfaces of the cam horns as shown in Fig. 20 to return the barrel chamber and the bore to a firing position coaxial with the firing pin of the bolt before said pin strikes the primer of the cartridge in said chamber.

In the firearms of the present invention, means is provided for causing relative transverse movement between the cartridge-receiving chamber and the firing pin or other portion of the breech closure member. In the firearms described above the cartridge-receiving chamber or firing chamber at the rear of the barrel is formed in the barrel and has a fixed position relative to the barrel bore, but it will be apparent that such chamber may be formed in a separate member which rotates, slides or swings transversely relative to the barrel bore, in which case the bore need not move transversely relative to the breech closure member or breech bolt.

Figures 21, 21*a*, 22 and 23 show in diagrammatic form a modified blowback firearm A^4 wherein the cartridge-receiving chamber or firing chamber is separate from the barrel and is movable transversely relative thereto. The self-actuating firearm A^4 has a rigid metal frame 178 which is internally threaded at its front end to receive an externally threaded rear end portion 179 of a rigid longitudinal barrel 105*b* which is held in a fixed position relative to the frame. The barrel has a longitudinal bore 106*b* that may be provided with conventional rifling. A separate barrel block or slide 108*b* is mounted at the rear of the barrel 105*b* and is shaped to provide a cartridge-receiving chamber or firing chamber 107*b* that may be moved transversely into axial alinement with the barrel bore 106*b*.

A breech bolt 180 is mounted on the frame 178 rearwardly of the barrel block 108*b* for longitudinal sliding movement on the frame toward and away from said barrel block, a driving spring or bolt return spring 181 yieldably resisting movement of the bolt rearwardly away from the barrel. A conventional single-row box magazine 182 is carried by the frame at the rear of the barrel block for supplying cartridges to be fed to the barrel chamber 107*b*. A lever 183 is pivotally mounted at its rear end on a pivot pin 184 carried by a rear portion of the frame and is slotted at its front end to fit on a pin 185 carried by the lower end of the barrel block so that the front end of said lever moves upwardly and downwardly with the cartridge-receiving chamber 107*b*. The barrel block is mounted for vertical sliding movements between pairs of parallel guides 186 mounted on the frame 178 at opposite sides of the firearm and is biased upwardly by a lifter spring 187 on the frame which yieldably resists movement of the cartridge-receiving chamber downwardly out of register with the barrel bore. A slight longitudinal movement of the barrel block may be permitted by the guides 186 if a booster effect is desired, but it is usually preferable to prevent any longitudinal movement of said block relative to the frame 178.

If desired, a bumper block or stop 18*b* may be rigidly mounted on the frame 178 to limit upward movement of the barrel block 108*b* by the spring 187, said bumper block engaging the top of the barrel block when the chamber 107*b* reaches its uppermost firing position in axial alinement with the bore 106*b* as shown in Figs. 21 and 22. The portion of the barrel block 108*b* projecting forwardly of the vertical guides 186 is externally cylindrical and is movable into engagement with a similarly shaped surface on the bottom of an arcuate protuberance or stop 188 located on the front portion of the frame 178 just above the barrel portion 179, the barrel block engaging said protuberance while it engages the bumper block 18*b*. One or more radial pressure relief vents 380 are provided in the protuberance adjacent the rear face of the barrel to minimize the buildup of gas pressure on the bottom face of the protuberance after firing which would tend to displace the barrel block downwardly away from the protuberance.

In order to prevent excessive leakage of gases between the flat vertical faces of the barrel and the barrel block after firing, it is preferable to provide sealing means for reducing such leakage. As herein shown, the barrel block is provided with a cylindrical counterbore at its forward end which receives an externally cylindrical packing bushing 381 of substantially uniform radial thickness which sealingly engages the cylindrical surface of the counterbore. During firing, the gas pressure acts on the back face of the bushing 381 and slides the bushing forwardly against the flat rear face of the barrel 105*b* to seal the space between said rear face and the front face of the barrel block, the flat front face of the bushing sealingly engaging said rear face as best shown in Fig. 21*a*. The rear face of the barrel is flush with the flat vertical face of the frame 178 below the protuberance 188 so that the bushing 381 is free to slide vertically over said flat face as shown in Fig. 23.

Means is provided for swinging the lever 183 in response to longitudinal movement of the breech bolt 180 so as to move the cartridge-receiving chamber 107*b* from its firing position in register with the barrel bore to a pre-determined loading position in register with the uppermost cartridge in the magazine 182. Such means includes a cam dog 189 of substantially segmental form that is pivotally mounted on the central portion of the lever 183 and a leaf spring 190 mounted on the lever for biasing the cam dog upwardly in the clockwise direction as indicated in Figs. 21 to 23.

Fig. 21 shows the positions of the parts of the firearm A^4 at the instant of firing. At this time the barrel block 108*b* is supported by the spring 187 in its uppermost firing position with the cartridge-receiving chamber 107*b* coaxial with the barrel and with the fixed firing pin on the bolt, the cam dog being rearwardly of the bolt and in its uppermost position. After extraction and ejection, the bolt 180 rides rearwardly over the cam dog and the chamber 107*b* remains in its uppermost firing position as shown in Fig. 22. As the bolt passes the cam dog, said dog returns from a depressed position as shown in Fig. 22 to an interception position. As the bolt is pushed forwardly by the spring 181, the bolt engages the cam dog to depress the dog and the lever 183, to compress the spring 187, and to lower the chamber 107*b* to a lowermost loading position as shown in Fig. 23 wherein the chamber is substantially in register with the uppermost cartridge of the magazine.

While the cartridge-receiving chamber 107*b* is in its loading position, a central feed lip 191 on the bottom of the bolt passes between the upper lips of the magazine 182 and engages the base of the uppermost cartridge in said magazine to feed the cartridge into said chamber. After the cartridge is moved a substantial distance into said chamber and out of contact with the magazine, the breech bolt rides off the cam dog and the lifter spring 187 returns said chamber to its uppermost firing position.

Thereafter the cartridge in said chamber is fired and the cycle is repeated. This arrangement is particularly advantageous since the gun may be designed so that the cartridge is almost fully chambered before the cartridge-receiving chamber is moved upwardly from its lowermost loading position.

If desired, yieldable means may be provided for depressing the barrel. Figures 24 and 25 show a modified form of the present invention wherein the barrel is moved transversely by a spring in response to rearward movement of the bolt. As shown in these figures, a blowback firearm A^5 is provided having a rigid frame **192** with a receiver **193**, a barrel **194** having trunnions **195** journaled in the front portion of the frame, a breech bolt **196** mounted in the receiver **193** for longitudinal sliding movements toward and away from the barrel, a recoil spring or driving spring **197** interposed between the bolt and the rear wall of the receiver for biasing the bolt toward the barrel, and a conventional box magazine **198** mounted in a fixed position in the receiver for supplying cartridges to be fed to the barrel. The barrel **194** has a conventional bore and a conventional firing chamber or counterbore **199** for receiving cartridges from the magazines. The bolt **196** has a circular bolt recess **200**, a fixed firing pin at the center of said recess, and a feed rib **201** that passes between the magazine lips to advance a cartridge into the barrel.

A longitudinally elongated slot **202** is provided in the top wall of the receiver **193** to receive a vertical bolt handle **203** that projects upwardly from the bolt. Rigidly connected to the bolt handle is a longitudinally extending guide rod **204** having an enlarged portion **205** at its forward end. A crank **206** is mounted for swinging movements on a pivot pin **207** rigidly connected to the frame **192** and projects through an opening **208** in the top wall of the frame. The crank has an upright spring-engaging portion **209** adjacent the rod **204** and a flat barrel-engaging portion **210** substantially perpendicular to said upright portion. A helical compression spring **211** is mounted on the guide rod **204** between the crank portion **209** and the rod head **205** and engages said crank portion to resist movement of said crank portion toward said head and to hold the crank portion **210** against the barrel. A barrel block or lug **212** is rigidly mounted on the rear end of the barrel and engages the flat under surface of the crank portion **210**. A pair of integral cam horns **213** are provided on opposite sides of the breech bolt **196** and project forwardly therefrom for engaging the bottom of the barrel block on opposite sides of the barrel, each of said horns having an inclined barrel-engaging surface **214**.

The operation of the firearm A^5 is much like that of the other blowback firearms described above. At the instant of firing the flat front face of the breech bolt **196** is substantially in engagement with the flat rear face of the barrel **194**, the cam horns **213** engage the bottom of the barrel block **212** to support the chamber **199** in its uppermost firing position coaxial with the bolt recess **200**, the rim of the cartridge is in the bolt recess and is gripped by the extractor, and the crank **206** is pressed by the spring **211** against the top of the barrel block to hold the barrel block against the cam horns **214** as shown in Figs. 24 and 25. Just after firing the pressure of the propellant gases cause the bolt **196** to move rearwardly to extract the empty cartridge case from the chamber, said case supporting the rear end of the barrel until the mouth of the case clears the end of the barrel. After extraction is completed the empty cartridge case is ejected in the conventional manner and rearward movement of the bolt continues so as to further compress the recoil spring **197** and the barrel-actuating spring **211**.

As the bolt moves rearwardly the pressure of the spring **211** on the upright crank portion **209** increases so that the crank **206** is rotated to depress the barrel **194** to a lower loading position as shown in dot-dash lines in Fig. 25 substantially in alinement with the uppermost cartridge in the magazine **198**. After the rear end of the barrel is lowered by the yieldable connection between the bolt and the barrel, the bolt is shoved forwardly by the recoil spring **197** and the feed rib **201** pushes the uppermost cartridge longitudinally out of the magazine into the barrel. After the cartridge is clear of the magazine and part way into the chamber **199**, the inclined surface **214** engages the bottom of the barrel block to lift the barrel chamber from its loading position to its firing position in alinement with the firing pin. After the cartridge reaches the firing position the fixed firing pin carried by the bolt strikes the primer of the cartridge to fire the gun.

The firearm A^5 will function satisfactorily with the elements described above. However, in order to reduce the danger of jamming when the barrel is not properly depressed, it is often preferable to provide means for arresting forward movement of the bolt whenever the barrel is above its loading position. As herein shown, an interlock mechanism is provided including interengaging levers **215** and **216**, said levers being pivotally mounted on a pair of lateral horizontal pins carried by the frame **192**. The barrel **194** has a downwardly projecting portion **217** that engages the front end of the lever **216** and the bolt **196** has a downwardly projecting portion **218** rearward of the magazine **198** that engages the front end of the lever. The rear end of the lever **216** engages the front end of the lever **215** so that movement of one lever about its pivotal axis swings the other lever in the opposite direction about its pivotal axis.

The normal position of the levers is shown in solid lines in Figs. 24 and 25. When the barrel is properly depressed to its loading position, the portion **217** engages the lever **216** and lowers the rear end of the lever **215** out of the path of travel of the bolt as shown in dot-dash lines in Fig. 25. However, if the barrel is not properly depressed and does not engage the lever **216** before forward movement of the bolt begins, the front end of the lever **215** projects into the path of movement of the bolt and engages the front face of the portion **218** to halt movement of the bolt before the front of the bolt reaches the magazine. This prevents feeding of a cartridge toward the barrel until the barrel is properly depressed to receive the cartridge.

It will be noted that the cam slot **57** of the firearm A has a widened portion **120** so that the barrel remains in its lower loading position until the cartridge is fed to the barrel chamber. Figures 26 to 30 show modified forms of the present invention wherein the cam slot is of substantially uniform width throughout its length and means are provided for feeding the cartridge from the magazine to the barrel before the bolt reaches the magazine.

Figures 26 and 27 show in diagrammatic form a blowback firearm A^6 which may be constructed substantially like the firearm A. The firearm A^6 has a rigid frame including a pair of parallel flat side plates **219** and a back plate **220** rigidly connected to said side plates. A breech bolt **221** is rigidly connected to a pair of flat parallel cam plates **222** and **223** of identical construction which are mounted on the frame for movement longitudinally between the side plates parallel to said side plates. The bolt has a conventional extractor **224** on its right side, a conventional bolt recess **225** with a conventional fixed firing pin or the like at the center of the recess, and an internally cylindrical opening near its left side for receiving an ejector rod **226** that extends forwardly from the back plate **221**. A recoil spring or bolt return spring **227** is mounted on the ejector rod between the back plate and the bolt to press the bolt forwardly.

The firearm A^6 has a barrel **228** similar to the barrel of the firearm A and having laterally alined horizontal trunnions **229** journaled in the side plates **219**. A barrel block **230** is ridigidly mounted on the rear end of the

barrel and has an internally cylindrical opening of a size to receive a horizontal cam pin or follower **231** that projects laterally from opposite sides of the barrel block. The cam plates **222** and **223** have laterally alined cam slots **232** each with a substantially uniform width throughout its length corresponding substantially to the diameter of the cam pin **231**. The opposite end portions of the cam pin fit in the slots **232** and slide relative to said slots as the bolt reciprocates. Each slot **232** has straight horizontal front and rear portions **233** and **234** and an inclined intermediate portion **235** that extends upwardly from the front portion to the rear portion. A horizontal ejection port **236** is provided in the right cam plate **223** just below the rear portion **234** of the cam slot, said port being large enough to permit ejection of cartridge cases laterally through the side of the gun. Where it is desired to make both cam plates the same, a similar port may also be provided in the left cam plate.

A conventional single-row box magazine **237** is supported in a fixed position on the frame to store a row of cartridges **238** for firing in the chamber **239** of the barrel. The magazine **237** and the cam plates **222** and **223** may be mounted in any suitable manner, for example like the magazine **35** and the cam plates **55** and **56** of the firearm A.

An externally cylindrical stud **240** projects horizontally from each side of the bolt **221** into a circular opening in the cam plate to connect the bolt to the side plates, and an externally cylindrical spindle or pin **241** extends through the bolt into circular openings in the cam plates for the same purpose. A bolt handle similar to the handle **66** may be mounted on the spindle **241** if desired, and where a two-position firing pin is provided in the bolt, said spindle and bolt handle may be substantially the same as the spindle **65** and handle **66** of the firearm A.

The operation of the blowback firearm A^6 during rearward movement of the bolt is substantially the same as that of the firearm A. At the instant of firing the front of the bolt is substantially in engagement with the rear face of the barrel, the cam pin **231** is near the rear ends of the cam slots **232**, the chamber **239** and the bore of the barrel are coaxial with the bolt recess **225** and the firing pin, and the upper cartridge **238** in the magazine is held below the upper magazine lips by a horizontal rammer or feed bar **242** that is rigidly connected to the bottom of the bolt and projects a substantial distance forwardly therefrom. The barrel has a front lower portion **243** that is cut away on an incline to clear the rammer.

The cam pin **231** remains in the straight portions **234** of the cam slots **232** until the empty cartridge case is fully removed from the chamber by the extractor **224** and is clear of the barrel. Thereafter the inclined marginal walls of the inclined portions **235** engage the pin to lower the barrel chamber **239** to a predetermined loading position. During rearward movement of the bolt the front face **244** of the ejector rod **226** engages the base of the empty cartridge case in the bolt recess **225** to eject the case horizontally out the side ejection port **236** and the rammer **242** rides off the uppermost cartridge to permit the cartridge to move upwardly to a predetermined discharge position against the magazine lips. The cam pin **231** is then in its lowermost position in the front portions **233** of the cam slots and the chamber **239** is in its loading position substantially in alinement with the uppermost cartridge **238** in the magazine. Rearward movement of the bolt continues until the cam pin is near the front of the cam slots.

The compressed spring **227** then forces the bolt forwardly and the rammer **242** engages the base of the uppermost cartridge in the magazine to feed the cartridge a substantial distance into the chamber **239** and clear of the magazine lips while the pin is in the straight portions **233** of the cam slots. After the cartridge is clear of the magazine and is supported by the barrel, the inclined surfaces of the cam portions **235** engage the cam pin **231** to elevate the barrel chamber and the cartridge carried thereby to a firing position in alinement with the bolt recess **225** before the base of the cartridge enters said recess and before the firing pin strikes the primer of the cartridge. The portion **243** of the barrel clears the advancing front portion of the rammer **242** or may slidably engage the rammer as the barrel is elevated.

It will be understood that the rammer employed to feed the cartridge into the barrel before the barrel is moved out of its lowermost loading position may be movable independently of the bolt or in response to movement of the barrel or the bolt. Figures 29 and 30 show in schematic form a modified blowback firearm A^7 which is constructed substantially the same as the firearm A^6 except that separate means are provided for moving the rammer forwardly in response to rearward movement of the bolt. The firearm A^7 has a bolt **221***a* and a barrel **228***a* substantially the same as the bolt **221** and the barrel **228** and mounted on the side plates **219** in the same way. The barrel **228***a* is substantially the same as the barrel **228** except that the lower front portion **243***a* thereof is not cut away. The bolt **221***a* is substantially the same as the bolt **221**, but the extractor **224***a* is located above the bolt recess **225** and the ejector is located below the firing pin to eject the cartridge upwardly as in the firearm A. However, it will be apparent that side ejection may also be employed as in the firearm A^6 in which case the ejector and extractor could be mounted as in the bolt **221**.

The bolt group including the cam plates **222** and **223** and the bolt **221***a* is mounted for longitudinal reciprocation parallel to the side plates **219** as in the firearm A^6 and is biased forwardly by a suitable recoil spring or driving spring, for example as in the firearm A. The cam pin **231** of the barrel block cooperates with the cam slot **232** to raise and lower the rear end of the barrel **228***a* as in the firearm A^6.

Means is provided for feeding cartridges **238** from the magazine **237** to the chamber **239** of the barrel **228***a* while the cam pin **231** is in the straight lower front portion of the cam slot **232** including a rammer or feed bar **242***a* of a size to fit between the upper lips of the magazine **237**, a rammer crank **246** and a crank return bar **247**. The rammer crank has a hub **248** journaled on a horizontal pivot pin **249** and upper and lower arms **250** and **251**, respectively, integrally connected to said hub and adapted to engage said crank return bar and said rammer, respectively. The rammer has an ejector nose **252** at its forward end and a slot **253** for receiving the lower arm **251**. A lateral stud **254** is rigidly mounted on the rear of the cam plate **222** for engaging the front of the crank arm **250** to swing the crank counterclockwise and the return bar **247** has front and rear laterally extending end portions **255** and **256** for engaging the rear of the stud **254** and the rear face of the arm **250**, respectively.

The operation of the firearm A^7 is much like that of the firearm A^6. At the instant of firing the ejector nose **252** is in a slot **245** in the bottom of the bolt **221***a* rearwardly of the magazine **237**, the front face of the bolt **221***a* is substantially in engagement with the rear face of the barrel **228***a*, the barrel chamber **239** is coaxial with the bolt recess **225** and the firing pin, the cam pin **231** is adjacent the front end of the cam slot **232**, and the rim of the cartridge **238** in said barrel chamber is in said bolt recess and is gripped by the extractor **224***a* as shown in Fig. 29. The cam pin **231** remains in the upper straight portion **233** of the cam slot until the empty cartridge case is extracted from the barrel chamber, and as rearward movement of the bolt continues the flat front vertical face of the ejector nose **252** engages the base of the cartridge case to eject the case vertically out the top of the gun and the inclined surface of the cam slot portion **235** engages the cam pin **231** to depress the rear

end of the barrel. The stud 254 moves rearwardly with the bolt and engages the upper crank arm 250 to move said crank arm rearwardly and to move the lower crank arm 251 forwardly. The forwardly moving arm 251 engages the front wall of the slot 253 to push the rammer 242*a* forwardly during rearward movement of the bolt. The front face of the rammer 242*a* engages the base of the uppermost cartridge in the magazine 237 after the cam pin 231 reaches its lowermost position in the lower portion 233 of the cam slot and after the barrel chamber 239 has been moved to its lowermost loading position substantially in longitudinal alinement with said uppermost cartridge. As rearward movement of the breech bolt continues the rammer feeds the cartridge into the barrel chamber as shown in Fig. 30 until the cartridge is fully chambered. The forward feeding of the cartridge is therefore completed before the recoil spring moves the bolt forwardly.

As the bolt moves forwardly the inclined portion of the cam slot 232 engages the cam pin 231 to return the rear portion of the barrel to its uppermost firing position and the stud 254 engages the front end portion 255 of the rammer crank return bar 247 to move said bar forwardly with the bolt. As the return bar moves forwardly its rear end portion 256 engages the rear face of the upper crank arm 250 to return said crank arm and the rammer to the position shown in Fig. 29 before the firing pin strikes the primer of the cartridge in the barrel chamber.

It will be apparent that the lateral or transverse movement between the barrel and the breech bolt or breech closure member necessary to effect transverse movement of firing pin and barrel chamber relative to each other may be obtained by moving a portion of the breech closure member transversely relative to the frame as well as by moving the barrel transversely. Figures 31 to 34 show a modified blowback firearm A^8 wherein positive acting cam means are employed to rotate the breech bolt in response to longitudinal sliding movement of the breech bolt relative to the frame. The firearm A^8 comprises a rigid frame including a generally annular receiver 258 having an internally cylindrical bore 259 in which is slidably mounted an externally cylindrical breech bolt 260. The bolt is provided with an internally threaded radial hole to receive an externally threaded portion of a combined bolt handle and cam follower 261 which is rigidly mounted on the right side of the bolt and projects radially through a cam slot 262 in the receiver 258. A feed slot or magazine opening 263 is provided in the bottom of the receiver and a side ejection opening 264 is provided in the receiver between the feed slot and the cam slot. A conventional single-row box magazine 265 containing a row of conventional rimless cartridges 266 is mounted in a fixed position relative to the receiver with its inturned feed lips projecting into the feed slot 263, the uppermost cartridge in the magazine being held by said lips in a predetermined discharge position in said slot below the outer cylindrical surface of the breech bolt. A small integral feed rib 267 is provided on the bottom of the bolt that projects radially beyond said cylindrical surface into the feed slot 263.

The breech bolt is provided with a substantially circular cartridge-head recess 268 near the bottom of the front bolt surface of a size to receive the head of a cartridge 266, a conventional spring-pressed extractor 269 mounted at the right side of said recess to enter the extractor groove of the cartridge and to grip said head, and a conventional fixed firing pin 270 at the center of the cartridge-head recess for striking the primer of the cartridge. The breech bolt has a longitudinal bore and counterbore of a size to receive a spring-loaded horizontal ejector rod 271 having a radially enlarged head 272 at its rear end, the axis of said rod being on the left side of the firing pin. The front cartridge-engaging face of the ejector rod projects into the recess 268 behind the foremost surfaces of the bolt when said rod is in its foremost position relative to the bolt. A flat circular spring plate 273 is pressed against the flat rear face of the bolt and against the head 272 by a bolt return spring or driving spring 274. The receiver is internally threaded to receive an externally threaded back plate or plug 275 which engages the rear of the driving spring.

A conventional stationary barrel 276 is rigidly connected to the receiver 258 and has a feed ramp 277 at the lower portion of its rear end. The barrel has a longitudinal bore 278 and a counterbore or chamber 279 coaxial with said bore and of a size to receive one of the cartridges 266.

At the instant of firing the flat front face of the breech bolt is at its foremost position substantially in engagement with the flat front wall of the receiver 258, the bolt handle 261 is at the front of the cam slot 262, the firing pin 270 and the cartridge-head recess 268 are in their lowermost position coaxial with the barrel chamber 279 and directly above the magazine 265, and the feed rib 267 is at the left side of the slot 263 clear of the magazine as shown in Figs. 31 to 33.

The cam slot 262 has straight top and bottom marginal surfaces 280 and 281 and inclined front and rear marginal surfaces 282 and 283 which engage the bolt handle 261 during longitudinal movement of the breech bolt, said surfaces preferably being radially disposed as indicated in Fig. 32. After firing and during extraction of the empty cartridge case from the barrel chamber, the bolt handle or cam follower 261 engages the straight surface 281 of the cam slot and the cartridge-head recess 268 remains in its firing position coaxial with the barrel chamber. After the extraction is completed and the empty cartridge case is clear of the barrel, the bolt handle arrives at the inclined surface 283 to initiate rotation of the bolt and the spring 274 increases the pressure of the plate 273 on the extractor rod head 272 to move the front surface of said rod forwardly beyond the bottom of the cartridge-head recess 268 whereby the empty cartridge case is ejected laterally through the opening 264. As the bolt handle rides up the inclined surface 283, the recess 268 is swung laterally out of register with the barrel chamber 279 and the feed rib 267 is swung laterally toward the magazine. When the bolt reaches its rearmost position in full recoil, the bolt handle 261 is adjacent the rear of the cam slot 262 in its uppermost position as shown in dot-dash lines in Fig. 32, the feed rib 267 is spaced rearwardly from the base of the uppermost cartridge in the magazine and is longitudinally alined with the primer of said cartridge and with the barrel chamber, and the cartridge-head recess 268 is out of longitudinal alinement with said cartridge and said barrel. As the breech bolt is advanced by the recoil spring 274, the flat front face of the feed rib 267 moves into engagement with the uppermost cartridge 266 in the magazine and said feed rib moves straight ahead between the magazine lips to feed the cartridge into the chamber 279. During this forward movement the bolt handle rides along the straight cam surface 280 so that no lateral movement is imparted to the feed rib at this time. After the feed rib has moved a substantial distance between the magazine lips and after the nose of the cartridge rides up the feed ramp 277, the bolt handle rides down the inclined cam surface 282 to return the bolt recess 268 to its original position coaxial with the barrel chamber. However, said recess is not brought into alinement with the base of the cartridge until the cartridge is almost completely chambered so that there is little danger of premature firing due to engagement of the firing pin with the base of the cartridge before the cartridge is chambered.

The front portion of the ejector rod 271 projects into the cartridge-head recess 268 during feeding of the cartridge into the barrel chamber but does not extend beyond the front face of the bolt so as to interfere with movement of the cartridge into the barrel. After the

head of the cartridge is alined with said cartridge-head recess and the cartridge is fully chambered, the mouth of the cartridge case engages the shoulder 284 at the front of the chamber to stop movement of the cartridge, and the base of the cartridge engages the ejector rod while the breech bolt completes the last fraction of an inch of its forward movement and the head of the cartridge enters said cartridge-head recess, whereby the bolt moves away from the head 272 of the ejector rod as shown in Fig. 31.

It will be understood that portions of the magazine lips may be cut away if desired to permit the necessary lateral swinging movements of the feed rib 267 with a cam slot 262 of a given shape. It will also be understood that Figs. 31 to 34 are merely schematic and that the firearm A^8 may take various other forms as will be apparent to those skilled in the art.

It will be apparent that a hammer-type firing mechanism may be employed in the firearms described above as well as striker-type firing mechanisms or other conventional firing arrangements employing fixed or movable firing pins. Figures 35 to 39 illustrate another modified firearm A^9 constructed in accordance with the present invention wherein a conventional hammer-type firing mechanism is employed and the barrel is moved upwardly from its loading position by a lifter spring. The firearm A^9 has a rigid metal frame 287 including an internally cylindrical receiver 288 and a transverse back plate 289. An externally cylindrical breech bolt 290 having an externally cylindrical outer surface with a diameter substantially equal to the internal diameter of said receiver is mounted in said receiver for longitudinal reciprocation. A radial guide pin or stud 291 is rigidly connected to the breech bolt at the left front portion thereof and projects radially through a longitudinally elongated slot 292 in the receiver 288. A long guide rod 293 is rigidly connected to a laterally projecting portion of the back plate 289 outside of the receiver and extends longitudinally parallel to the receiver and through a longitudinal hole in the guide pin 291 to provide a guide and support for a helical driving spring or recoil spring 294 which biases the breech bolt forwardly in a conventional manner.

As herein shown, the firearm A^9 has a buffer spring arrangement similar to that of the firearm A including a longitudinal ejector rod 295 having a flat circular collar 296 rigidly mounted thereon and a helical buffer spring 297. The ejector rod extends through an internally cylindrical opening 298 in the rear portion of the breech bolt as best shown in Fig. 39.

An externally cylindrical barrel 299 is pivotally connected to the front end of the receiver by means of a trunnion block 300 that is journaled in the receiver for oscillation about a lateral horizontal axis whereby the rear portion of the barrel may be moved vertically. The front portion of the breech bolt extends forwardly over the barrel and has a semi-cylindrical internal surface 301 with a diameter corresponding to that of the barrel that engages the top of the barrel when the barrel is in its firing position coaxial with the receiver 288 as shown in Fig. 37. Said front bolt portion is cut away to provide laterally alined inclined cam surfaces 302 on its opposite sides and an ejection opening 303 on its right side. The barrel is provided with integral laterally projecting lugs or cam followers 304 that extend below the front portion of the breech bolt and engage the cam surfaces 302 to lower the rear end of the barrel, said lugs and cam surfaces providing positive-acting means for moving the barrel transversely in response to longitudinal movement of the breech bolt. At the instant of firing the left barrel lug 304 is substantially in engagement with a horizontal bottom surface of the bolt while the right barrel lug is spaced from the upper semi-cylindrical portion of the bolt.

The barrel is biased upwardly by yieldable means including a helical lifter spring 305, an upright rod 306, and a pair of laterally alined latches 307 pivotally connected to the frame 287 on opposite sides of the breech bolt. The upper arm of each latch 307 has an enlarged hook portion 308 which is shaped for engagement with the top of one of the lugs 304 when the rear portion of the barrel is depressed as shown in Fig. 38, the opposite sides of the bolt being cut away to clear said hook portions as the bolt reciprocates. The rod 306 serves as a combined guide and support for the spring 305 and has an enlarged circular head at its upper end that is pushed upwardly by the spring against the barrel. The lower portion of the rod projects through a hole in the lower arm of the latch 307 and is guided by the latch, the spring 305 engaging said lower arm to bias it downwardly and to bias the hook portion 308 rearwardly toward the lug 304. Radially projecting knock-off pins 309 are mounted on opposite sides of the breech bolt 290 to engage the hook portions 308 after a cartridge has been fed to the barrel chamber so as to release the latches 307 and to permit upward movement of the barrel chamber by the spring 305. If desired, additional radial pins 310 may be mounted at the front of the bolt to provide positive-acting means for moving the hook portions 308 toward their topmost catch positions in engagement with the lugs 304.

The barrel has a longitudinal bore 311 which is preferably rifled in the conventional manner and a cartridge-receiving chamber at the breech end of the bore, said bore and chamber being coaxial with the receiver 288 at the instant of firing as shown in Figs. 35 to 37.

A conventional single-row box magazine 312 having an upwardly-biased platform 313 supporting a row of cartridges 314 is mounted in a fixed position in a magazine recess 315 of the frame and projects into the receiver 288. The conventional inturned feed lips at the top of the magazine hold the uppermost cartridge 314 in a predetermined discharge position for feeding to the barrel chamber, and, during rearward movement of the breech bolt, the rear of the barrel is lowered to a loading position with its bore 311 substantially coaxial with said uppermost cartridge as shown in Fig. 38.

The lower portion of the breech bolt 290 is cut away as best shown in Fig. 36 to clear the upper portion of the magazine and the inturned magazine lips, and a conventional feed rib 316 of rectangular cross section is provided that moves longitudinally between said magazine lips to engage the base of the uppermost cartridge in its discharge position and to feed the cartridge into the barrel chamber.

As herein shown, a conventional hammer mechanism is employed in the firearm A^9 including a hammer 317 that engages the rear vertical face of the bolt and the flat horizontal bottom face of the feed rib 316, a trigger 318, a hammer spring 319, and an automatic sear 320. The spring 319 is mounted in the bottom of an open-top metal cylinder 321 that is rigidly connected to the frame 287 and engages the bottom face of a cylindrical piston or plunger 322 that is mounted for reciprocation in said cylinder. The hammer 317 is mounted for vertical swinging movements on a horizontal pivot pin 323 carried in a fixed position on the frame 287 and is pivotally connected to the hammer spring plunger 322 by means of a connecting rod 324 so that the spring 319 acts in a direction to resist movement of the hammer away from the breech bolt.

The trigger has a forwardly projecting manual sear portion 325 that is movable through a small opening in the cylinder 321 to engage the top of the hammer spring plunger 322, and to prevent forward movement of the hammer against the firing pin. The trigger is mounted to swing on a horizontal pivot pin 326 carried by the frame 287 and is biased in a counterclockwise direction by a spring 327 that is mounted on said pivot pin, the lower portion of the spring being bent inwardly to engage

the rear face of the trigger and the upper portion engaging the rear face of a horizontal stop pin or stud 323 rigidly mounted on said frame, whereby the manual sear 325 is pressed by the trigger spring towards its catch position shown in Fig. 38.

The automatic sear 320 is in the form of a bellcrank and is mounted on the right side of the magazine 312 on a horizontal pivot pin 329 carried by the frame 287 with its lower arm extending rearwardly from said pivot pin to engage the hub portion of the hammer 317 and its upper arm extending upwardly in the path of movement of a small integral lug 330 carried by the rear portion of the breech bolt 290. The lower arm of the sear 320 is biased downwardly toward the hub of the hammer 317 by a cantilever spring 331 that is rigidly connected at its forward end to the frame 287. The hub portion of the hammer is provided with a sear notch 332 to receive the nose of the lower sear arm as shown in Fig. 38, said notch cooperating with the automatic sear in the conventional manner.

Any suitable firing pin arrangement may be provided in the main portion of the breech bolt rearwardly of the ejection opening 303. As herein shown, the breech bolt 290 is bored and counterbored to receive a conventional firing pin 333 coaxial with the receiver 288 and having an enlarged piston-like head 334 at its rear end for engaging the hammer 317 and a small nose 335 at its front end for engaging the primer of a cartridge 314. A helical spring 336 is mounted on the firing pin in the counterbore of the bolt for engaging the front face of the head 334 to press the firing pin rearwardly, and a retaining screw 337 is mounted on the bolt for limiting such rearward movement of the firing pin, the nose portion of the retaining pin fitting in an annular groove 338 in the head 334 that has an axial length greater than the diameter of said nose portion as shown in Fig. 39.

The breech bolt 290 has a flat front vertical face 339 which is substantially in engagement with the flat rear face of the barrel 299 at the instant of firing and has a conventional circular cartridge-head recess 340 of uniform depth coaxial with the receiver 288 and the firing pin nose 335 and of a size to receive the rim of a cartridge 314. The right side of the bolt is provided with a narrow recess to receive an extractor 341 for gripping the rim of the cartridge in the bolt recess 340, a cantilever spring 342 being provided for biasing the extractor towards its cartridge-rim-engaging position shown in Fig. 39. A detachable horizontal bolt handle 343 is rigidly connected to the bolt rearwardly of the extractor 341 and projects through a horizontally elongated slot in the right side of the receiver 288 (as in the firearm A).

The operation of the blowback firearm A^9 is much like that of the firearm A^4 and should be apparent from the above description. At the instant of firing the cartridge 314 in the barrel chamber is fully forward, the rim of the cartridge is in the bolt recess 340 which at this time is coaxial with the bore, the extractor 341 is in gripping engagement with the rim of the cartridge, the hammer 317 strikes the firing pin head 334, and the firing pin nose 335 strikes the primer of the cartridge to ignite the propellant charge. The resulting propellant gases emitted from the cartridge case force the bullet through the bore 311 and act on the breech bolt 290 to move the bolt rearwardly and to compress the recoil spring 294. During the first portion of the recoil movement of the breech bolt, the lifter spring 305 holds the barrel 299 in its uppermost firing position against the bolt surface 301, the feed rib 316 slides rearwardly over the top of the upper cartridge 314 in the magazine, and the extractor 341 pulls the empty cartridge case out of the barrel chamber. After the empty case is fully extracted and is clear of the barrel, the cam surfaces 302 move rearwardly into engagement with the barrel lugs 304 to initiate lowering of the barrel chamber, the feed rib 316 rides off the cartridge to permit said cartridge to move upwardly to its discharge position against the magazine lips, and the ejector rod 295 engages the base of the empty cartridge case to eject the same laterally through the ejection opening at the side of the gun. As the cam surfaces move rearwardly the barrel lugs are moved downwardly and carry the barrel chamber towards its lower discharge position. As the breech bolt 290 approaches full recoil, the lugs 304 approach their lowermost positions and ride downwardly off the flat rear faces of the hook portions 308, and the lifter spring 305 which was compressed by the descending barrel presses said hook portions rearwardly over the top of the barrel lugs. If the hook portions are not moved rearwardly by the spring to a catch position in the path of movement of said barrel lugs, the pins 310 engage said hook portions to cause such movement. During the rearward movement of the bolt, the hammer 317 is tilted rearwardly to compress the spring 319, the bottom surface of the feed rib 316 moves into engagement with the top of the hammer, and the rear of the bolt engages the collar 296 as shown in Fig. 38 to compress the buffer spring 297.

The compressed recoil spring 294 then causes forward movement of the bolt toward the barrel. After the bolt moves forwardly out of engagement with the barrel lugs 304, the rear of the barrel is held by the hook portions 308 in its lowermost loading position substantially coaxial with the uppermost cartridge in the magazine, and the feed rib 316 moves into engagement with the base of said uppermost cartridge and strips the cartridge from the magazine. During forward movement of the bolt and while the barrel is in its lowermost loading position, the lower arm of the automatic sear 320 intercepts and engages the radial face of the hammer sear notch 332 to stop forward movement of the upper portion of the hammer 317, whereby the bolt and the firing pin move out of engagement with the hammer and the firing pin nose 335 is moved rearwardly by the spring 336 out of the cartridge-head recess 340. After the cartridge is within a small fraction of an inch of being fully chambered and is clear of the magazine, the forwardly moving knock-off pins 309 push the hook portions 308 out of engagement with the barrel lugs 304 and the compressed lifter spring 305 presses the barrel upwardly, the cartridge in the barrel chamber being carried upwardly by the barrel. As the barrel chamber rises to its uppermost firing position coaxial with the receiver 288 and the firing pin, the rim of the cartridge in said chamber registers with the bolt recess 340, permitting the bolt to move about one-twentieth of an inch or so to complete its forward movement. This final movement of the bolt 290 brings the radial lug 330 against the upper arm of the automatic sear 320 as shown in Fig. 35, disengaging it from the hammer which is then moved at high velocity by the compressed hammer spring 319 against the head 334 of the firing pin to fire the cartridge. The above cycle of operations is then repeated, the gun continuing to fire automatically until the magazine is emptied or until the finger piece of the trigger is released. Firing may be discontinued at any time by releasing the trigger, in which case the trigger spring 327 moves the manual sear 325 into the path of movement of the hammer spring plunger 322 to prevent engagement of the hammer with the firing pin. The firearm may be fired at any time by pulling the trigger to move the sear 325 out of the cylinder 321 and will continue to fire until the trigger is released.

The firearm A^9 is particularly advantageous for firing short cartridges since the arm may be designed so that the latches 307 are not released from the barrel lugs 304 until the cartridge is substantially fully chambered or within about one-twentieth of an inch or so of complete chambering. Where the cartridge is fully chambered before the barrel rises from its loading to its firing position, the firearm will function even with the shortest cartridges.

Since the magazine 312 is spaced a substantial distance from the axis of the firing pin there is ample room in the

bolt 290 to mount the firing pin and other elements. As herein shown, the bolt 290 is massive, but it will be understood that the bolt may be lightened if desired by removing excess metal, reducing the diameter of the bolt, or in any other suitable manner.

It will be noted that mounting of the barrel for transverse swinging movements as in the firearm A^9 and the other firearms described above practically eliminates "double feeding." If the recoil is adequate the gun functions in the normal manner, but if the recoil is inadequate so that the barrel is not moved transversely to its loading position, the new round will simply be pushed against the rear face of the barrel block (if its base is engaged by the feed rib of the bolt). Manual retraction of the breech bolt then clears the entire jam without additional adjustment, removal of a partly-loaded round or any of the other difficulties often encountered in conventional arms.

If desired, the hammer mechanism of Figs. 35 to 39 may be replaced by a striker-type firing mechanism or a simple and inexpensive fixed firing pin arrangement, for example as shown for convenience in the firearms A^3 to A^8. However, conventional hammer-type and striker-type firing mechanisms have several advantages over fixed firing pin arrangements and may be employed advantageously in any of the firearms A to A^9.

While single-row box magazines have been illustrated for convenience with most of the above-described firearms, it will be understood that double-staggered-row box magazines and many other different types of cartridge storing and feeding devices may also be employed in the firearms of the present invention.

It will be understood that, in accordance with the provisions of the patent statutes, variations and modifications of the specific devices disclosed herein may be made without departing from the spirit of the invention.

Having described my invention, I claim:

1. A firearm having a frame, a longitudinally extending barrel mounted for movement transversely relative to said frame, a breech closure member mounted in said frame and held against movement transversely relative to said frame, said barrel and said closure member being mounted for relative movement longitudinally toward and away from each other and moving away from each other after firing of a cartridge in said barrel, a cam plate fixed with respect to said closure member and having a cam slot therein with inclined upper and lower marginal edge portions, a cam follower carried by said barrel and traveling relative to said slot along the length of said slot during relative longitudinal movement between said barrel and said closure member, said inclined upper marginal edge portion engaging said follower during separation of said barrel and said closure member to move the cartridge-receiving breech end portion of said barrel transversely from a firing position to a loading position and said inclined lower marginal edge portion engaging said follower as said barrel and said closure member approach each other to move said breech end portion transversely from said loading position to said firing position, and means for feeding a cartridge to the breech portion of said barrel while said breech portion is in said loading position and for removing the empty cartridge case from said barrel after firing and while said breech portion is in said firing position.

2. A firearm having a pair of parallel side plates and a barrel carried by said side plates between said plates, means for holding said plates in spaced parallel relation comprising upper and lower externally cylindrical rods carried by said plates and rollers mounted on said rods between said plates having circumferential grooves near opposite sides of the firearm located substantially along laterally spaced longitudinal planes parallel to said side plates, a pair of inner plates mounted in the grooves of said rollers for longitudinal reciprocation relative to said barrel along said planes and held in parallel spaced relation by said rollers, a breech bolt carried by said inner plates for movement therewith relative to said barrel, and yieldable means including a driving spring for biasing said bolt toward said barrel.

3. A firearm as defined in claim 2 wherein a trigger is mounted for swinging movement on a rod carried by the side plates below said inner plates and wherein rollers are mounted on said rod between said side plates on opposite sides of said trigger for engaging and rotatably supporting said inner plates, said trigger having portions movable into and out of the path of movement of said inner plates which catch on said inner plates to hold said plates and the bolt carried thereby in a retracted position, said inner plates being released by pulling the trigger to allow forward movement of the bolt by said driving spring toward said barrel.

4. A firearm having a barrel and a breech bolt mounted for relative movement, a pair of outer side plates connected to said barrel, a pair of inner side plates connected to said bolt, a series of spaced rollers carried by said outer side plates and engaging upper and lower surfaces of said inner plates to support said inner plates relative to said outer side plates and to prevent lateral or swinging movement of said inner plates relative to said outer side plates, said rollers forming the sole support for said inner plates, and cam means responsive to relative longitudinal movement of said inner and outer plates for causing relative lateral movement between said bolt and said barrel.

5. A firearm having spaced parallel side plates of the same size and shape, a series of spaced parallel connecting bolts extending laterally through said plates, spacing sleeves mounted on said connecting bolts between said plates and engaging said plates, anti-friction rollers mounted on said sleeves for rotation about the axes of said bolts, a pair of spaced cam plates between said side plates having parallel top and bottom surfaces engaging said rollers and mounted on said rollers for reciprocating movements parallel to said side plates, said rollers having grooves which receive said cam plates to hold said plates parallel to said side plates, a transversely movable barrel having trunnions near its forward end journaled in said side plates at the forward end thereof, a breech bolt mounted between said cam plates for movement in unison therewith and having a retractable firing pin therein, a cam slot in one of said cam plates and a cam follower mounted on said barrel near the rear end thereof and positioned in said slot so as to move the breech end of the barrel transversely in response to reciprocation of said breech bolt and said cam plates, a bolt handle detachably connected to said breech bolt and projecting through a horizontal slot in one of said side plates, and means for biasing said breech bolt towards said barrel including a driving spring rod having a lug at its forward end projecting through a horizontal slot in the other of said side plates and engaging one of said cam plates and a compressible driving spring carried by said rod.

6. A firearm having a frame, a barrel mounted on said frame and having a longitudinal bore and a cartridge-receiving chamber communicating with said bore, said barrel being mounted for movement relative to said frame to shift said chamber transversely from a firing position to a loading position, means for preventing longitudinal movement of said barrel relative to said frame, a breech bolt mounted rearwardly of said chamber for movement longitudinally relative to said frame toward and away from said barrel, means including an energy-storing spring for moving said breech bolt longitudinally toward and away from said barrel, a magazine carried by said frame and having a series of cartridges therein each of a size to fit in said chamber, said magazine having inturned lips at its upper end limiting upward movement of a cartridge out of the magazine and for locating the front portion of a cartridge in a discharge position substantially in aline-

ment with the loading position of said chamber and having means for yieldably pressing said cartridges upwardly toward said discharge position and for holding the uppermost cartridge against said lips, means including interengaging members carried by said barrel and said bolt and responsive to longitudinal movement of said bolt relative to said barrel for moving said chamber transversely between said loading and firing positions so that said chamber is in said firing position just before firing and is in said loading position during forward movement of said bolt, and a feed member carried at the bottom of said bolt which passes between said magazine lips and engages the base of a cartridge in said discharge position during forward movement of said bolt to feed said cartridge forwardly into said chamber while the chamber is in said loading position, said feed member moving said cartridge out of engagement with said magazine lips before said chamber is moved toward said firing position, said cartridge being carried transversely by said chamber to a position to be fired.

7. A firearm having a barrel with a longitudinal bore through which travels a projectile fired from a cartridge, means forming at least one cartridge-receiving chamber of a size to receive said cartridge, a breech bolt mounted for movement longitudinally relative to said barrel, a firing member carried by said breech bolt, means including a magazine supporting a cartridge in a predetermined discharge position for feeding to said chamber, means for moving said chamber transversely a distance at least about equal to the diameter of said chamber from a firing position wherein said chamber is substantially in longitudinal alignment with said firing member and said bore to a predetermined loading position substantially in longitudinal alinement with the front portion of a cartridge in said discharge position after ignition of a cartridge and extraction of the empty cartridge case thereof, means for feeding said cartridge into said chamber while the chamber is in said loading position in response to relative longitudinal movement between said bolt and said barrel, and means for moving said chamber and the cartridge therein transversely from said loading position to said firing position before ignition of another cartridge.

8. A firearm having a barrel and a breech bolt mounted for relative longitudinal movement, a frame comprising a pair of outer side plates connected to said barrel, a pair of inner side plates rigidly connected to said bolt, a series of spaced guide members carried by said frame and having means engaging upper and lower surfaces of said inner plates to support said inner plates relative to said outer side plates and to prevent lateral or swinging movement of said inner plates relative to said frame, and cam means responsive to relative longitudinal movement of said inner and outer plates for causing relative transverse movement between said bolt and said barrel.

9. A firearm having a pair of parallel side plates and a barrel carried by said side plates between said plates, means for holding said plates in spaced parallel relation comprising upper and lower guide members having grooves near opposite sides of the firearm located substantially along parallel spaced longitudinal planes parallel to said side plates, said guide members comprising rollers mounted for rotation about axes substantially perpendicular to said plates, a pair of inner plates mounted in the grooves of said guide members for longitudinal reciprocation relative to said barrel along said planes and held in parallel spaced relation by the side walls of said grooves, a breech bolt carried by said inner plates for movement therewith relative to said barrel, and yieldable means for biasing said inner plates forwardly.

10. A firearm having a frame, a longitudinally extending barrel mounted on said frame and having a cartridge-receiving member forming a chamber at the rear of said barrel for receiving cartridges to be fired in the barrel, means forming a breech closure member at the rear of said chamber, said members being mounted for longitudinal and transverse movement relative to each other, means for holding one of said members at all times against movement longitudinally relative to the frame, means responsive to the energy of the propellant gases produced in the barrel after firing of a cartridge for causing relative longitudinal separating movement between said members and for extracting the empty cartridge case from said chamber, means responsive to said relative longitudinal separating movement for moving said first-named member transversely a distance at least about equal to the diameter of said chamber from a firing position to a loading position only after said extracting is completed, means for holding said first-named member in said firing position throughout said extracting, means for presenting the next cartridge between said members for feeding to said chamber each time such separating movement occurs, means for causing relative longitudinal closing movement between said members and for causing the major portion of the next cartridge to enter said chamber while said first-named member is held in said loading position, means for moving said first-named member transversely from said loading position to said firing position during said relative longitudinal closing movement only after the major portion of the cartridge has entered the chamber and before the cartridge is fully chambered, and means for causing ignition after the cartridge is fully chambered and while said first-named member is in said firing position.

11. A firearm having a frame including a receiver, a barrel mounted on said frame and having a longitudinal bore through which travels a projectile fired from a cartridge, means forming a cartridge-receiving chamber at the rear end of the barrel to receive each cartridge to be fired, means for closing said chamber comprising a breech bolt at the rear of said chamber mounted in said receiver for movement longitudinally toward and away from said barrel, means for igniting the propellant of each cartridge comprising a firing member carried by said breech bolt, said chamber supporting a cartridge in a firing position in alignment with said firing member and said bore at the instant of ignition, means for extracting the empty cartridge case during rearward movement of the bolt after ignition and for holding said chamber in said firing position until extraction is completed, means for thereafter moving said chamber transversely from said firing position to a loading position, means for supporting a cartridge in a discharge position substantially in alignment with said chamber when the chamber is in said loading position, means for feeding a cartridge from said discharge position to a position within said chamber while the chamber is in said loading position, and means for moving said chamber transversely from said loading position toward said firing position before the bolt closes the opening at the rear of said chamber and after the major portion of said cartridge has entered the chamber so that the cartridge moves transversely in unison with the chamber, said last-named means causing the cartridge to be substantially completely chambered before the primer of the cartridge moves into longitudinal alignment with said firing member whereby the danger of premature firing is reduced.

12. A firearm having a frame including a receiver, a longitudinally extending barrel mounted on said frame and having a longitudinal bore through which travels a projectile fired from a cartridge, means forming a cartridge-receiving chamber at the rear end of the barrel to receive each cartridge to be fired, a breech bolt mounted in said receiver at the rear of said barrel chamber for movement longitudinally toward and away from said barrel, means responsive to the energy of the propellant gases produced in the barrel after firing of a cartridge for retracting said bolt rearwardly away from said barrel

and for extracting the empty cartridge case from said chamber, means for supplying a new cartridge to a predetermined discharge position between said bolt and said chamber for feeding to said chamber each time said bolt is retracted, yieldable means acting on said bolt for moving said bolt forwardly toward said barrel, means for moving said chamber transversely a distance at least about equal to the diameter of said chamber from a firing position in alignment with said bolt to a loading position substantially in alignment with a cartridge in said discharge position, said chamber arriving at said loading position after extraction of the empty cartridge case and during rearward movement of the bolt, means responsive to the longitudinal movement of the bolt for feeding a cartridge to said chamber while the chamber is in said loading position, means for moving said chamber transversely from said loading position to said firing position simultaneously with longitudinal movement of said bolt relative to said barrel and after the cartridge has entered said chamber a substantial distance so that said cartridge is moved transversely with said chamber to said firing position, and means for igniting the propellant of the cartridge in said firing position after the cartridge is fully chambered.

13. A firearm comprising a longitudinally extending barrel having a cartridge-receiving member forming a chamber at the rear of the barrel for receiving cartridges and having a longitudinal bore extending from said chamber to the front end of the barrel, means forming a breech closure member at the rear of said chamber, said members being mounted for longitudinal and transverse movement relative to each other, means for holding one of said members against longitudinal movement, cartridge-holding means for supporting a cartridge in a discharge position for feeding to said chamber, means responsive to relative longitudinal movement between said members for moving said cartridge-receiving member transversely to shift said chamber a distance at least about equal to the diameter of said chamber between a firing position and a loading position substantially in alignment with a cartridge in said discharge position, means for causing a cartridge in said discharge position to enter said chamber in response to relative longitudinal movement of said members while said chamber is substantially in alignment with a cartridge in said discharge position, and means for igniting the propellant of the cartridge in said chamber after the cartridge is fully chambered and while said chamber is in said firing position.

14. A firearm as defined in claim 13 wherein said cartridge-receiving member forms the rear portion of said barrel, said barrel is mounted for transverse movement and for reciprocation longitudinally toward and away from said breech closure member, and said cartridge-holding means has belt means for holding the cartridges in regularly spaced parallel relation, said chamber moving forwardly away from the empty cartridge case after ignition and transversely into alignment with the next adjacent cartridge and moving rearwardly to receive said next cartridge and transversely to index said belt means, whereby the cartridges carried by said belt means are automatically advanced due to the transverse movement of the barrel.

15. A firearm as defined in claim 13 wherein the means for moving said chamber transversely from said firing position to said loading position causes such movement positively in response to longitudinal relative movement between said barrel and said breech closure member and the means for moving said chamber transversely from said loading position to said firing position comprises spring means biasing said chamber in a direction toward said firing position.

16. A firearm as defined in claim 13 wherein said breech closure member is a reciprocable breech bolt and the means for feeding a cartridge to said chamber comprises rammer means extending forwardly of the bolt to feed the cartridge into the chamber before the bolt closes said chamber.

17. A blowback firearm having a frame including a receiver and a forwardly extending barrel member held against longitudinal movement relative to said receiver, said barrel having a longitudinal bore through which travels a projectile fired from a cartridge in said barrel, means for preventing at all times longitudinal movement of the barrel relative to said frame, a breech bolt member mounted for longitudinal movement forwardly and rearwardly in said receiver, a magazine in said receiver having a series of cartridges therein and spring means biasing said cartridges towards a discharge position in the magazine, said bolt member having a portion that engages the base of one cartridge in said discharge position during forward movement of said bolt member to feed said one cartridge into a chamber at the breech end of the barrel, a recess in the front of said bolt member for receiving the base of a cartridge, a firing pin mounted in a fixed position on said bolt and having a primer-engaging nose projecting forwardly beyond the bottom of the bolt recess throughout the movement of said bolt member, means for extracting and ejecting the empty cartridge case from said chamber after firing and during rearward movement of the bolt member, said barrel member being mounted for movement in said receiver to shift the relative transverse position of said firing pin and said chamber, means responsive to longitudinal movement of said bolt for moving a portion of said barrel member transversely so that said firing pin is out of alignment with the primer of the cartridge being fed to the barrel until that cartridge is substantially in said chamber, and means for moving said portion of said barrel member transversely after the cartridge enters the chamber of the barrel and before the firing pin engages the cartridge so that the firing pin is in alignment with the primer of the cartridge in said chamber, said last-named means including a cam follower mounted on said barrel member and a cam track fixed with respect to said bolt.

18. In a firearm having a barrel and a breech closure member mounted for relative longitudinal movement relative to each other, a firing pin mounted in said breech closure member for movement from a forward fixed firing position wherein the forward end of said pin projects beyond the cartridge-base-engaging face of the breech closure member to a rearward fixed non-firing retracted position, a safety spindle mounted for movement from a fixed fire position to a safe position and engaging said firing pin to limit rearward movement thereof and to move said firing pin from its retracted to its firing position, said safety spindle when in its fire position having means preventing movement of said firing pin rearwardly out of its firing position and when in its safe position permitting movement of said firing pin rearwardly to its retracted position so that such firing pin cannot contact a cartridge to cause ignition thereof during relative longitudinal movement of the breech closure member and the barrel, and means for retaining the spindle in said fixed fire position throughout a complete cycle of operation of the firearm and for retaining the spindle in said safe position throughout a complete cycle of operation of the firearm.

19. In a firearm having a barrel and a bolt mounted for relative longitudinal movement relative to each other, a firing pin mounted in said bolt for movement from a forward firing position wherein the forward end of said pin projects beyond the cartridge-base-engaging face of the bolt to a rearward non-firing position, a safety spindle mounted for movement from a fire position to a safe position and engaging said firing pin to limit rearward movement thereof and to move said firing pin from its retracted to its firing position, said safety spindle when in its fire position having means preventing rearward move-

ment of said firing pin out of its firing position and when in its safe position permitting rearward movement of said firing pin to its retracted position, yieldable means for biasing said firing pin from its forward firing position rearwardly toward its retracted position to hold said pin in engagement with said safety spindle, means for holding the safety spindle in said fire position throughout a complete cycle of operation of the firearm, and rotatable means including a bolt handle detachably connected to said spindle to move the spindle from said safe to said fire position.

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