Sept. 1, 1964 F. P. REED 3,146,673

MEANS FOR INDEXING MULTIPROJECTILE CARTRIDGES INTO FIRING ALIGNMENT IN A MULTIBORE GUN

Filed July 18, 1963 3 Sheets-Sheet 1

Fig. 1

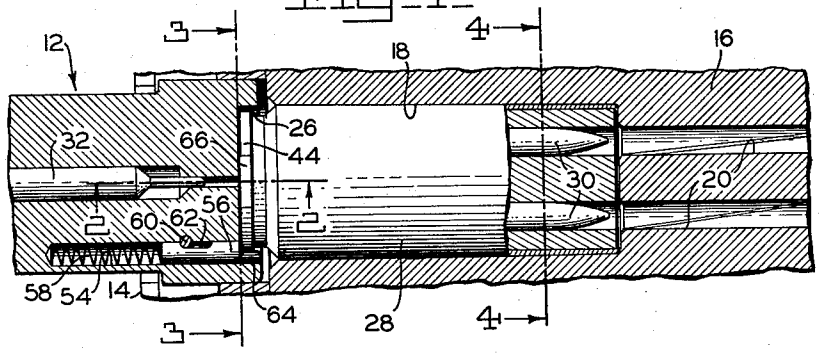


Fig. 2

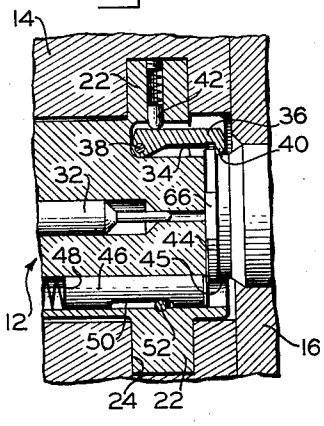


Fig. 3

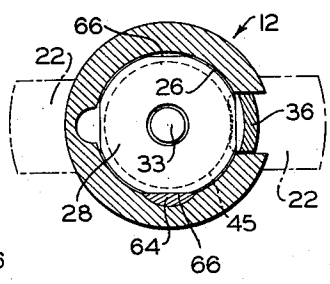


Fig. 4

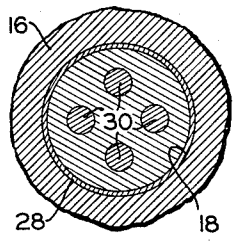


Fig. 5

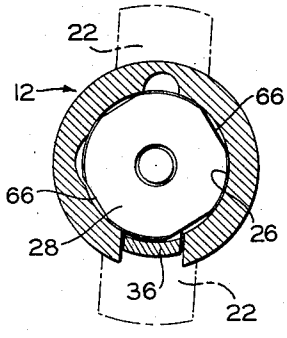


Fig. 6

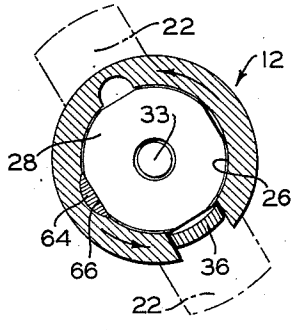


Fig. 7

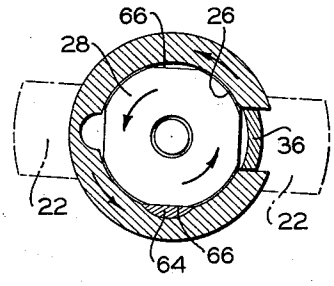
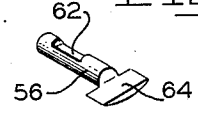


Fig. 8



INVENTOR.
Frederick P. Reed

BY
Harry M. Saragovitz,
Edward J. Kelly,
Herbert J. Bell, Jr.
Albert E. Arnold

Sept. 1, 1964 F. P. REED 3,146,673

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Filed July 18, 1963 3 Sheets-Sheet 2

Fig. 9

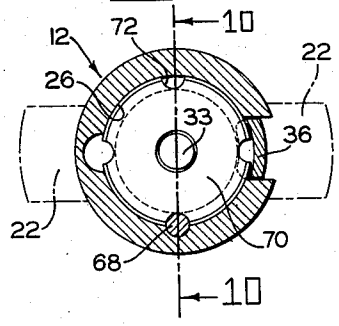


Fig. 10

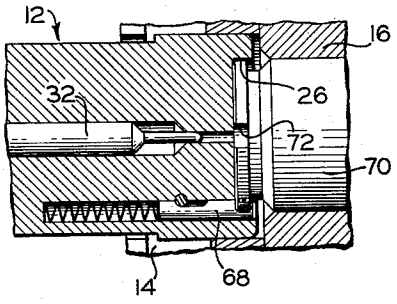


Fig. 11

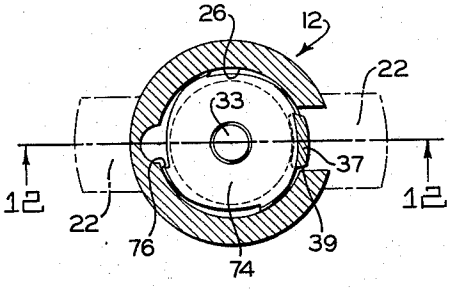


Fig. 12

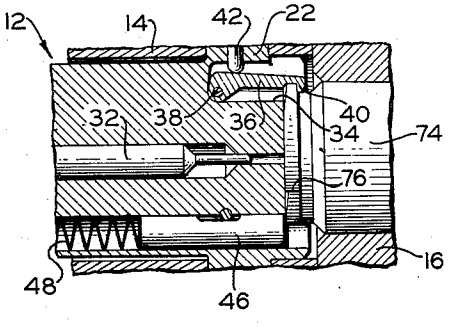


Fig. 13

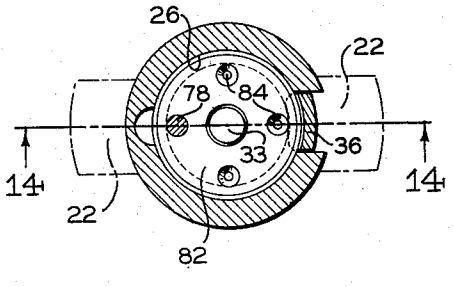
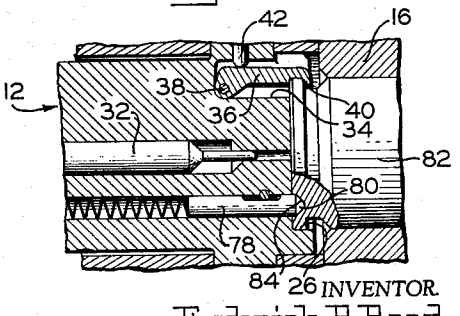


Fig. 14



INVENTOR.
Frederick P. Reed

BY
Harry M. Saragovitz, Herbert Berl
Edward J. Kelly,
& Albert E. Arnold Jr.

Sept. 1, 1964 F. P. REED 3,146,673

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Filed July 18, 1963 3 Sheets-Sheet 3

Fig. 15

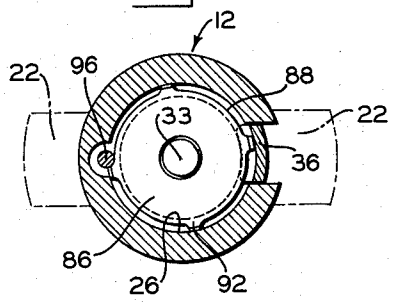


Fig. 16

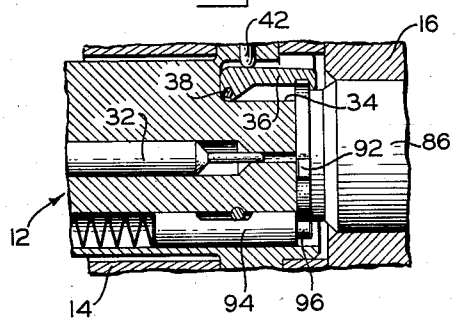


Fig. 17

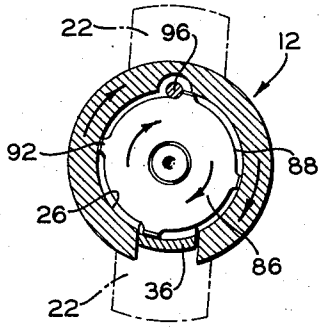


Fig. 18

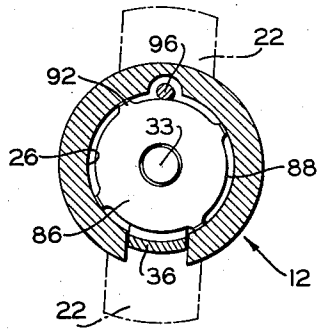


Fig. 19

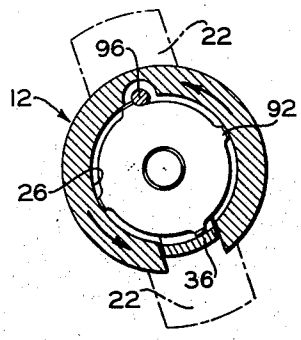
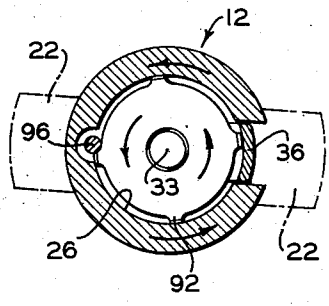


Fig. 20



INVENTOR.

Frederick P. Reed

BY

Harry M. Saragovitz, Edward J. Kelly, Herbert Berl & Albert E. Arnold Jr.

United States Patent Office

3,146,673

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3,146,673

MEANS FOR INDEXING MULTIPROJECTILE CARTRIDGES INTO FIRING ALIGNMENT IN A MULTIBORE GUN

Frederick P. Reed, Ludlow, Mass., assignor to the United States of America as represented by the Secretary of the Army

Filed July 18, 1963, Ser. No. 296,137
7 Claims. (Cl. 89—126)
(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to firearms adapted to fire multiprojectile ammunition through an equivalent number of barrel bores and is more particularly directed to means for indexing each cartridge, during movement into firing position, to align each projectile therein with the corresponding barrel bore.

Extensive experimentation with current military firearms indicates that an increase in firepower does not necessarily improve the probability of hitting a relatively distant moving target. For example, when the increased firepower is produced by full automatic operation of the firearm, the recoil forces encountered during each burst of fire normally interfere with the aim of the average operator to such an extent that hit probability is actually reduced despite the greater quantity of projectiles fired at the target area. It is, therefore, apparent that the effectiveness of a military firearm is dependent on the accuracy of fire as well as the quantity thereof.

Accordingly, it has been proposed that cartridges of conventional cylindrical configuration be provided with a plurality of equispaced projectiles radially disposed about the central axis of the cartridge and adapted to be simultaneously fired through a corresponding number of similarly oriented barrels or bores within a single barrel. This combination of ammunition and firearm structure renders it possible to increase the number of projectiles which can be fired at a given target area within a specific period of time without the accompanying loss in accuracy normally incurred in full automatic operation of the firearm.

However, while the advantages of this type of multiprojectile ammunition have long been recognized in the firearm art, the difficulties involved in indexing the projectiles into axial alignment with the barrel bores during the feeding or chambering of the cartridge have heretofore limited the utilization of these concepts to firearms in which the ammunition is hand loaded into the firing chamber.

Accordingly, it is an important object of this invention to provide a multibored firearm with means for automatically indexing multiprojectile cartridges to bring each projectile into axial alignment with a corresponding bore during movement into firing position.

It is a further object of this invention to incorporate the aforesaid indexing means in a longitudinally reciprocating bolt provided with a conventional extractor and ejector and adapted to be helically rotated into locked battery position.

Another object of the present invention is to provide cartridge indexing means as aforesaid wherein the cartridge is automatically rotated to the required angular position during the locking of the bolt in battery position regardless of the original orientation thereof in the firing chamber in the barrel.

A more specific object of this invention is to incorporate the aforesaid indexing means as a part of the conventional firearm mechanism utilized to replace the fired case with a live cartridge.

Since the indexing means of this invention operates by

imparting a portion of the locking and unlocking rotation of the bolt to the cartridge case, it is necessary to delay the rotation of the fired case until the gas pressure on the walls thereof has been sufficiently reduced to permit the required rotation in the firing chamber. Ordinarily, this is satisfactorily accomplished during the period in which the bolt is locked to the barrel since the duration of this locking period is in direct proportion to the pressures produced by the firing of the ammunition. However, in view of the critical timing involved in the unlocking of the bolt, especially with modern high pressure ammunition, the frictional engagement which may exist between the fired case and the walls of the firing chamber at the moment the bolt begins to unlock may be of such magnitude as to prevent the desired rotation of the fired case.

It is, therefore, a further object of the present invention to provide indexing means as aforesaid which will not begin to rotate the fired cartridge case until the bolt is in the final portion of the unlocking rotation thereof.

The present invention essentially comprises a spring-biased plunger longitudinally mounted in the forward end of a reciprocating bolt having opposed locking lugs adapted to be helically rotated into mating recesses in the breech end of a multibored barrel. The front end of the plunger normally projects from the face of the bolt to engage in one of a plurality of radially disposed recesses formed in the base of a multiprojectile cartridge. Since this engagement takes place during the locking rotation of the bolt, the cartridge is correspondingly rotated thereby to position each projectile in coaxial alignment with one of the bores in the barrel regardless of the original orientation of the cartridge upon entry into the firing chamber in the breech end of the barrel. The plunger-receiving recesses in the base of the cartridge may be formed by a plurality of symmetrically spaced peripheral flats or notches which cooperate with the walls of the cartridge seating recess in the front end of the bolt. Alternately, these recesses may consist of openings located entirely within the peripheral boundary of the cartridge case rim. In either event, the recesses are spaced apart in correspondence with the radial positions of the projectiles in the cartridge case.

Instead of a separate spring-biased plunger, the necessary rotation of each chambered cartridge may be imparted thereto by the conventional ejector plunger and the required ejection function thereof retained by the provision of a stepped surface therein engageable with the base of the cartridge during the withdrawal thereof from the firing chamber. If desired, the projectiles in the cartridge may be rotated into corresponding alignment with the bores of the barrel during the locking of the bolt in battery by the engagement between the side of the conventional extractor claw and one of an equivalent number of teeth formed by helical cuts consecutively spaced along the rim of the cartridge case in correspondence with the projectiles therein.

In the event the residual pressure within the interior of a fired cartridge case is sufficiently high to interfere with the rotation imparted thereto by the unlocking movement of the bolt, such rotation may be delayed by the expedient of elongating the recesses provided in the base of the cartridge for the entry of the front end of the indexing plunger.

Other objects and advantages of the invention will be apparent from the following specification and the accompanying drawings which are for the purpose of illustration only and in which:

FIG. 1 is a vertical section of the breech portion of a firearm in which a longitudinally reciprocating bolt, shown in fully locked battery position, is provided with means for indexing a multi-projectile cartridge into firing alignment with a multibore barrel;

FIG. 2 is a horizontal section taken along line 2—2 in FIG. 1 to show the relative positions of the extractor and ejector assemblies in the forward end of the bolt;

FIG. 3 is a transverse section taken along line 3—3 in FIG. 1 to show the engagement between the indexing plunger and one of the indexing recesses in the base of the cartridge, the locking lugs on the bolt being shown in phantom to indicate the angular orientation thereof in locked battery position;

FIG. 4 is a transverse section taken along line 4—4 in FIG. 1 to show the position of the projectiles upon completion of the indexing movement of the cartridge;

FIG. 5 is a section comparable to that of FIG. 3 but showing the bolt at the start of the locking rotation thereof prior to the entry of the indexing plunger into one of the indexing recesses in the base of the cartridge;

FIG. 6 is a section similar to FIG. 5 but showing the bolt rotated to the position in which the indexing plunger has entered into an indexing recess and is beginning to impart corresponding rotation to the cartridge;

FIG. 7 is a section similar to FIGS. 5 and 6 but showing the relative positions of the cartridge and the bolt immediately prior to the completion of the locking rotation of the latter;

FIG. 8 is a perspective view of the cartridge indexing plunger shown in FIGS. 1–7;

FIG. 9 is a transverse section comparable to that of FIG. 3 but showing an alternate arrangement for the required engagement between the indexing plunger and the base of the cartridge;

FIG. 10 is a section taken along line 10—10 in FIG. 9 to show the simplified configuration of the indexing plunger;

FIG. 11 is a section comparable to that of FIG. 9 but showing an arrangement whereby the extractor is utilized to impart the required indexing rotation to the cartridge and thereby eliminate the need for a separate plunger;

FIG. 12 is a section taken along line 12—12 in FIG. 11 to show the configuration of the cartridge case rim required to permit indexing by the extractor;

FIG. 13 is a section taken similarly to FIGS. 9 and 11 but showing an arrangement wherein the indexing plunger also serves to eject the fired cartridge cases from the firearm;

FIG. 14 is a section taken along line 14—14 in FIG. 13 with the rear end of the cartridge case being partially broken away to show the combined indexing plunger-ejector in indexing engagement therewith;

FIG. 15 is a section taken similarly to that of FIG. 13 but showing an arrangement designed to delay the initiation of the rotation imparted to the fired cartridge case during the unlocking of the bolt;

FIG. 16 is a section taken along line 16—16 in FIG. 15 to show the configuration of the front end of the indexing plunger;

FIG. 17 is another section similar to FIG. 15 but showing the angular position of the bolt at the conclusion of unlocking rotation;

FIG. 18 is another section showing the bolt in the unlocked position thereof prior to being rotated into indexing engagement with a randomly oriented cartridge;

FIG. 19 is another section showing the bolt in the angular position assumed at the instant the indexing plunger begins to impart corresponding rotation to the cartridge; and

FIG. 20 is a section showing the continuation of the bolt movement in FIG. 19 at a point immediately prior to the attainment of fully locked battery position.

As illustrated in the drawings, the present invention is applicable to those firearms in which a bolt 12 reciprocates longitudinally within a receiver 14 and is adapted to be rotated by suitable cam means (not shown), into and out of battery engagement with a barrel 16 having a single firing chamber 18 opening into a plurality of equally spaced bores 20 radially disposed about a central

axis. The locking of bolt 12 in battery position is preferably accomplished by the entry of opposed lugs 22 thereon into mating recesses 24 in receiver 14 and is concluded when such lugs reach a fully horizontal position as shown in FIG. 3.

The front end of bolt 12 is centrally recessed, as shown at 26, to provide a circular seat for the base of a cartridge 28 containing a plurality of projectiles 30 equivalent to bores 20 in number and arrangement. A percussion type firing pin 32 is centrally mounted in bolt 12 for firing movement against a conventional primer 33 in cartridge 28. Although the present invention is here described in terms of four bores 20, it should be understood that the number thereof may be more or less and is only limited by the practical considerations involved in establishing the size of the firearm and the ammunition therefor.

A rectangular opening 34 is longitudinally formed into the exterior of bolt 12 in communication with circular recess 26 to receive an extractor 36 pivoted at 38. The free end of extractor 36 is provided with a claw 40 which is normally urged inwardly by a spring-biased plunger 42 vertically mounted in one of locking lugs 22 on bolt 12. Thus, during movement of bolt 12 into battery position, claw 40 will ride over the rim 44 on cartridge 28 to engage in the annular extractor groove 45, as shown in FIG. 2, for extraction during the recoil movement imparted to bolt 12 upon firing.

An ejector 46 is slidably disposed in the front end of bolt 12 along an axis which intersects the periphery of recess 26 at a point diametrically opposite extractor 36. A spring 48 is seated against the rear end of ejector 46 and normally urges the front end thereof into contact with the base of cartridge 28. In addition, ejector 46 is exteriorly grooved, as indicated at 50, for the passage of a transverse pin 52 suitably fixed in bolt 12 which thereby limits the travel of ejector 46 in either direction. Thus, as the fired case is completely withdrawn from firing chamber 18, it is pivoted about the point of engagement thereof with extractor claw 40 and out of a suitable exit (not shown) in the side of receiver 14.

At a point substantially midway of extractor 36 and ejector 46, the front end of bolt 12 is provided with a longitudinal hole 54 which intersects the periphery of circular recess 26 in substantially the same manner as the hole for ejector 46. A cylindrical indexing plunger 56 is slidably seated in hole 54 against a longitudinal spring 58 and is normally biased forwardly into contact with the base of cartridge 28. The engagement between a transverse pin 60 fixed in bolt 12 and the end walls of a groove 62 in indexing plunger 56 limits the longitudinal movement thereof in either direction in substantially the same manner as ejector 46. The forward end of plunger 56 is stepped and laterally extended to form an arcuate segment as best illustrated at 64 in FIG. 8.

A plurality of chordal flats 66 are formed about the periphery of rim 44 on cartridge 28 and are equally spaced to correspond with the spacing of the projectiles 30 therein. The distance between each flat 66 and the periphery of cartridge rim 44 is specifically designed to provide an entry for segment 64 on the front end of plunger 56.

Cartridge 28 may be fed into chambering alignment with bolt 12 either in belted arrangement or from a suitable magazine attached to the firearm. In either case, bolt 12 pushes each cartridge 28 forwardly into firing chamber 18 so that, upon completion of chambering, ejector 46 and plunger 56 will be forced into the face of bolt 12 during the locking rotation thereof. Once cartridge 28 is chambered, extractor claw 40 will ride over rim 44 of cartridge 28 and into annular groove 45 for rotatable engagement therewith as best shown in FIG. 2.

However, as bolt 12 is being rotated into the locked position thereof, the stepped surface of segment 64 at the forward end of plunger 56 will move into alignment with

the nearest flat 66 and thence be biased forwardly by spring 58 into the recess formed between flat 66 and the wall of cartridge recess 26 in bolt 12. Thereupon, the continued rotation of bolt 12 will be correspondingly imparted to cartridge 28 as shown in FIGS. 6 and 7. The angular rotation of bolt 12 into locked battery position is, of course, slightly greater than the angle between flats 66 in order to insure engagement with plunger 56 regardless of the random position assumed by cartridge 28 in the fully chambered position. Since locking lugs 22 always terminate in the same horizontal position at the conclusion of locking, each cartridge 28 will be indexed with each projectile 30 therein in axial alignment with the corresponding bore 20 in barrel 16. During the unlocking movement of bolt 12 imparted thereto by the firing of the properly indexed cartridge 28, the latter will be loosened in firing chamber 18 for withdrawal therefrom by extractor 36 without any interference by plunger 56.

As can be seen in FIGS. 9 and 10, the configuration of the front end of the indexing plunger and the rim of the cartridge need not be limited to that shown in FIGS. 1–8. For example, the indexing plunger may be formed as a cylindrical rod 68 without any stepped portion at the front end thereof. In order to utilize this arrangement, cartridge, here indicated by numeral 70, is provided with substantially semicircular notches 72 spaced about rim 44 in radial correspondence with projectiles 30 therein. Operation of this indexing plunger 68 is the same as that described in connection with the plunger of FIGS. 1–8.

As shown in FIGS. 11 and 12, it is also possible to eliminate the need for a separate indexing plunger. This may be accomplished by forming the rim of the cartridge, here indicated by numeral 74, with a consecutive series of ratchet-type teeth 76 spaced to correspond with projectiles 30 therein. As a result, the side of cartridge claw, here numbered 37, may be utilized to engage the nearest tooth 76 and impart the continuing rotation of bolt 12 thereto in the same manner as indexing plunger 56 in FIGS. 1–8. Since the maximum depth of the helical surface forming each tooth 76 is less than the height of extractor claw 37, the latter will engage the rim of cartridge 74 regardless of the particular orientation thereof upon entry into firing chamber 18. In order to provide optimum contact with teeth 76, the sides of extractor claw 37 are beveled as best shown at 39 in FIG. 11. The diameter of ejector 46 is, of course, greater than the height of teeth 76 to insure contact with the base of cartridge 74 regardless of the orientation thereof.

In certain cases, it may be preferable to provide the indexing rotation of the cartridge by means of the ejector rather than the extractor. This may be accomplished, as shown in FIGS. 13–14, by forming the ejector, here numbered as 78, with a beveled front end 80. In addition, the base of cartridge, here identified by 82, is provided with a plurality of indentations 84 shaped to receive the beveled front end of ejector 78. The depth of each indentation 84 is slightly greater than the beveled portion of plunger end 80 to insure positive engagement therebetween during the rotation of cartridge 82. Indentations 84 are spaced about a circle of lesser diameter than the rim of cartridge 82 and are disposed in corresponding alignment with projectiles 30 therein. Thus, ejector 78 may be utilized to index cartridge 82 during the locking rotation of bolt 12 and due to the shallow depth of indentations 84 will still be compressed sufficiently to impart the required ejection movement to a fired case upon the complete withdrawal thereof from firing chamber 18.

While little or no difficulty has been experienced in rotating the fired cartridge case immediately upon the initiation of the unlocking movement of the bolt, the variations normally encountered in high pressure ammunition render it advisable to introduce a predetermined delay in the rotation imparted to the cartridge during the unlocking of the bolt. As shown in FIG. 15, this may be accomplished by reducing the diameter of the cartridge, here numbered 86, at a plurality of locations 88, to provide a corresponding number of ribs 92 spaced in radial correspondence with projectiles 30. In addition, the front end of the spring-biased ejector, here indicated by 94, is provided with a forwardly projecting stud 96 whose length is substantially equal to that of ribs 92. The sides of ribs 92 are arcuately contoured to mate with stud 96 as best shown in FIGS. 15 and 17.

Thus, as bolt 12 is rotated to unlock, stud 96 rides along the reduced diameter portion 88 without imparting any corresponding rotation to cartridge 86 until contact is made with rib 92. By this time, the residual pressure forcing the walls of cartridge 86 against the interior of firing chamber 18 has been appreciably reduced in comparison to that which existed at the beginning of the unlocking rotation of bolt 12. As a result, cartridge 86 can be readily rotated by bolt 12 during the remainder of the unlocking movement thereof to the position shown in FIG. 17.

This arrangement does not prevent the required rotation which must be imparted to cartridge 86 during the locking movement of bolt 12 in order to insure proper alignment between projectiles 30 and barrel bores 20. As shown in FIGS. 18–20, if cartridge 86 is oriented so that upon the conclusion of the chambering movement imparted thereto by bolt 12, stud 96 will protrude beyond reduced diameter portion 88, the subsequent contact with rib 92 during the locking rotation of bolt 12 will impart the required indexing movement to cartridge 86. In the event cartridge 86 is oriented so that stud 96 initially contacts one of ribs 92, the required engagement with the reduced diameter portion 88 will automatically take place during the locking rotation of bolt 12. The arcuate extent of the cartridge rim between ribs 92 is, of course, slightly less than the corresponding angular distance between projectiles 30 and, as best shown in FIG. 15, such ribs 92 are positioned to halt stud 96 in radial alignment with one of projectiles 30 at the conclusion of the locking rotation of bolt 12. As a result, each projectile is axially aligned with a corresponding bore 20 in barrel 16.

Thus, the present invention provides means for effecting the positive indexing of a multiprojectile cartridge into firing alignment with a multibore barrel regardless of the original orientation of the cartridge in the firing chamber. Such indexing permits the utilization of multiprojectiles in those firearms in which the ammunition is automatically fed into firing position during each cycle of operation and, consequently, increases the quantity of projectiles which may be fired at a target area within a given time without a corresponding increase in the number of operating cycles required by the firearm. Furthermore, the ability to launch a plurality of projectiles with the firing of but a single cartridge provides an appreciable reduction in the costly handling required to insure an adequate supply of ammunition at the firearm.

Although several particular embodiments have been described in detail herein, it is evident that many variations may be devised within the spirit and scope thereof and the following claims are intensed to include such variations.

I claim:

1. In an automatic firearm, a barrel having a firing chamber for receiving a cartridge containing a plurality of projectiles radially spaced about a central axis, said barrel having a plurality of bores extending forwardly from said firing chamber in correspondence to the number and arrangement of the projectiles, a longitudinally reciprocating bolt having a circular seat for the base of the cartridge and adapted to be rotated into and out of locked battery position, and indexing plunger slidably disposed in the front end of said bolt, and spring means normally biasing said plunger to project from said bolt, the cartridge having a plurality of recesses spaced about the rear end thereof in respective radial alignment with the projectiles therein and in position to receive the front

end of said indexing plunger during rotation of said bolt into locked battery position whereby the cartridge is rotated thereby to position the projectiles therein into firing alignment with said barrel bores at the conclusion of the locking rotation of said bolt.

2. The combination defined in claim 1 wherein said recesses are formed by chordal surfaces disposed about the rear end of the cartridge in position to cooperate with the periphery of said circular cartridge seat in said bolt when the cartridge is fully forward in said firing chamber, and wherein the front end of said indexing plunger is arcuately shaped to fit into one of said recesses upon alignment therewith during the locking rotation of said bolt.

3. The combination defined in claim 1 wherein said recesses are in the form of semicircular notches disposed about the periphery of the cartridge at the rear end thereof.

4. The combination defined in claim 1 wherein said recesses are in the form of circular indentations radially spaced in the base of the cartridge about the central axis thereof, and wherein the front end of said indexing plunger is reduced to mate with anyone of said indentations upon axial alignment therewith during the locking rotation of said bolt.

5. In an automatic firearm, a barrel having a single firing chamber and a plurality of parallel bores extending forwardly therefrom in radially spaced arrangement about a central axis, a longitudinally reciprocating bolt having a circular seat for the base of the cartridge and adapted to be rotated into and out of locked battery position, a cartridge having a rim at the rear end thereof and adapted to be chambered by the movement of said bolt into battery position, said cartridge including a plurality of projectiles radially spaced about the interior thereof to correspond with said bores in number and arrangement, an extractor pivotally mounted in the front end of said bolt, an ejector slidably disposed in said bolt diametrically opposite said extractor, an indexing plunger slidably disposed in said bolt substantially midway of said extractor and said ejector, spring means seated in said bolt for biasing said plunger to protrude forwardly therefrom, means for limiting movement of said plunger in either direction, said cartridge having a plurality of chordal surfaces about the exterior periphery of the rim equal in number and spacing to the projectiles therein, and a stepped portion at the front end of said indexing plunger shaped to fit into the space between any of said chordal surfaces and the periphery of said circular seat in the front end of said bolt upon alignment therewith during the rotation of said bolt toward lock battery position whereby said chambered cartridge is rotated therewith to position the projectiles therein into firing alignment with said barrel bores at the conclusion of the locking rotation of said bolt.

6. In an automatic firearm, a barrel having a single firing chamber and a plurality of parallel bores extending forwardly therefrom in radially spaced arrangement about a central axis, a longitudinally reciprocating bolt adapted to be rotated into and out of locked battery position, a cartridge terminating in a rim at the rear end thereof and

having an annular extractor groove forwardly of and adjacent said rim, said cartridge including a plurality of projectiles radially spaced about the central axis thereof to correspond with said barrel bores in number and arrangement, an extractor pivotally mounted in the front end of said bolt and terminating in a claw at the forward end thereof engageable with the rim on said cartridge, an ejector slidably disposed in said bolt diametrically opposite said extractor, and a plurality of helical ratchet teeth consecutively formed about the exterior periphery of the rim on said cartridge to lie in the path of said extractor claw during rotation of said bolt to the locked battery position thereof whereby said cartridge is rotated therewith to position the projectiles therein into firing alignment with said barrel bores at the conclusion of the locking rotation of said bolt, the maximum height of each ratchet tooth being less than the corresponding engagement surface on the underside of said extractor claw to insure positive extraction of said cartridge during the rearward movement of said bolt.

7. In an automatic firearm, a barrel having a single firing chamber and a plurality of parallel bores extending forwardly therefrom in radially spaced arrangement about a common axis, a longitudinally reciprocating bolt adapted to be rotated into and out of locked battery position, a cartridge having a rim at the rear end thereof and a plurality of projectiles radially spaced about the longitudinal axis thereof to correspond with said barrel bores in number and arrangement, an extractor pivotally mounted in the front end of said bolt to engage with the rim of said cartridge at the conclusion of the forward movement of said bolt, an ejector slidably disposed in said bolt diametrically opposite said extractor, spring means seated in said bolt for biasing said ejector to protrude therefrom, means for limiting movement of said ejector in either direction, and a stud projecting centrally from the front end of said ejector, said cartridge having a plurality of reduced diameter portions equally spaced about the rear end thereof to define arcuately elongated recesses when fully seated in said circular recess in the face of said bolt, said reduced diameter portions having separating ribs therebetween rotatably engageable with said extractor, said reduced diameter portions being positioned to receive said stud on said ejector during movement of said bolt into battery position whereby the subsequent locking rotation thereof is correspondingly imparted to said cartridge for aligning said projectiles therein with said barrel bores at the conclusion of the locking movement, said separating ribs being positioned, in the locked battery position of said bolt, to permit the latter to rotate through the major portion of the unlocking movement thereof prior to imparting any rotation to said cartridge upon contact between said stud and the next adjacent rib.

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