A bolt action assembly for firearms comprising a bolt slidably mounted in an action frame bore. The bolt is closed and substantially solid in cross section at its rearward end and is fitted with a removable bolt head at its forward end. The bolt rides in a ball bearing bushing suitably positioned in the action frame bore. Extractors are provided on the bolt head for gripping a cartridge rim and are opened through the force or reaction between the extractors and the cartridge rim. Enlarged diameter portions in the action frame bore permit the extractor to open to grip the cartridge rim in the chambering phase and to release the cartridge casing in the ejection phase. The internal surfaces of the bore other than at the enlarged portions normally maintain the extractors in the closed position. The bolt head has locking lugs thereon which cooperate with lugs on a recoil ring to maintain the bolt in the closed position. The recoil ring and bolt head are removable to allow substitution of another bolt head and recoil ring accommodating a cartridge of a different caliber.
BOLT ACTION ASSEMBLY

This invention relates to a bolt action assembly for a firearm. It is an object of this invention to provide a bolt action assembly for a firearm which overcomes numerous disadvantages of "conventional" bolt action assemblies.

The structural components of a bolt action assembly, i.e., the bolt and the recoil lugs must be of great strength in order to withstand the tremendous rearwardly directed pressure exerted upon firing of a cartridge.

It is desirable to form these parts of a high strength metal which is quite expensive both to obtain and to machine to proper dimensions. However, since the lugs are generally integral with the bolt frame housing and the bolt is a unitary structure, the entire housing and bolt must be formed of the high grade metal even though the major portions thereof are not subjected to the high pressure. This is quite expensive, consequently, a number of firearms are manufactured with bolts and recoil lugs of less expensive and less durable metals which not only increase the danger factor but also shorten drastically the life of the bolt action assembly.

It is an object of this invention to overcome the aforementioned disadvantages in conventional firearms by providing replaceable component parts of a very high grade of steel. It is proposed to provide a high-strength recoil ring having recoil lugs thereon, which ring is removably positioned in the action frame bore. Further, a bolt is provided having a detachable head portion which is made of a high-strength metal. By using a replaceable recoil ring and bolt head — the component parts which absorb the most force and therefore must be the strongest — the remaining parts, i.e., the main body portion of the bolt and the action frame housing, may be of less expensive materials therefore maintaining the economical practicability of the firearm while enhancing the safety and durability factors. Further, by providing a recoil ring and bolt head which may be replaced with another bolt head and recoil ring, repair in case of damage is greatly facilitated. One merely needs to remove the barrel and replace the recoil ring without machining or replacing the entire action frame and to remove the bolt and replace the bolt head without replacing the entire bolt. In most conventional firearms, the recoil lugs, which are part of the recoil ring of this invention, are integral portions of the action frame housing and the bolt is an integral one piece member.

A further and very important object of this invention is to provide a replaceable recoil ring and bolt head which may be interchanged with a recoil ring and bolt head of a different size to accommodate cartridges of different calibers. The existing recoil ring of given dimensions may be replaced with another ring either larger or smaller in a dimension affecting the head space of the firearm. Thus, the machine work necessary to adjust head space in a conventional integral design may be avoided. Bolt head and recoil ring assemblies may be offered to the consumer in kit form for use with one or more different size cartridges in a particular firearm. In this way, one firearm may fill the need wherein two or more were required previously.

It is a further object of this invention to increase the safety factor of a firearm by providing a bolt which is closed at its rearward end and substantially solid in cross section. In conventional designs, the firing pin and firing pin spring, etc. is assembled from the rear of the bolt through suitable bores therein by removing a bolt sleeve which normally is threaded in the end of the bolt. The build up of escaped gases sometimes is sufficient to "blow" the bolt sleeve causing injury to the user. By providing a removable bolt head, the firing pin, ejector mechanism, etc., may be inserted through the front of the bolt with the rearward end of the bolt being substantially solid and, therefore, safe from spontaneous disassembly due to the high pressure in the event gases are loosed as when the cartridge case bursts or the primer is pierced by the firing pin.

Further in reference to gas control, there exists an extremely close fit between the bolt body and the action frame bore of this invention. The bolt head is provided with locking lugs and extractors. Just to the rear of the bolt head at the leading portion of the bolt body is a substantially conical shoulder which acts as an obstacle to loose gases. The shoulder will deflect the gases and slow them as they attempt to travel further down the action frame bore. Positioned in the bore behind the shoulder are annular, combination rubber and steel seals which encompass the bolt periphery and work on a principle whereby the greater the pressure the tighter the seal with the bolt body. In this manner, the gases will be safely contained in front of the action until they have dissipated into the atmosphere through the cartridge ejection port. Those gases which enter the bolt body through the firing pin hole would be contained by means of a rubber seal around the firing pin until they too have been dissipated through suitable gas ports in the body.

Another object of this invention is to provide a bolt which reciprocates freely in the bolt action bore. In conventional designs the bolt is characteristically loose and sloppy when it is in the rearmost position. This condition causes the bolt to bind when it is rapidly operated or when there is substantial side pressure applied upon the closing of the bolt. This problem is overcome by this invention by means of a recirculating ball bushing which is positioned in an inset in the action bore and surrounds the bolt body. The bushing engages the bolt body within rather close tolerances precluding substantially all relative lateral movement between the two members. Further, due to the anti-frictional nature of the ball bushing there is almost no frictional bolt drag. The ball bushing takes the major load during operation.

Another important object of this invention is to provide an extractor mechanism which embodies great strength and simplicity. The bolt head is provided with extractors spaced around the periphery of the bolt head which are pivotally mounted to swing radially outwardly to an open position allowing the cartridge case rim to slide past the extractors and to abut the bolt head face. The extractors are normally maintained in the closed position merely by the interior surfaces of the action frame bore. That is, the action frame bore is of an inside diameter only slightly greater than the outer diameter of the bolt head as defined in the locking lug and prevents the pivoted extractor from swinging radially outwardly to the open position. The front surface of each extractor is provided with a cam surface which engages a cartridge casing rim injected into the action frame bore. The bolt head pushes the cartridge case into the recoil ring which is provided with spring-loaded ball detents which impede the forward
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movement of the cartridge case. Adjacent the recoil ring is an enlarged diameter portion of the action frame bore which permits the extractors to pivot radially outwardly. The extractors which are in abutment with the cartridge case rim will pivot radially outwardly at the enlarged portion due to the reaction of the cam surfaces with the peripheral edge of the cartridge case rim.

As the extractors open, the cartridge case rim slides past the extractors and abuts the bolt head face. The recoil ring is provided with tapered raceways. The raceways define a diameter approximating the diameter of the enlarged portion on the rear side of the ring but taper to define a diameter on the front side of the ring approximating the diameter of the bore. The tapered raceways receive the locking lugs and serve as cams for closing the extractors around the cartridge case rim. Further forward movement of the bolt head moves the locking lugs past the recoil ring and partial rotation of the bolt by means of a bolt handle causes the locking lugs to engage the recoil lugs on the forward side of the recoil ring thereby locking the bolt in closed position.

After firing of the cartridge, the cartridge case is withdrawn by means of the extractors gripping the cartridge case rim. At least one of the extractors continues to grip the rim as the case is drawn back through the enlarged area because the one extractor is provided with spring biasing means normally keeping it closed and is pivoted about a pivot pin which is mounted closer to the centerline of the bolt body than the pins of the other extractors. The spring is of only sufficient tension to safely withdraw the case from the dentent means and through the enlarged area after which the extractors are once again limited in the swinging action because of the internal surfaces of the action frame bore. A second enlarged area is located in the action frame bore adjacent the extractor claws at the rearmost travel of the bolt whereupon the extractors are again allowed to open. An ejector mechanism pushes outwardly on the cartridge case rim opposite the spring biased extractor. The spring biased extractor serves as a fulcrum causing the cartridge case to pivot through the cartridge ejection opening in the action frame.

A further object of this invention is to provide extractors of relatively large proportions having the necessary inherent strength and for engaging the cartridge case rim over a substantial portion of its periphery up to 100 per cent. The extractors are mechanically closed and maintained in a closed position in a manner to preclude the extractors from springing or jumping over the cartridge case rim under any circumstances.

Specifically this invention comprises a bolt action assembly for a firearm comprising a bolt action frame having a longitudinal bore therein for receiving a cartridge casing having an extractor groove and a rim. A bolt is slidably received in said bore having a body portion and a detachable head portion and a substantially flat front face on the head portion. The bolt slides through and is supported by a circulating ball bushing which is positioned in the bore. A handle is provided on the bolt for moving the bolt within the bore. A recoil ring having a front and rear side is positioned at the forward end of the action frame bore and is aligned therewith. Detent means are provided in the recoil ring for impeding the movement of a cartridge case therethrough. The bolt head is provided with locking lugs adapted for cooperation with recoil lugs on the front side of the recoil ring for purposes of locking the bolt in closed position. Cartridge extractors are pivotally mounted on the locking lugs and swing radially outwardly from the closed to the open position. The inner diameter of the action frame bore closely approximates the outer diameter of said bolt head portion and normally maintains the extractors in the closed position. Each of the extractors is provided with a cam surface on its front face for contacting a cartridge case rim. A first enlarged diameter portion is provided in the bore adjacent the rear side of the recoil ring whereby the extractors are permitted to pivot outwardly upon reaction of the cartridge rim and said cam surfaces when the movement of the cartridge relative to the bolt is impeded by said dentent means. The cartridge rim then moves past said extractors and to abut said face. Raceways in the recoil ring are tapered from the enlarged diameter portion down to the normal bore diameter for purposes of closing the extractors about the cartridge case rim as the bolt head and cartridge case move through the recoil ring. A second enlarged diameter portion is provided at the rear of the bore allowing the extractors to pivot outwardly and release the cartridge case upon retraction of the bolt. One of the extractors is normally closed by a spring biasing means and is pivoted about a point closer to the centerline of the bolt body and serves as a fulcrum point in cooperation with an ejector means for ejecting the cartridge casing. The ejector means comes into operation simultaneously with the arrival of the extractors at the second enlarged diameter portions.

Referring now to the figures:

FIG. 1 is a cross sectional view of the bolt action assembly of the invention showing the bolt in the retracted position;

FIG. 2 is a cross sectional view similar to FIG. 1 showing the bolt in the closed but not locked position;

FIG. 3 is a top cross sectional view taken along lines 3—3 of FIG. 2;

FIG. 4 is a cross sectional side view with a full bolt head showing a spent cartridge as it is released by the extractor mechanism with the bolt in the retracted position.

FIG. 5 is a cross sectional view with a full bolt head showing the initial engagement of the bolt head and extractors with the cartridge case;

FIG. 6 is a cross sectional side view with a full bolt head showing the extractors in the open position allowing the cartridge case to abut the bolt face prior to being fully gripped by the extractors;

FIG. 7 is a cross sectional side view with a full bolt head showing the extractors being forced to the closed position about the cartridge rim prior to the cartridge being chambered;

FIG. 8 is a cross sectional side view with a full bolt head showing the cartridge chambered and the bolt in the closed but not locked position;

FIG. 9 is a cross sectional view of the recoil ring taken substantially along lines 9—9 of FIG. 8;

FIG. 10 is a view similar to FIG. 9 showing the bolt in the locked position;

FIG. 11 is a front view of the recoil ring alone showing tapered channels and retarder means in phantom;

FIG. 12 is a side view of the recoil ring;

FIG. 13 is a rear view of the recoil ring;

FIG. 14 is a front view of the bolt head and

FIG. 15 is a view of the opposite side of the bolt head showing the extractor with the deep-set pivot point.
Referring now to FIG. 1, the bolt action assembly of this invention is indicated generally by the numeral 10. The bolt frame 12 has a longitudinal bore 14 therein for receiving a cartridge casing C having an extractor groove or rim. Slidably received in the bore 14 is a bolt generally indicated by the numeral 16 comprising a body portion 18 and a head portion 20. The bolt is further provided with a handle 21 for purposes of reciprocating the bolt in the conventional manner. A ball bearing assembly 22 comprising a bushing having recirculating balls therein is positioned within the action frame bore 14 in an annular inset 24. The action frame 12 is segmented at 26 by suitable threads and may be separated for purposes of inserting the ball bearing bushing. The bushing is further provided with annular seals 28 comprised of metal and resilient materials such as plastic or rubber for tightly engaging the cylindrical surface of the bolt body 18 to prevent gases from passing along the area between the action frame interior surfaces and the cylindrical surface of the bolt body. The seals are of the type that grip more tightly the greater the pressure that is exerted against them.

The bolt body 18 though not fully shown is closed at its rearmost end and is substantially solid in cross section at that point. Therefore, unlike conventional bolts, the firing pin mechanism is inserted through the forward end of the bolt body by removing the head portion 20. The head portion 20 is secured to the bolt body 18 by means of locking pin 30 which engages a slot in the neck portion 32 which is inserted in a cylindrical recess 34 in the bolt body 18. The bolt body 18 has along one side thereof a longitudinal slot 36 which is parallel with the axis of the bolt. A suitable follower lug mounted on the action frame rides in the slot to insure linear, non-rotatable movement of the bolt within the bore 14. The slot includes a transversely extending section at its rearward end which permits the bolt to be rotated to the locked position. An ejector pin 38 which is normally spring-biased to the recessed position flush with the bolt face 40 by spring means 42 is provided in the head portion 20 and terminates in a right angular projection 44 which projects into slot 36. The ejector pin is caused to reciprocate and project outwardly from the bolt face 40 when the bolt reaches its rearmost position. At that point the right angular member 44 engages the follower lug, not shown, forcing the ejector pin forward against the action of spring 42.

The bolt head is provided with four radially spaced locking lugs 46 best shown in FIG. 15. Pivotedally mounted on the locking lugs are four extractors 48a, 48b, 48c and 48d which are moved from an open to a closed position to grip the rim of the cartridge case and are held in the closed position by the lock columns of the inner surfaces of the action frame bore 14. The extractors are permitted to swing to the open position to grip a cartridge case rim prior to the case being chambered and to release the cartridge case for ejection after firing by enlarged diameter portions 50 and 52 respectively of the bore 14.

A removable recoil ring 54, best seen in FIGS. 9 through 13, is positioned in an annular inset portion 56 in the action frame 12 with the inner diameter of the recoil ring being dimensioned to admit a cartridge of a specified caliber. Recoil rings of various sizes along with bolt heads of various sizes may be substituted in the action frame to accommodate different caliber cartridges by removing the barrel 58 which is threaded into the action frame. The recoil ring is provided with tapered raceways 60 as best shown in FIGS. 3 and 6 through 8, which receive the locking lugs 46 of bolt head 20 as the bolt is moved forward through the recoil ring. The raceways terminating on the rear side of the ring define an interrupted circle of a diameter the same as that of the enlarged diameter portion 50, while on the front side, the channels define a circle of a diameter the same as that of the bore 14. The ring is provided with tapered ramps 62 which serve to guide the cartridge into the ring. The ramps extend rearwardly of the lugs 74 which extend through the ring and are circumferentially spaced by the race-ways 60.

Spring loaded detent means are provided to position radially inwardly of the recoil ring 54 to define a circle of a diameter less than the outer diameter of a cartridge for which the ring is adapted. The detent means is comprised of springs 64 with ball detents 66. It is to be understood that the openings through which the balls project are of a diameter less than the diameter of the balls to prevent the balls from passing completely through the openings.

It is to be emphasized that the extractors are not opened by any separate mechanical means. The opening is effected by reaction with the cartridge case rim when permitted by action frame bore enlargements. The closing of the extractors is effected by the closely surrounding action frame bore 14.

The operation of the bolt action can best be understood with reference to FIGS. 4 through 8. A cartridge C is injected into the bore 14 from a suitable magazine. The bolt 16 is pushed forward and the cartridge is in abutment with the extractors 48a, 48b, 48c and 48d at a point in the bore 14 intermediate the two enlarged diameter portions 50 and 52. In this position, the extractors are in the closed position and the tips of the extractors define an opening of a diameter less than that of the rim of the cartridge such that the cartridge is not permitted past the extractors. At this point, the cartridge case rim will be against the cam surfaces of the respective extractors.

As the casing is pushed through the recoil ring 54, the ball detents 66 grip the cartridge case impeding its forward movement. At this point, the extractors on the bolt head are adjacent the enlarged diameter portion 50. Due to the force of the reaction and the particular angle of the cam surface against the cartridge case rim, the extractors are forced to pivot to the open position and are allowed to do so by means of the enlarged diameter portion 50. Upon the extractors reaching the open position, the cartridge case rim slips past the extractor edges or tips and abuts the bolt face 40. Continued movement of the bolt 16 causes the extractors to move to the closed position gripping the cartridge case rim. The extractor claws are forced to close position by the tapered races 60 which serve as cam surfaces forcing the closing action. Upon further movement of the bolt, the cartridge C is chambered and the bolt is rotated to the locked position in the conventional manner. That is, the bolt is rotated to cause engagement of the locking lugs and the recoil lugs 74 on the recoil ring. Each of the lugs 46 are provided with cam surfaces 47 to facilitate the smooth engagement of the lugs 46 with the lugs 74. The bolt as shown in FIGS. 2 and 8 is in the closed position but not the locked position for purposes of clarity. It is to be understood that the
b bolt will be rotated 45° from the position shown when in the locked position.

After the cartridge has been fired, the bolt is unlocked and pulled back through the recoil ring 54. The cartridge is not released as it passes through the enlarged diameter portion 56 due to one of the extractors 48a, being spring biased to the closed position. Further the extractor 48a has a pivot point spaced closer to the centerline of the bolt than the other pivot points for the other extractors as best seen in FIG. 15. The bolt continues its rearward movement and stops at a point where the extractors are adjacent the enlarged diameter portion 52. Simultaneously, the right angular projection 44 is pushed forward by means of a follower lug, not shown, riding in groove 36 causing the ejector pin 38 to project outwardly against the cartridge case forcing the extractors 48a-d to the fully open position. The extractors are of course permitted to open because of the enlarged diameter portion 52. The ejector pin 38 is offset with relation to the centerline of the bolt and is positioned opposite the spring biased extractor 48a having the deeper set pivot point. Consequently, the ejector pin 38 pushes on one side of the cartridge case rim and the spring biased extractor 48a serves as a fulcrum thereby causing the cartridge case to pivot outwardly and through an ejection port.

During the firing of the cartridge in event of bursting, the rearward movement of escaped gases is impeded by

the conical shoulder 78 of the bolt head. The tolerance between the internal surfaces of the bore 14 and the exterior surface of the bolt 16 is quite close to preclude gases from passing farther. Additionally, the seals 28 prevent rearward movement of the gases and force them through the main ejection port in the action frame.

It is to be understood that the invention disclosed herein is not limited to the particular number of extractors or lugs or to any particular positioning of the extractors or lugs. The lugs may range from two to four in number and the extractors from one to four in number.

As mentioned earlier, the bolt action may be easily modified to accommodate a different caliber cartridge by substituting a different barrel 58, a recoil ring 54 and bolt head 20.

In a general manner, while there has been disclosed an effective and efficient embodiment of the invention, it should be well understood that the invention is not limited to such an embodiment as there might be changes made in the arrangement, disposition, and form of the parts without departing from the principle of the present invention.

I claim:

1. A bolt action assembly for firearms for loading and extracting a cartridge case comprising
   a bolt action frame mounted on said firearm having a longitudinal bore therein for receiving a cartridge case having an extractor groove and rim,
   a bolt slidably mounted in said bore having a head and a body portion and a substantially flat front face on said head portion,
   extractors pivotally mounted for movement between an opened and closed position on said bolt head for engagement with a cartridge rim one of said extractors has a pivot point closer to the center-line of said bolt body than the pivot points of the other extractors, and
   cam surfaces on said extractors,
   said bore having an enlarged diameter portion permitting said extractors to pivot radially outwardly upon reaction of the engagement of said cartridge rim and said cam surfaces when said bolt moves against said cartridge case whereby said cartridge rim moves past said extractors and abuts said face, and
   means in said bore for closing said extractors about said case rim upon continued movement of said bolt and said case,

2. A bolt action assembly as defined in claim 1 and wherein said bolt head is removably attached to said body portion at one end thereof and the other end of said bolt body portion is closed and substantially solid in cross-section.

3. A bolt action assembly as defined in claim 1 and including a removable recoil ring in the forward end of said bore and locking lugs on said bolt head portion for cooperating with said recoil ring for locking said bolt in closed position.

4. A bolt action assembly as defined in claim 1 and wherein anti-friction bearing means are provided in said bore engaging said bolt for facilitating the sliding movement of said bolt within said bore.

5. The bolt action assembly as defined in Claim 1 and including a second enlarged diameter portion of said bore for permitting said extractors to pivot outwardly to the open position to release said cartridge case near the point of the rearmost travel of said bolt and ejector means for ejecting said cartridge.

6. A bolt action assembly as defined in Claim 5 wherein one of said extractors is normally spring biased to the closed position and said ejector means cooperates with said spring-biased extractor which serves as a fulcrum point to eject said cartridge when said extractors are adjacent said second enlarged diameter portion.

7. A bolt action assembly as defined in Claim 1 and including a recoil ring having a front side and a rear side in said bore and aligned therewith at the forward end of said bore, said rear side of said recoil ring being adjacent said enlargement, second cam surfaces defined by tapered raceways through said ring, said recoil lugs on the front side of said ring and extending therethrough, locking lugs on said bolt head portion, said bolt head extending through said recoil ring and said locking lugs extending through said raceways and cooperating with said recoil lugs to lock said bolt in the closed position.

8. A bolt action assembly as defined in claim 7 and including tapered ramps extending from said recoil lugs and rearwardly of said ring, whereby said cartridge engages said ramps which guides said cartridge into said ring.

9. A bolt action assembly as defined in claim 4 and wherein said anti-friction bearing means comprises a recirculating ball bushing.

10. A bolt action assembly for a firearm having a removable barrel comprising a bolt action frame mounted on said firearm having a longitudinal bore therein in communication with said barrel at one end thereof and receiving a cartridge of a certain caliber, a recoil ring mounted on said action frame in said bore end adjacent said barrel and aligned therewith,
a bolt slidably received in said bore having a body portion and a head portion rotatable relative to said recoil ring,
locking lugs on said bolt head portion cooperating with said recoil ring to lock said bolt in closed position,
said bolt head portion being removable from said bolt body and said recoil ring being removable from said bore for purposes of substituting a bolt head portion and a recoil ring accommodating a cartridge of a different caliber.

11. A bolt action assembly as defined in claim 10 and including extractors pivotally mounted on said locking lugs.

12. In a bolt action assembly for a firearm comprising a bolt action frame on said firearm having a longitudinal bore therein for receiving a cartridge casing having an extractor groove and rim,
a bolt slidably received in said bore having a body portion, a detachable head portion and a substantially flat front face on said head portion,
a handle on said bolt for moving said bolt within said bore,
bearing means within said bore and engaging said bolt to enable substantially frictionless sliding movement,
ejectors pivotally mounted on said head portion for engaging and gripping a cartridge case rim, the diameter of said bore closely approximating the outer diameter of said bolt head portion thereby normally maintaining said extractors in closed position,
a recoil ring having a front and rear side at the forward end of and aligned with said bore,
detent means in said ring for impeding the movement of a cartridge case through said ring,
locking lugs on said bolt engaging said front side of the recoil ring when said bolt is closed and rotated to a locked position,
cam surfaces on said extractors for engaging a cartridge case rim,
a first enlargement in said bore adjacent the rear side of said recoil ring whereby said extractor claws are permitted to pivot outwardly upon reaction of the cartridge rim and said cam surfaces when the movement of said cartridge relative to said bolt is impeded by said detent means thereby permitting said cartridge rim to move past said extractors and abut said bolt face,
tapered raceways in said ring for closing said extractors about said case rim as the cartridge and bolt head pass through said ring,
a second enlarged diameter portion in the rear of said bore allowing the extractors to pivot outwardly and release said cartridge case after retraction of the bolt,
one of said extractors normally being spring-biased to a closed position with a deeper pivotal position, and
ejector means cooperating with said spring-biased extractor to eject the cartridge case when extractors are adjacent said second enlarged diameter portion.