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INSIDE THE ARCHIVE

THE KEL-TEC RDB

TOP DOG • PARKER BROTHERS SHOTGUNS, PART TWO • LAB RADAR • SAVE MONEY WITH USED CNC MACHINERY

ORIGINAL METHODS. MODERN ACCESS.

ARCHIVE EDITION 182

DIGITAL ARCHIVE EDITION

Preserved for the bench.

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IN THIS ISSUE

Contents

A complete guide to the searchable editorial work preserved from February 2019.

2 Top Dog
AMERICAN GUNSMITH EDITORS • ORIGINAL PAGES 2

3 The Kel-Tec RDB
BRIAN R. SMITH • ORIGINAL PAGES 3-9

10 Parker Brothers Shotguns, Part Two
PAUL MAZAN • ORIGINAL PAGES 10-13

14 Lab Radar
ROBERT KOLESAR • ORIGINAL PAGES 14-16

17 Save Money With Used CNC Machinery
CURT DOHERTY • ORIGINAL PAGES 17-18

19 Marlin 60
ROBERT K. CAMPBELL • ORIGINAL PAGES 19-21

22 FN FAL “Frankengun”
DAVE STROM • ORIGINAL PAGES 22-23

24 Reader Forum
AMERICAN GUNSMITH EDITORS • ORIGINAL PAGES 24

MAINTENANCE & REPAIR

Top Dog

BY AMERICAN GUNSMITH EDITORS FEBRUARY 2019

ORIGINAL PP. 2

Every one of your customers and repair jobs involves a firearm and you're as likely as anyone to be asked for advice on their use. Unless you exclusively repair wall hangers, those firearms will be used. Skillful marksmanship when it counts for something important—be it hunting, defense/tactical, or similar—will likely be done under conditions of varying degrees of stress. Scientific testing has proven formal competition is the only stressor that continues to work over time.

Laboratory results reveal novice parachutists on their first day of jumping experience less stress by their third jump than a competitor with a decade of experience during a contest. This has important implications for gun owners that want or need to learn how to shoot well under stress. *Top Dog: The Science of Winning and Losing* by Po Bronson and Ashley Merryman shows what it takes to win and reveals what's truly in the heart of a champion. The joy of victory and the character-building agony of defeat.

Testosterone and the neuroscience of mistakes. Why rivals motivate. What teamwork really requires. It's about baseball, marksmanship, the SAT, sales contests, and Linux. How before da Vinci and FedEx were innovators, first, they were great competitors. "To compete

well means to take risks that are normally constrained by fear," Bronson says. "Risk-taking is a crucial quality of competitiveness.

Science shows that if you focus on the odds, you tend not to take the risk." *Top Dog* places its focus on the importance of competition rather than the "10,000 hours of practice" that is often discussed. Completion requires taking risks that are held back by fear and can teach us moral behavior—the Greeks called it *aretas*, attaining excellence through competition. Playing to win is very different than playing not to lose. Being stressed before competition is good and if framed as a positive can improve performance.

This stress boosts testosterone but doesn't create unwanted aggression—it leads to intensity and focus. Bronson explains, "To harness the power of testosterone, the rules of what earns social regard must be changed. Change the culture and the high-Test people will change what they do to earn respect." Positive thinking is often not helpful but having understanding and respect for the opponent or the obstacle to be faced is. This sort of experience and benefit is available to everyone at the next competitive event.

Sharing the science and research found in *Top Dog* will help you guide customers and fellow gun owners to events that will help them most.

RIFLES

The Kel-Tec RDB

Lightweight, compact, and innovative, Kel-Tec brings another entry to the bullpup firearm market, offering true ambidextrous handling.

BY BRIAN R. SMITH FEBRUARY 2019

ORIGINAL PP. 3-9



Top: Kel-Tec RDB Bullpup shown from the left side and fitted with a 20-round USGI aluminum magazine. The folded charging handle is visible directly below the front sight and above the upper edge of the handguard. Above: RDB's right side with a 30-round USGI aluminum magazine fitted. The 30-round magazine's longer projecting length does not interfere with the strong hand grasping the pistol grip.

ORIGINAL ARCHIVE IMAGE • PERMISSION CONFIRMED

Ever since the technology to manufacture compact semiauto rifles was developed, forward-thinking designers began to prototype such firearms with forward-placed controls. These so-called “bullpup” rifles place the magazine behind the main grip and moves the breech to the rear, usually a cartridge length in front of the butt plate.

When fitted with a 16" or 18" barrel, the overall length is substantially reduced from that of a comparably chambered semi-auto of conventional layout, naturally appealing to paratroopers, armor crews, and personnel who engage in close quarters battle. The first really successful modern bullpup was the Steyr AUG, made famous in more than a few Hollywood fiction creations.

The French followed with the FAMAS bullpup and the British replaced their version of the FAL, the L1A1, with the Enfield SA80 which evolved into the current BAE Systems' L85A2. Relatively lately the

Israelis brought out their Tavor in a few chamberings and FN the P90 and F2000. The AUG clone Microtech MSAR was introduced in 2007 but Steyr opening a US facility meant that the semi-auto version of the AUG was more readily available and it killed demand for the MSAR, which closed its doors in 2015.

There have been many more bullpups, both rifle and shotgun, but the subject of this article is the third bullpup offering from Kel-Tec CNC, the RDB. The Kel-Tec RDB (Rifle, Downward-ejection, Bullpup) is chambered in 5.56×45mm NATO and

The 30-round magazine's longer projecting length does not interfere with the strong hand grasping the pistol grip. followed Kel-Tec's 7.62 NATO chambered RFB and the 12 gauge KSG shotgun.

Like the AR-15, the RDB uses a similar multi-lugged rotating bolt with not one but two spring-loaded ejectors and with the ex-

tractor at the 5 o'clock to 7 o'clock position on the bolt face, which causes cartridge cases to be ejected downward through a sheet metal-lined central port in the RDB behind the magazine well and in front of the butt plate.

There is no ejection port on the right side of the receiver, so the RDB can be shouldered left or right without a thought to the empties flying close by one's face, although in any event if the shooter is wearing a lightcolored shirt, expect to use some stain-removing laundry aids as the sooty cases dribble down the front of the shooter's torso. The RDB features a reversible charging handle, which is shipped from the factory fitted to the left side of the weapon.

Partial disassembly (covered later) allows quick “mirror-image” repositioning of the charging handle to the right side of the RDB, for left-handers or those right-handers who prefer the “AK” charging handle setup of holding the pistol grip in the right

THE KEL-TEC RDB CONTINUED

ORIGINAL PAGE 4



Above left: RDB's right side controls. From right to left, trigger, safety at the top of the pistol grip, magazine release in front of the magazine well, and the bolt release directly above the rear end of the magazine release. Above right: Trigger, left hand safety lever, and one of the takedown pushpins in between them. Note two of the many hex recess screws used by Kel-Tec to assemble the RDB.

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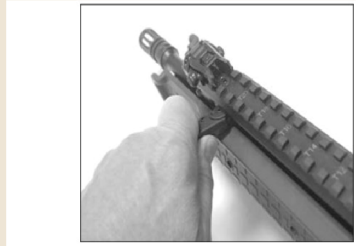
Below left: Left hand fingers grasping the folding charging handle. The charging handle is reversible in a matter of seconds from the factorybuilt left side position to the right side. Below center: Charging handle fully withdrawn to the rear by the left hand. The rear sight is an allmetal Magpul MBUS Pro. Below right: Charging handle shown rotated slightly upward and retained in its hold open groove, similar to that of a STEN submachine gun or a HK 91, 93, or MP5. The handle can be "sling shot" or slapped down from this position to release the bolt assembly forward.

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Below left: Left hand fingers grasping the folding charging handle. The charging handle is reversible in a matter of seconds from the factorybuilt left side position to the right side. Below center: Charging handle fully withdrawn to the rear by the left hand. The rear sight is an allmetal Magpul MBUS Pro. Below right: Charging handle shown rotated slightly upward and retained in its hold open groove, similar to that of a STEN submachine gun or a HK 91, 93, or MP5. The handle can be "sling shot" or slapped down from this position to release the bolt assembly forward.

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Below left: Left hand fingers grasping the folding charging handle. The charging handle is reversible in a matter of seconds from the factorybuilt left side position to the right side. Below center: Charging handle fully withdrawn to the rear by the left hand. The rear sight is an allmetal Magpul MBUS Pro. Below right: Charging handle shown rotated slightly upward and retained in its hold open groove, similar to that of a STEN submachine gun or a HK 91, 93, or MP5. The handle can be "sling shot" or slapped down from this position to release the bolt assembly forward.

ORIGINAL ARCHIVE IMAGE • PERMISSION CONFIRMED

From right to left, trigger, safety at the top of the pistol grip, magazine release in front of the magazine well, and the bolt release directly above the rear end of the magazine release. hand and tilting the RDB counter-clockwise 90 degrees to allow easy access of the weak hand to the charging handle. Kel-Tec designers thoughtfully provided a charging handle hold back notch similar to that on Heckler & Koch rifles and submachine guns, but on both sides of the RDB.

Simply pull back the charging handle fully rearward and The charging handle is reversible in a matter of seconds from the factorybuilt left side position to the right side. Below center: Charging handle fully withdrawn to the rear by the left hand. The rear sight is an allmetal Magpul MBUS Pro. The handle can be "sling shot" or slapped

down from this position to release the bolt assembly forward. rotate it upward to engage the retention notch to hold the bolt open.

The rotating bolt may be AR-15like but the bolt is housed in an AK-like bolt carrier block that rides on guide rails welded to the inside of the sheet metal receiver. The carrier block is also welded to along operating rod similar to the gas piston/carrier extension of the AK-47/AKM but it is hollow at the rear and houses the long action spring and action spring rod. When the RDB is assembled, there are of the action spring impinges against the inside surface of the receiver which forms the butt plate.

The front of the action spring rod mates in a spring-loaded gas piston housed within the gas block near the front of the handguard.

The forward tip of the action spring rod thus retains the gas piston itself inside the gas block; the gas piston is a friction fit dependent on the spring force of the three sealing rings surrounding the gas piston body and in contact with the inside diameter of the gas block.

The RDB has an adjustable gas feature consisting of a knurled knob in front of the gas block, fitted with recesses into which the bullet of a cartridge can be inserted to facilitate adjustment when the rifle is hot. Alternatively, wear gloves when adjusting the gas on a recently-fired RDB. Rotating the knob full clockwise when viewed from the muzzle conducts full gas from the barrel port to the gas piston. Most RDBs cycle with the

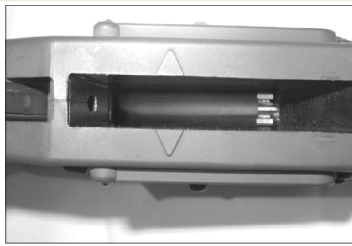
THE KEL-TEC RDB CONTINUED

ORIGINAL PAGE 5



Above left: Fingers depressing magazine release. In normal use the inside of the weak hand trigger finger squeezes the magazine release backward while the thumb grasps the back wall of the magazine to facilitate removal as not all magazine types drop free. Above right: Aluminum sheet metal-lined ejection port directly behind the magazine well and immediately in front of the butt. The bolt lugs are visible at the right end of the magazine well itself.

ORIGINAL ARCHIVE IMAGE • PERMISSION CONFIRMED



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ORIGINAL ARCHIVE IMAGE • PERMISSION CONFIRMED



Left: Folded charging handle and the gas adjustment knob directly to its left and below the front sight, an all-metal Magpul MBUS Pro. The recess in the knurled adjustment knob is for the point of a cartridge tip for gas adjustment when the weapon is thermally hot.

ORIGINAL ARCHIVE IMAGE • PERMISSION CONFIRMED

In normal use the inside of the weak hand trigger finger squeezes the magazine release backward while the thumb grasps the back wall of the magazine to facilitate removal as not all magazine types drop free. The bolt lugs are visible at the right end of the magazine well itself. gas regulator adjusted three to five clicks counter-clockwise from the full clockwise stop position. There are no reference numbers or markings so one must count the clicks.

If insufficient gas is conducted to the piston, the action will short stroke, resulting in a partial extraction and possible new cartridge feed jam. The jam must be cleared one of two ways: Either through the magazine well with the bolt retracted and held to the rear by the charging handle in its notch or by disassembly of the weapon.

It is NOT recommended to fully cycle the charging handle to clear the jam with a loaded magazine in place as doing so may strip even more cartridges from the magazine

resulting in a tighter jam. Again, safe the weapon, ensure the muzzle is pointing down-range, retract the charging handle, and fish out any live cartridges and the empty casing that failed to extract/eject using a screwdriver or two like chopsticks or a set of long needlenosed pliers.

The firing and operational controls are located on the pistol grip or on the receiver convenient to the pistol grip. The ambidextrous safety selector is readily activated by the strong hand thumb. The trigger is ergonomically located in the pistol grip. The magazine release is a U-shaped spring steel stamping located centrally behind the pistol grip and directly in front of the forward edge of the magazine well.

The magazine release slides in guide grooves on either side of the polymer The recess in the knurled adjustment knob is for the point of a cartridge tip for gas adjustment when the weapon is thermally hot. magazine well. Pushing the magazine release rearward

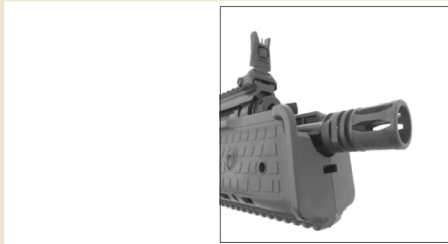
causes the magazine catch tab to “cam” out of the magazine retaining slot and the magazine itself. The spring steel properties of the magazine release reset it to its forward position upon release.

The RDB accepts standard “NATO Draft Standard Agreement (STANAG) 4179” pattern 5.56x45mm magazines, including the ubiquitous USGI 20 and 30round aluminum-bodied M16/M4 magazines as well as the variety of commercial metal and polymer magazines. The bolt release is also ambidextrous with serrated, tapered rectangular thumbpieces on both sides of the magazine well. Pressing one of these thumbpieces downward releases the bolt.

There are four assembly groups to an RDB: Barrel, Bolt, Receiver, and Grip as Kel-Tec calls them. The Barrel group consists of the barrel, gas block, charging handle, optic rail, and polymer fore end halves. The Bolt group consists of the bolt carrier, bolt, action spring, and ac-

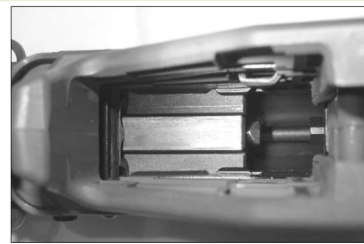
THE KEL-TEC RDB CONTINUED

ORIGINAL PAGE 6



Above left: RDB's magazine well, looking at the bottom of the bolt carrier. The "stirrup" at the upper right is the magazine catch that engages the rectangular recess in the side of a NATO STANAG-type magazine. Above right: RDB's "business end" showing its closed-bottom birdcagetype flash hider. The left and right handguards end in short 90-degree flanges to each side, providing finger stops to keep the weak hand from sliding off the front into harm's way.

ORIGINAL ARCHIVE IMAGE • PERMISSION CONFIRMED



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ORIGINAL ARCHIVE IMAGE • PERMISSION CONFIRMED



Below left: This RDB was fitted with a Magpul MBUS Pro metallic front and rear sight set on the factory-installed M1913 Picatinny rail. The rear MBUS Pro is foldable to reduce profile in the event an optic is fitted and features a folding small aperture for distance shooting. Below right: RDB shown with the two middle take down pushpins withdrawn, the grip assembly group rotated downward, and the barrel assembly group slid forward by force of the expanded action group. The barrel group is readily removed forward and completely out of the receiver assembly group.

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The "stirrup" at the upper right is the magazine catch that engages the rectangular recess in the side of a NATO STANAG-type magazine. The left and right handguards end in short 90-degree flanges to each side, providing finger stops to keep the weak hand from sliding off the front into harm's way. The Receiver group consists of the receiver itself, a Usection heat treated sheet metal channel with four lugs into which holes are punched to accept takedown pins.

Other Receiver group components include the heat shield which serves as a cheekpiece, the stock (butt plate), and the stock cover (butt plate pad). The Grip group contains the two halves of the polymer pistol grip/magazine well assembly which contains the The rear MBUS Pro is foldable to reduce profile in the event an optic is fitted and features a folding small aperture for distance shooting.

The barrel group is readily removed forward and completely out of the receiver assembly group. trigger and other fire controls, safety, magazine well, magazine catch, bolt release, ejection port, etc. There are four captive push pins which hold the entire firearm assembled. To disassemble, first cock the weapon.

Pressing the two middle pins from left to right using either a cartridge tip or a brass punch allows the Grip group to be rotated downward slightly and permits the Barrel group to be withdrawn forward, after which the Bolt group can be withdrawn from the rear of the Barrel group. Disassembly is "assisted" somewhat by the compressed action spring which tends to push the Barrel and Bolt groups forward with the two center assembly pins removed and the Grip group tilted downward.

Removal of the rearmost assembly pin separates the rear of the Grip group from the rear of the Receiver group. Removal of the forward-most assembly pin separates the front handguard assembly from the Barrel group.

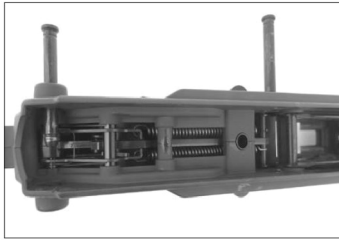
To field strip the Bolt group, drive out the firing pin retaining pin from left to right using a punch, capturing the O-ring used by Kel-Tec to keep the firing pin retaining pin in place.

Withdraw the firing pin to the rear and then remove the bolt cam pin from its cam slot in the left side of the bolt carrier. Then withdraw the bolt from the carrier toward the front. The RDB's bolt is a modification of an AR bolt in principle.

There are multiple lugs surrounding the bolt head from approximately 8 o'clock to 4 o'clock when looking at the bolt face, with the extractor located from 5 o'clock to 7 o'clock, and two spring-loaded ejector pins at 11 o'clock and 1 o'clock with the firing pin port in the center of the bolt face. The arrangement of the

THE KEL-TEC RDB CONTINUED

ORIGINAL PAGE 7



Above left: The two centermost take down pushpins are withdrawn to the right, showing the receiver group tilted upward. The pushpins engage the holes in the lugs of the sheet metal receiver. Above right: Two centermost take down pushpins are the primary ones removed for basic disassembly (shown pushed out toward top of photo). The fire control parts and dual mainsprings are somewhat hidden beneath the right and left halves of the Zytel polymer pistol grip halves and tubular steel compression limiters. This makes for disassembly and reassembly operations requiring "six to eight hands" or a purpose-built assembly jig that is cost-prohibitive for the average gunsmith.

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Below left: The receiver group consists of the hardened sheet metal receiver, a polymer cheek piece, and the butt/buttpad components. Below right: The notched component projecting upward and looking for all the world like a rear sight is actually the hammer, riveted to a rotating, angled sheet metal arm. Talk about "long-throw" hammers—this hammer has the longest pivot radius of any firearm the author has examined in nearly 50 years of the study of firearm design.

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The pushpins engage the holes in the lugs of the sheet metal receiver. The fire control parts and dual mainsprings are somewhat hidden beneath the right and left halves of the Zytel polymer pistol grip halves and tubular steel compression limiters.

This makes for disassembly and reassembly operations requiring "six to eight hands" or a purpose-built assembly jig that is cost-prohibitive for the average gunsmith. features just described makes the bolt head/bolt face remind this author of a "skullface." Further stripping of the bolt is similar to that of an AR bolt, removing pins which free the ejectors and the extractor claw. There are two versions of the RDB's action spring assembly.

The Talk about "long-throw" hammers—this hammer has the longest pivot radius of any firearm the author has examined in nearly 50 years of the study of firearm design. early type is captured inside the bolt carrier and released by depressing a small latch at the rear

of the carrier. Use care and apply a restraining force to control the spring as it is freed from the carrier.

The later version of the action spring assembly is not captured inside the bolt carrier and disassembly Kel-Tec does not recommend further disassembly, and having examined the RDB after its disassembly into the four groups, I don't either. Kel-Tec is known for its CNC machining methods and unconventional designs that make widespread use of much polymer and many, many pins, screws, and nuts.

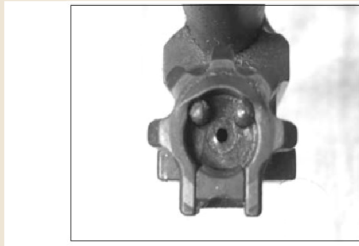
Examining the Grip group, it is obvious that the factory makes use of an elaborate assembly jig as well as likely automated assembly. Attempting to fully disassemble and reassemble an RDB is simply outside the scope of the average gunsmith's capabilities and there is no economic justification for making the fixturing for anyone who would infrequently see one of these firearms.

For those interested in more detail, a copy of the RDB's owner's manual with several "exploded views" of its components is available for download from the Kel-Tec site at bit.ly/2vKxjxQ. Recently I was asked to look at a fairly new RDB that was intermittently failing to go into battery and the bolt carrier was "hanging up" as the bolt face contacted the barrel extension.

Since a watched pot bly of the RDB results in the action spring pushing the action spring rod well out of the carrier tube until the action spring full extended, perhaps a foot or more out of the carrier. never boils, when the owner and I examined the RDB together and handcycled the action a number of times there was no indication of a problem. We took the rifle to the range and following a magazine full of 55 grain Fed-

THE KEL-TEC RDB CONTINUED

ORIGINAL PAGE 8



Left: The seven-lug, two-ejector bolt face (which does look like a face!), exhibiting the extractor at the 6 o'clock position so that empties are tilted downward for ejection out the bottom of the RDB. Despite the different configuration of individual components, the RDB's bolt is similar in concept to that of an AR.

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Below left: The barrel extension, bolt, and bolt carrier are shown in relation to one another just prior to going into battery. Below right: The barrel extension, bolt, and bolt carrier are shown with the bolt in battery. Note the position of the bolt cam pin.

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Below left: The barrel extension, bolt, and bolt carrier are shown in relation to one another just prior to going into battery. Below right: The barrel extension, bolt, and bolt carrier are shown with the bolt in battery. Note the position of the bolt cam pin.

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eral 5.56 ammo, the bolt did fail to go into battery when released. Because the RDB's design is so enclosed, it was difficult to see up through the magazine well but it was obviously that the bolt came to rest too far to the rear as the bolt lugs were visible. Repeated racking of the operating handle either caused the jam or cleared the jam. It was time to do some exploratory surgery. I disassembled the RDB and tried fitting the Bolt and Barrel groups together by hand.

It was obvious that the bolt carrier needed to be perfectly aligned with the barrel and looking at the inside of the receiver the bolt carrier guide rails could be seen.

I used the receiver as a guide for the carrier, a function it normally does in an assembled RDB, and brought the Barrel group together with the Bolt group without the action spring or action spring rod in order that the Bolt group could be slid to and fro as needed.), exhibiting the extractor at the 6 o'clock position so that empties are tilted downward for ejection out the bottom of the RDB. Despite the different configuration of individual components, the RDB's bolt is similar in concept to that of an AR.

It became apparent that there was considerable play between the bolt carrier and the guide rails inside the receiver, approximately 0.090" total as measured by calibrated digital caliper. So much so that the bolt carrier could be tilted from side to side ("yawed") and in doing so, the front faces of the bolt lugs would be offset from the gaps between the lugs in the barrel extension and the bolt face would stop against the rear face of the barrel extension lugs.

In order to prove the theory of too much clearance between the guide rails being the cause of the problem, I called a friend whom I knew to have an RDB and asked to take a look at it and get confirming measurements. In the meantime, as an experiment I placed the receiver of the problematic RDB between the padded jaws of a small bench vise and applied some clamping force to the receiver so as to force the guide rails closer to each other in the area where the bolt carrier would be with the bolt in battery.

Numerous repeated cycles of the bolt carrier resulted in no more "hang ups" of the bolt face on the barrel extension face with the receiver so "pinched" and the receiver assembled to the barrel group.

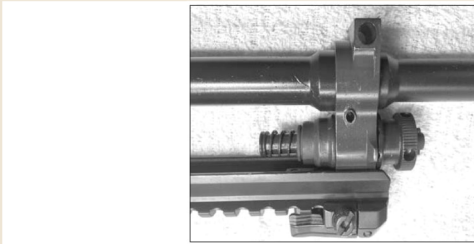
Knowing the receiver to be heat treated just from the audible "ring" it made when bumped against another metal object, and also knowing that the owner had recently purchased the RDB new, I advised him to contact Kel-Tec, explain the problem, and email them a copy of the sales receipt and take advantage of the lifetime warranty to the original purchaser. They would email in turn a prepaid shipping label and he would merely need to box it up, contact a shipping carrier driver, and wait.

Just before shipping the problematic RDB to Kel-Tec, my friend brought over his RDB and a quick examination through the magazine well showed that there was significantly less clearance between the bolt carrier guide rails in the receiver in his RDB than in the customer's. Disassembly of both bullpups and measurement of the rail spacing in the receivers yielded the shocking result that the rails of the RDB with the bolt hang up issue were 0.040" widerspaced than those of RDB from my friend.

There was simply too much "slop" between those rails to accurately guide the carrier and bolt into battery with 100% certainty. The wait for Kel-Tec's turnaround for the RDB's repair turned

THE KEL-TEC RDB CONTINUED

ORIGINAL PAGE 9



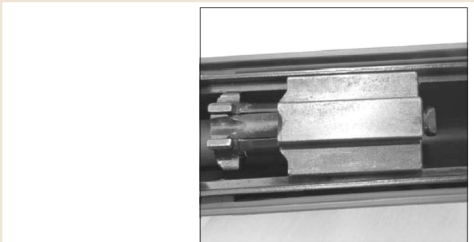
Right: Components of the RDB barrel group shown here include the barrel, gas block and regulator, short stroke gas piston, and M1913 Picatinny sight rail with folded Magpul MBUS Pro front sight mounted. Far right: Brass punch shown removing the floating gas piston to the rear. The piston is retained in the gas block by the front of the action spring rod.

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Right: Components of the RDB barrel group shown here include the barrel, gas block and regulator, short stroke gas piston, and M1913 Picatinny sight rail with folded Magpul MBUS Pro front sight mounted. Far right: Brass punch shown removing the floating gas piston to the rear. The piston is retained in the gas block by the front of the action spring rod.

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Below left: The RDB floating gas piston assembly showing three gas seal rings at left on the gas piston and the spring loaded gas piston driver at right. Below right: The loose fit of the bolt carrier between the rails which caused intermittent failures of the bolt to go into battery and sticking operating handle. The bolt carrier guide rails inside the receiver were 0.040" farther apart than the guide rails on a second, problem-free RDB measured by the author.

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Below left: The RDB floating gas piston assembly showing three gas seal rings at left on the gas piston and the spring loaded gas piston driver at right. Below right: The loose fit of the bolt carrier between the rails which caused intermittent failures of the bolt to go into battery and sticking operating handle. The bolt carrier guide rails inside the receiver were 0.040" farther apart than the guide rails on a second, problem-free RDB measured by the author.

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Far The piston is retained in the gas block by the front of the action spring rod. out to be about seven weeks and the owner anxiously brought it over for examination. When we unpacked the rifle, the receiver had the same serial number as before. Prior to shipment we had applied a small ID mark to the interior of the receiver and that telltale was there. It was the original receiver, but what of the guide rail spacing?

The rails turned out to be closer together but only in the area where the bolt carrier would be with the bolt entering battery / engaged into battery. The guide rail spacing near the butt was still approximately 0.040" wider than that of the RDB owned by my friend but only 0.009" wider at the critical spot where the carrier would be as the bolt entered battery. The bolt carrier guide rails inside the receiver were 0.040" farther apart than the guide rails on a second, problem-free RDB measured by the author.

We took turns repeatedly cycling the bolt carrier manually, probably 300-400 times the evening of the RDB's return from the Florida factory. Not a single hang up occurred. The proof of the pudding being in the eating (to correctly state the adage), as soon as he could the owner took the "factory-adjusted" RDB to the range and called me reporting that in six 30-round magazines fired there were no hang ups or stoppages of any sort.

While I believe it would have been possible to use a padded vise to permanently "spring" the sides of the receiver closer together to reduce or eliminate the excessive gap between the bolt carrier guide rails, controlling the necessary amount of plastic deformation of the receiver may have been problematic. Squeezing the sides of the receiver sufficiently to get the metal to "move" and not spring back could very well have resulted in the guide rails being too close, requiring re-spreading of the receiver.

Tempering back the receiver, adjusting the spread of the guide rails, and retempering to the original hardness would have been the technically correct remedy but that would likely have required refinishing and may have affected the appearance and readability of the etched serial number. If the RDB had been purchased secondhand, the factory warranty would have been void. I would have explained the planned repairs to the owner and with his sign-off as to understanding the risks, proceeded with pinching the receiver.

However, given the Kel-Tec lifetime warranty to original owners, and it being anew firearm, I'll stand by my recommendation to the owner to ship it back to the manufacturer. In this case it was best for all parties for the problematic RDB to go back to the factory. AG

HISTORY

Parker Brothers Shotguns, Part Two

Once you find and obtain a classic Parker, it will likely be in need of some repairs, especially if you paid a less-than-premium price for it.

BY PAUL MAZAN FEBRUARY 2019

ORIGINAL PP. 10-13

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My tastes are simple. I am always satisfied by the very best there is. Unfortunately, I can't afford that so I come as close as I can. Last time we looked at some history of the Parker Brothers shotguns and how to tell a real Parker from the fakes. This time we'll look at some common repairs you may find are needed on a used gun.

Stock Work I have covered major stock repair in several articles and rather than bore the reader with yet another description of how to use threaded rod to hold stocks broken at the wrist together, let's look at some of the more common crack, dent, and scratch repairs found on most old guns that have spent a considerable time in the field in their long lives. Most double guns of any age and use will show cracking behind the receiver and/or tang.

This is mainly because the design of the double is almost a perfect splitting wedge. You take a fine piece of walnut, hollow out the end for a depth of three inches or so to hide the action parts in, and bolt a heavy, hard-kicking machine on it. As if that weren't enough, you

put an upper and lower tang on it just to be sure it concentrates all that force in one spot in I found a surprise under this broken buttplate. A group of signatures and the date 1892. The gun was made in 1890. I wonder who those fellows were?

As found, this once proud Parker GH was broken, battered, and held together with cord, nails, and a nut and bolt. the middle of the wood. The only thing worse is to put a sideplate on it like the old L. C. Smith so you then have all four sides being hammered on and nothing more than four little fingers of wood to stop them.

Then, just in case we have somehow contrived everything to take a couple hundred years of punishment without splitting, we oil the bores and the interior workings and stand the gun in the corner of a closet or a gun cabinet resting on its butt. Now we come to the scientific part of the whole thing. There is this force called gravity. It pulls everything down toward the center of the earth. Apples from trees, gun parts from benches, and oil from barrels and action parts. To get to the center of the earth that oil

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After stripping the remaining finish, pulling out the nails that could be pulled, and removing the bolt and nut, the stock is immersed in turpentine for two weeks to leach the oil out so glue can stick to the wood for repair. A piece of the toe was broken off so a new piece of walnut was shaped and glued in place. Final fitting is done after the glue sets up. must first pass through the stock.

The stock, however, is porous wood that traps the oil and holds on to it until it rots and pieces of the stock along with the oil in them fall to the ground. While waiting for the wood to rot the oil soaks into it and makes it soft, making it easier to split. It also will keep glue from holding the wood together when you try to repair it. Like the toe, aside had been chipped off the pistol grip. The area was flattened and a piece of walnut was glued in place.

After allowing the glue to set the repaired grip section was contoured to blend in. All of that was just to get you to understand why that beautiful, carefully finished piece of cracked walnut has nuts and bolts, nails, and wood screws going through it. Some previous owner tried to fix it and stop it from cracking further. He carefully spread the cracks and dropped whatever glue he had around the house into the cracks and clamped them closed.

Unfortunately, the oil in the wood would not allow the glue to stick to the wood. It acted as a release agent and the next time he shot the gun the cracks reopened and got worse. No matter how many times he tried or what glue he used the results were always the same. Your results will be equally poor unless you get the oil out of the wood.

Finally, in frustration our intrepid hero who didn't know to get the oil out first gave up on glue, got desperate, and resorted to the wood screw, nails, and—in the case with the gun in the pictures here—a nut and bolt. It worked, after a fashion, for awhile. The cracking stopped but the wood continued to soften and the gun went from a thing of beauty to an embarrassment. Lucky you, for if it had worked chances are you wouldn't now own the gun at the price paid. So, how do you do it right?

First, strip all the finish off the stock and get it down to bare wood. You will probably notice that the wood near the receiver is much darker than near the buttplate. That dark color is oil and dirt. The farther down the stock it extends the longer the oil has had to leech into the wood or the more oil was used. The oil will have penetrated all the way through

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Using a drill press and a Magna- Tip bit that fits the slot, the screwdriver bit is held in place vertically and the downward pressure from the drill press will keep the bit from camming out of the slot. A trick I learned on YouTube. Using a gluing clamp and a piece of dowel rod, the mainspring is held under compression with the holes aligned, making inserting the pin an easy task.

The pin is pushed half way through and then the other side is compressed and aligned so the pin can go through the rest of the way. The stock in the really bad areas and only part way in the rest of the stock. Nothing done strictly on the surface will fix this but I like to start off by scrubbing the stock under a running tap with hot water, soap, and a good, stiff brush. You will see your rinse water running off dark brown.

This is a mixture. The Vspring for the top lever is cut out of 1095 spring steel, ready to be heated, bent, and heat treated. This is a very inexact way to make a spring but works in an emergency. A supplier for correctly-

made and heat-treated springs is listed in the article. Small pins were impossible to remove without further damaging the surface. They were driven deeper into the wood so the area could be checked over. Of stain and oil and dirt and simply speeds the process.

I've tried heating and wiping the oil off, I've tried oven cleaner after letting the stock sit in the sun. I've scrubbed it with pretty much every super cleaner on the market and in time oil always leached back to the surface. The only method that has worked for me is to immerse the stock in a solvent for extended periods of time. Paint thinner works as does mineral spirits but I like old fashioned turpentine the best.

It stinks and you will need to leave it in the garage or some covered space so the wife doesn't kick you and your witch's brew out of the house. I will let it soak for at least two weeks, sometimes longer. As the solvent dissolves the oil near the surface, the oil floats out of the wood, the solvent leaches in and is exposed to more oil until, theoretically, all

the oil is now in the solution in the tank and no longer in the wood. The tank will have gone from clear to a dark gray.

Once the stock is as near oil free as it is ever going to be, hang it in a place with good ventilation for another two weeks for the solvent to evaporate out. Now you can spread the cracks and force in as much good wood glue as you can into the cracks and clamp the stock together. When cured, that treatment should hold up for years, or least none of mine have split again and I have been using this method for at least the last three decades. Dents can be steamed out with a wet rag and a hot iron and gouges.

Nail holes and screw holes can be filled with a mixture of sanding dust and glue. Carefully clean out any dirt remaining in the gouge or hole. With the sanding dust or sawdust in a container, mix in wood glue and make a paste, then use a scraper to force the paste into the hole. Once

PARKER BROTHERS SHOTGUNS, PART TWO CONTINUED

ORIGINAL PAGE 13

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With the pistol grip recheckered, the pins are much less noticeable. dry sand, stain and re-finish with the rest of the stock. The filled holes will show up as dark spots but will look a whole lot better than the screw and nail heads. I have heard that there is now a clear wood glue on the market and I'd like to try that to see if I can get it to match the rest of the stock color better. Unfortunately, I haven't been able to find it locally.

Other Parts One of the most common problems I seem to encounter with the Parker guns is a broken or very weak top lever spring. For years I have made the flat Vsprings from 1095 spring stock I get from Brownells. I've done this only because I could never find anyone that had the springs. Spring making is an art and as far as artists go, I'm a fair mechanic.

In other words, not very good but I have made some serviceable springs by cutting and filing the spring steel to shape. No longer some collector's dream because it has been altered and refinished, I have a Parker I can be proud of and shoot with black powder shotshells only. heating it to red hot, and bending it to the shape I want. I will then let it cool, file it to fit, reheat it to red, and

quench it in oil. Once cool I leave the oil on it and set the oil on the part on fire and let it burn itself out.

This seems to anneal it well enough that the spring works in the gun without collapsing or breaking. I give any credit for this working to the steel and not the author. I recently discovered that Wolff Gunsprings (GunSprings.com, has an assortment of Vsprings for old revolvers that might have a size that would work here. Bob's Gunparts (gun-parts.com, gunparts@hsnp.com, in Royal, Arkansas actually has springs in stock that can be fitted to the Parker.

These seem to be made by guys that know what they are doing and I strongly advise you buy your springs there. The disassembly of the Parker is reasonably straightforward and if you have any doubt, I suggest You Tube for a video in how to disassemble and assemble the gun. I could find no written assembly/disassembly instructions but could find You Tube videos demonstrating this so I could study the procedure before I messed it up.

One of the best reassembly tips I ever picked up was on a You Tube video that showed how to use a gluing clamp and a piece of dowel or

drill rod to compress the mainsprings and hold them in place as you line up the holes and insert the pin. That sure has saved me a lot of cussing and searching for parts that took off to unexplored places in my shop. As a final tip, I owe this one to my mentor and friend Reid Coffield, the retired Gunsmithing editor for Shooting Times.

This pertains to any stock work where you need to match the color of one part to another, such as a refinished buttstock to a forend. Reid cleverly took every stock stain he could lay his hands on and stained a section of plain walnut with it and labeled a Popsicle stick with the name of the stain he used. He got some interesting results from light to dark.

Now, when he wants to match a color he pulls out his test board, lays it alongside the piece he is trying to match, and uses the stain that matches rather than guessing and fiddling trying to darken or lighten it. In case you are wondering when your gun was made, the Parker Gun Collectors Association (ParkerGuns.org, Wells MA 04090) has a webpage with a link to the year each serial number range was produced. AG

FROM THE ARCHIVE

Lab Radar

Doppler radar technology offers improvements over ballistic chronographs with older-style optical sensors and screens.

BY ROBERT KOLESAR FEBRUARY 2019

ORIGINAL PP. 14-16

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Every hardcore shooter needs a chronograph. If you're a reloader, even more so. If you don't have one, you're just guessing. I did a lot of that (guessing) in the past. I attempted to get a more accurate velocity picture by talking to the ballistics experts at the various ammo companies but those became "educated" guesses over the phone. You can't factor in barrel length, bore wear, temperature, etc. when trying to figure out accurate velocities for your particular load.

It becomes even more of a crapshoot if you're testing reloaded ammo. Shooting a rifle accurately is a precise science; guessing is not the way to go when estimating bullet drop or comparing your favorite load to similar cartridges. Each rifle and round is different; some radically so. The same is true for pistols. The problem with the olderstyle chronographs is that they're fragile, a pain to set up, and complicated to use. Readings sometimes aren't as accurate as you'd want.

Weather (mild wind or a little precipitation) makes use problematic. Using a standard chronograph is also difficult if you're shooting on a range with several shooters; the series of screens that need to be set up in front of the rifle/pistol being tested sometimes fall down, re-

quiring you to stop firing and walk out in front of the line and re-set them up. Time consuming. Sometimes a little shifting of the unit and the rifle may be necessary to gain a reading.

If you're using a muzzle brake or a large-caliber rifle, a barrier must be placed between the muzzle and the Lab Radar. Unit should NOT be in front of the muzzle when firing. Compact, lightweight, and easy to use. and a nuisance to the other shooters. I didn't want to deal with all that and did my best to get by, like many other shooters, by believing the published data, checking with the ammo ballisticians, or asking a friend with a chrono to help me out. Not the best solution. Enter the Lab Radar.

No screens to shoot through, easy to set up, and simple to use. It's compact, light, and goes anywhere; it looks like an average laptop computer when it's in its travel bag. For a guy like me that resisted the computer technology onslaught in the early 80s, it's easy to figure out. The instruction sheet is basic, well written (as in understandable) and uncomplicated. I fell in love with this unit the first time I used it and wondered how I'd gotten by without a chronograph before this. It works

LAB RADAR CONTINUED

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You can download data using an SD card (SDHC) or USB to your computer. Six AA batteries will get you started. It's recommended that batteries be removed if you're not using the unit often or placing it in storage. With pistols, bow and arrows, pellet and BB guns as well as rifles. The Lab Radar is actually a Doppler radar unit, not a chronograph, but does the same thing of measuring your weapon's projectile velocity.

And it does it easier, quicker, and Probably the biggest lesson learned after a couple of sessions with the Lab Radar was how wrong I'd been in "guestimating" my velocities. For instance, I figured that shorter barrels always translate into lower velocities. That's been the conventional wisdom longer than I've been shooting. Not true, usually. Two or

three inches on a barrel aren't enough to make a measurable difference, depending on the load.

Of course, a radically shorter barrel will produce lower velocities but even then the actual velocity is sometimes not as bad as you'd think. It's an individual thing that depends on the barrel and its internal smoothness, barrel wear, ammunition load, weather (how hot or cool it is when you're shooting) and the actual bullet weight and construction. The Lab Radar ends the speculation and the off-base estimates.

Here are a few examples of actual velocities I recorded using a new Savage 110 Storm .270. This is "aimed" at the target before use. Savage has a lightweight 22" stainless factory

barrel. What's interesting is the lack of a large velocity loss between the industry standard 24-28" test barrels and a light factory 22" hunting barrel. Shorter barrels don't take a back seat to long tube, velocity-wise.

I recorded a series of velocities over a period of four range sessions. All readings were taken from an average of three shots, fired in three-shot groups. I let the barrel cool for one minute between rounds. Temperature was about 85 degrees—typical central Texas late spring weather. Federal Non-Typical Whitetail 150 grain has a published velocity of tested actual velocity of 2802 FPS. Federal Partition 130 grain publishes 3060 FPS and tested 3027.

**FEDERAL FUSION 130 GRAIN
PUBLISHES 3050 AND TESTS 2920
WHILE FEDERAL**

LAB RADAR CONTINUED

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Carry bag, metal adjustable stand, and a USB cord are also available. 30-06. Some shifting of the rifle and Lab Radar unit may be necessary to get the muzzle within the recommended 18" to work properly. Unit should not be in front of the muzzle. Power-Shok 130 grain publishes 3060 and tests 3065. Using The Lab Radar After looking over the instructions (a quick, ten-minute read), I set up the Lab Radar for use on the bench.

Six AA batteries were inserted to gain power (Lab Radar recommends removing the batteries after use). You can also hook it up to a USB if you want to use your computer or external battery. I placed the unit to the right of the rifle, turned on Lab Radar Specifications Manufacturer TCK, LLC Power Requirements 6 AA/USB Frequency Range 24.080 to 24.168 GHz (8 MHz steps) Nom.

Transmitting Power 4.84 d Bm Dimensions 29cm by 26cm by 6cm Weight 2.1 pounds Mounting Hole Thread 1/4 by 20 Velocity Range 65-3900 FPS Memory Type Capacity

SD Card, 32Gb max. Time between shots 2 seconds Accuracy +/-0.1% (+/-1m/s @1,000m/s) Operating temperature 14-104 degrees F Environmental Conditions Indoor/Outdoor MSRP \$559.95 Contact myLabRadar.com, the screen, and "aimed" the Lab Radar with the small "V" at the very top/center of the unit at the target.

I then shifted my rifle and the chronograph until I had the muzzle well within the recommended 18" of the unit. The Lab Radar unit should not be placed in front of the muzzle. If you're using a muzzle brake or a really large-caliber rifle, a barrier must be inserted between the muzzle and the Lab Radar to protect the unit. After programming the screen, I fired a couple of shots to get the rounds on-target and to gain a preliminary reading. Too easy.

About the only thing that might get tricky is the muzzle's distance from the unit. After fooling around and firing a few shots, I came up with the correct relationship and distance from the rifle's muzzle to the Lab Radar box. Setting up for subsequent range

sessions was a snap, using what I learned the first time out. Getting a reading was instantaneous. Waiting all of two seconds is required for subsequent shots. After I finished, I uploaded the stored data to my computer, using the USB and an SD card.

Great for analyzing your rifle's performance and load for future comparison and testing... so twenty-first century. If you're shooting a rifle or pistol a lot, either in competition or doing extensive research on your reloads, the Lab Radar makes data collection for future use easy. It's also nice to know what the velocity of your favorite factory load is, instead of just reading the ammo box. I'll be buying the Lab Radar after I'm done.

It's become a critical part of my kit now when testing pistol loads for Bullseye or getting an accurate velocity on a favorite rifle. It works as intended, is easy to use, and fills a critical need for data that serious shooters need during load development. My Lab Radar will be with me on all my future range outings. AG

MACHINING

Save Money With Used CNC Machinery

Interested in manufacturing guns or parts? Want to automate some of your shop work? A CNC machine may be an ideal fit and buying used can save lots of money.

BY CURT DOHERTY FEBRUARY 2019

ORIGINAL PP. 17-18

CNC gunsmith machine shops are involved in manufacturing guns and parts. Gunsmiths use a computer program run by software and a CNC milling machine to accomplish a set of tasks. Consider repairing obscure or old firearms with no replacement parts available. Programmed with the correct dimensions and specifications, a CNC machine can largely automate making needed pieces. Another possible job is making customized versions of existing guns that would be time and cost prohibitive to build strictly by hand.

If you're so inclined, the right CNC machine could turn your shop into a manufacturing facility where you could design and create anew firearm that does not resemble any other on the market. If you are interested in gunsmithing in your home shop or to expand your existing gunsmith business, you can master such jobs and create a profitable business with the right equipment.

Used CNC gunsmithing machinery is a great way to save on costs and start a machine shop that lets you manufacture parts and guns meeting your choice and requirements. I'm the CEO of CNC Machines (CNCmachines.net, a used CNC dealership based in Sanford Florida. Our company has over 14 years of experience in helping manufacturers and gunsmiths get the best machinery for their projects. The CNC gunsmith process involves creating the design of the part to program your milling machine.

These machines come in a variety of sizes. Bigger models are more expensive than smaller machines which fit in a limited space. The process also requires using the CNC machine to contour, surface, drill, and engrave blocks of aluminum or steel according to the program. When finished, the parts are coated with anodized paint and then assembled together to get the creation ready for testing. Milling machines are the most widely used type of CNC machines around the world.

Top brands of CNC mills include Mazak, DMG Mori, HAAS, and Okuma. A variety of models from these brands are typically available at used CNC machine dealers to save you a lot on your purchase while serving you the most efficient machine for your gunsmithing jobs. Top CNC Machine Brands Mazak. With a reputation dating back to hundred years, Mazak is used everywhere from agriculture to aerospace. It is one of the leading brands that make all the types of CNC machines including mills.

Their 5-axis machines are specifically notable. Mazak is also popular for creating out of the class multitasking machines that handle turning, boring, milling, and other tasks in one unit. Consider a used Mazak CNC machine to get fully functional equipment within your budget. DMG Mori. This Japanese manufacturer is a specialist in 5-axis and has a global presence.

DMG Mori boasts locations in six continents of the world, warehouses full of replacement parts, and an outstanding 24/7 customer support to offer one of the best brands to work with in the world of machining. They manufacture some of the most powerful CNC machines with their CMX series being particularly popular for blending ease of use with precision. If you are a machinist on budget, used DMG Mori mills that guarantee 24 hours delivery on spare parts are a great choice. HAAS.

This is the only American milling machine manufacturer on this list and has been around in the market since the 1980s. Not only do they carry out all their manufacturing and production in the United States but also offer affordable prices and helpful, comprehensive tutorials on different aspects of mill operation. For experienced shop owners, HAAS delivers the quality that beats Japanese and Korean manufacturers. Used HAAS mills are often an ideal one-size-fits-all choice for those interested in making guns. Okuma.

With the largest distribution network across America and more than a century of industry experience, Okuma stands as one of the biggest players in the machinery world. This brand is the only single-source provider with CNC machines, motors, drives, spindles, controls, and encoders manufactured in-house. This is made possible with the innovation and cutting-edge technology they use to

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manufacture whatever they do. This is true for their milling machines as well. A recent development from Okuma is their App Store that works similarly as those used with smartphones. Okuma is a perfect choice for all those who are interested in starting a gunsmithing shop or CNC machine shop. Buying New or Used? As a gunsmith looking to purchase a CNC machine, you may wonder whether new machines are the best options out there. Certainly not.

Used CNC machines can deliver the efficiency and productivity just as anew machine does when you buy right. There are a number of important advantages of buying a used CNC gunsmithing machine. The first is machine cost. CNC machines can be a huge investment for your machine shop. Buying a used machine gives the same capabilities and functionality as anew one but is a more affordable choice for your business. Be careful and do not buy a used CNC machine on the basis of price tag alone.

Keep a watch on sellers trying to push older ma- They are cost effective and the easiest to repair. Our business (CNCmachines.net, specializes in finding good, used CNC machines for any shop or project. chines which are not reconditioned and are in complete disrepair. Work with a trustworthy used CNC machine dealer who can deliver you a well-maintained and functional CNC machine in your budget. Next is machine quality.

Quality of functionality is the advantage that older, used machines will always have over newer ones. Used models, upon reconditioning, are better options for buyers as they are remodeled to top working order. Moreover, they offer much time to identify any problem, differences between models and drawbacks, etc. When you work with an experienced and qualified CNC machine seller, you get machines that work to the highest capacity even after years. Finally is machine maintenance.

One of the biggest reasons why some used CNC machines are worth more than newer machines is experienced when you find a seller who knows how to recondition them. Buying a reconditioned machine delivers you the quality of function, faster RPM maximums, and longer running times. Used CNC milling machines and lathes are reconditioned to run for longer years and keep serving your production.

When you want to buy a CNC machine that proves to be a great piece of equipment rather than a problem dumped from somebody else, make sure you purchase a machine from a reputable, reliable dealer that offers support and service for your machines. Buying a used CNC machine from the right place can get you a cost-effective way to start your parts making and/or gun manufacturing business.

AG When we do find these available they are great at scalable production and are most likely purchased by manufacturers looking for a very stable machine.

RIFLES

Marlin 60

The Marlin 60 is a ubiquitous .22 rifle and one is likely to eventually find its way into your shop. Here's how to disassemble, maintain, functions check, and fix it.

BY ROBERT K. CAMPBELL FEBRUARY 2019

ORIGINAL PP. 19-21

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The Marlin 60 .22 Long Rifle semiautomatic rimfire rifle is a remarkably long lived firearm with millions of examples in service. In over forty years of dealing with firearms I can state that I have never seen a Marlin 60 failure related to the design or manufacture. Neglect in the form of a failure to clean, corrosion, and simple wear has been the usual culprit behind malfunctions of any type. Disassembling the Model 60 is easy, so simple in fact that you may do so with only a screwdriver.

That is probably a record of some type. Before looking at the common problems and how to fix them, let's dive into disassembly. Remove the magazine tube and shake the ri-

fle with the muzzle downward to remove any cartridges. Replace the magazine tube, rack the bolt to the rear and be certain the chamber is empty.

Without the force of the magazine spring it is possible that a cartridge might be stuck in the mechanism, so be certain to empty the magazine and replace it and then confirm the piece is unloaded and the slide racked while the magazine spring is in place for the final fail safe check. With the chamber verified empty, remove the magazine tube and spring assembly by twisting the tube to the point that the tab on the tube releases its hold on the magazine tube itself.

Next, with the rifle secured in a padded vise, remove the front and rear take down screws. Leave the screw at the front of the trigger guard as well as the Phillips head screw on the right of the mechanism in place. The receiver is simply pulled away from the wooden stock. The trigger and safety need not be removed but remove the assembly post with finger pressure toward the bottom. Never exert too much force on a plastic part!

To the best of my knowledge, this part has been plastic since the beginning of production. With the assembly post removed, the hammer mechanism should spring up. Pull the hammer mechanism

MARLIN 60 CONTINUED

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toward the rear and you will note two small ears toward the front. This part is easily removed. There is a resemblance to other hammer assemblies including the M1 and M1A. At this point the Marlin's bolt is visible from the lower receiver and there is a recoil spring that will be compressed at this point. It is desirable to remove the bolt now and it must be pressed or pulled to the rear approximately one quarter inch.

Press the rear of the bolt down at an angle and the bolt face should begin to rise out and away from the receiver. This will free the cocking handle. Little force is needed to free the cocking handle and it most often simply falls out of the bolt. When removing the bolt from the receiver be certain to control the

bolt as the recoil spring holds the bolt under tension. This is all that is needed to field strip, examine, and clean the firearm.

At this point examine the parts Most of the time a good cleaning followed with lubrication solves the problems encountered with feed reliability and function. Function Problems If there is actually a problem with the rifle's function it will likely be due to one of five springs. These springs include the Extension Spring, Ejector Lifter Spring, Sear Spring, Disconnect Spring, and Hammer Spring.

You will note as you disassemble the rifle that there are C-clips holding the pins in place in the receiver in the hammer mechanism. These clips are easily changed with a pointed screwdriver used to apply leverage to

them and then simply pushing off of the pin. To change a spring, remove the C-clip and partially remove the spring retaining pin to slide the spring off. Replace with a new spring from Brownells and you are good to go. Failures to feed, load, fire, and eject sometimes occur with every firearm.

When the bolt does not completely close on a loaded cartridge then there is a good chance the recoil spring has a kink in it. To attempt a stop gap if you do not have a new recoil spring on hand, straighten the recoil spring with pliers. When you replace the recoil spring be certain the spring isn't riding against the bolt's rear but rather that it is contained in the opening in the rear of the bolt for proper function. Failures to load, feed, and chamber are often a result of powder

MARLIN 60 CONTINUED

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der residue caked on the rifle. The .22LR cartridge is a dirty round and both lead lubricant on the bullet itself and powder residue will clog the rifle's action. Clean thoroughly and be certain that lead slick and powder build up is eliminated. A common hiding place for sludge is the extractor indent. The Marlin has extractor indents on each side of the chamber. These areas must be thoroughly cleaned, otherwise, build up will stop the extractor and impede function.

After cleaning these areas and the feed way check for proper bolt movement. Interestingly enough, the Marlin 60 is among a very few tubefed rifles that will benefit from some lubricant in the magazine tube. Conversely, since the .22LR is a dirty cartridge with bullet lube and powder deposits common, take it easy on interior and bolt lubrication. As for failures to fire, if the rifle doesn't fire after a good cleaning and lubrication the firing pin may be well worn.

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This isn't unusual in very old .22 rifles of any type as they seldom use hardened steel. The hammer spring may be weak. In a case of too much knowledge meets too little knowledge, some gunsmiths have clipped the hammer spring in order to produce a lighter trigger. The result is often a failure of the rifle to fire due to insufficient firing pin energy. Check the firing pin; the edge of the firing pin should be a chisel edge. There is also a small slot in the bolt with a pin that holds the firing pin in place.

This becomes worn and allows the firing pin to wobble. Also, leaving the bolt locked open isn't good and will cause wear on the firing pin spring. Occasionally, the Marlin 60 or the newer Marlin 795 are delivered with an over-strength recoil spring. The bolt will not completely close during cycling in this case. It is a simple matter to clip (Continued on page 23)

MARLIN 60 CONTINUED

ORIGINAL PAGE 23

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a few coils off if such a spring is encountered. A failure to extract with the Marlin is generally traced to the same problems as identified with other .22 self-loading rifles and usually indicates a need for the bolt and extractors to be cleaned. Check the extractors and be certain that they are clean and that the extractor hook is sharp. If not, they may need to be cleaned and the end trued up with a jeweler's file. Or in the worst case, they may need to be replaced.

Regarding accuracy improvement, these rifles are generally accurate enough for hunting, informal target practice, and training young shooters. With the CCI Mini Mag loading they may exhibit a two 22 rifle bolt in the middle of cleaning. Quite a bit of elbow grease was needed! One is the primary extractor and the other simply spring loaded and primarily a guide. to three-inch group for five shots at 50 yards and that is plenty accurate. The front bedding screw is a fertile field for experimentation.

If you tighten it too much it will adversely affect accuracy. Usually the mid point of tightness is best, but experimentation at a modest 25 yards will often demonstrate a good solid group. By the same token, be careful when tightening the trigger guard screws. The trigger guard is plastic and is easily cracked or out right broken. The Marlin 60 .22 is a common firearm certain to visit the shop from time to time.

The fixes are simple and if you need a small part or spring they are very inexpensive and readily available from Brownells. AG

RIFLES

FN FAL “Frankengun”

The “Right Arm of the Free World”, the FN FAL has numerous variations. This sometimes leads to builds becoming a sort of Modern Prometheus with mixed parts. Here’s how I returned one to function.

BY DAVE STROM FEBRUARY 2019

ORIGINAL PP. 22-23

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The Fusil Automatique Léger by Fabrique Nationale Herstal is a famed self-loading battle rifle made in over 90 countries in vast numbers and variations. At one time many were declared surplus and the receivers cut apart. American companies bought this “scrap”, made receivers and other parts, and then assembled the semi-automatic rifles for the American market. These guns have been made with parts in various condition. They might be like new or worn out.

The phrase “tolerance stacking” takes on a whole new meaning with some of these rifles. Many manufacturers are out of business due to shoddy manufacturing, adding further to the range of quality. Some, of course, are top notch in quality. Recently one of these FN FAL “Frankenguns” was brought to me

for repair. All I was told is it would not cycle. FAL rifles have a gas Take care to restrain other parts.

Given the range of tolerances of numerous parts, finding a plug that just happened to be larger and large enough to seal would be blind luck. Instead, I retrofitted the plug I had as shown. ” Numerous makes creates numerous parts. Just the sort of thing leading to a mixed “Frankengun.” system the can be adjusted as well as completely turned off. Owners commonly do not understand this and have it so far out of adjustment it will not cycle. In this case, testing revealed this was not the issue here.

Further investigation revealed the gas port was partially blocked. Clearing is was easy and there was no burr in the bore. The gas tube has two slots and must be pinned to stay open and in place once adjusted. Simply thread it in until the slots are wide open. The

pin was missing in this case but these are quite simple to make and install. Use soft steel and dress it down flush with the tube. Despite the fix, testing found it still would not cycle.

The barrel on this rifle was well over the legal length, not even including the removable muzzle break. However, this was still shorter the original barrel. I opened the gas port to 0.121. Though further testing demonstrated this improved things, this was still not the full cure. From the start, I knew a lot of gas was leaking out of the gas plug. This was clear from the carbon visible around the plug. I had placed masking tape from the left side, around the front of the gas plug, and to the right side.

Firing one shot would blow the tape off the rifle, demonstrating the leak. Finding a plug that was over size

FN FAL "FRANKENGUN" CONTINUED

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for a refit would be difficult at best as no parts supplier was going to measure them for me. Buying a box full of plugs in hopes of finding one that fit was out of the question. I did buy one and it helped a bit but was still not cycling fully. The solution was a sealing ring on the gas plug that would rest against

the gas block. I used the sealing washer from a spark plug to make the seal. These washers are very soft and malleable.

First, make two cuts in the washer with side cutters and remove about a 1/8" section. Then, simply place it on a steel surface and tap many times with a hammer to thin the

washer. I needed 0.020 and had it reshaped in a few minutes. Bend the washer to fit around the gas plug. When installing the plug it should be a very snug fit. In testing I did not need the gas fully on to get complete cycling. This made a satisfying and cheap fix for a "Frankengun." AG

METALWORKING

Reader Forum

BY AMERICAN GUNSMITH EDITORS FEBRUARY 2019

ORIGINAL PP. 24

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Assembly Instructions I need assembly instructions for the Springfield Model 67 pump shotgun. I'm also looking for data on A. J. Aubrey outside hammer shotguns as well as a firing pin and spring. Finally, where can I get a recoil spring and guide for a 1915 Beretta .32 ACP? S. D. Shearman Artesia, NM A Springfield 67 Series (C, D, E) schematic with parts list is available from Numrich (GunPartsCorp.com, as Product #: PDF0425 for \$1.50.

Urban Armory has a schematic online (Urban-Armory.com/cart/blueprints/savst_m67.gif) and Reid Rifle Maintenance has a Springfield Model 67 video on

You Tube at youtu.be/lz0xEcs65II. Numrich has a section (aj-aubrey) on A. J. Aubrey shotguns (single barrel, double barrel, outside hammer, and side-by-side models) with schematics and parts, including firing pins and springs. Numrich is again your friend with the Beretta. They have a section dedicated to Beretta auto pistols dating 1915-1919.

Their Beretta 1915-1919 schematic with parts list is Product #: PDF0767. Recoil spring is Product #: 897780 and Recoil Spring Guide is Product #: 897790. Forgotten Weapons has a You Tube video on the Beretta 1915 (youtu.be/yVvPOiHGh7o). AG

SEARCHABLE ISSUE RECORD

Archive index

Top Dog American Gunsmith Editors	2	Save Money With Used CNC Machinery Curt Doherty	17-18
The Kel-Tec RDB Brian R. Smith	3-9	Marlin 60 Robert K. Campbell	19-21
Parker Brothers Shotguns, Part Two Paul Mazan	10-13	FN FAL "Frankengun" Dave Strom	22-23
Lab Radar Robert Kolesar	14-16	Reader Forum American Gunsmith Editors	24

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