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AND THE AMERICAN GUNSMITH ARCHIVE

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ARCHIVE ISSUE NUMBER

INSIDE THE ARCHIVE

ENCYCLOPEDIC ERROR

OSPREY RIFLE BOOKS • WORKING INEXPENSIVE 1911S • MODEL 94 CUSTOM REPAIR • REMINGTON MODEL 24: OLD OR...

ORIGINAL METHODS. MODERN ACCESS.

ARCHIVE EDITION 162

DIGITAL ARCHIVE EDITION

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RIFLES

Osprey Rifle Books

BY AMERICAN GUNSMITH EDITORS JUNE 2017

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The Industrial Revolution provided the technological means to mass produce sufficient quantities of reliable, rifled firearms to make formal, massed marksmanship a worthy pursuit for militaries. No longer considered a bayonet handle capable of a few volleys before the inevitable infantry charge, long guns required rewriting established tactical doctrine. Of course, since then technology and tactics have continued to evolve.

This is well summed up in a pair of books from our friends at Osprey Publications (OspreyPublishing.com). The Mosin-Nagant Rifle by Bill Harriman documents the important mass-issued repeater. Besides more recently becoming an increasingly-popular surplus rifle for sporterization projects, the Mosin-Nagant was an effort to modernize Russia's Imperial army in the late 1800s.

Armed with a mishmash of various single shots, needle, and bolt action rifles in a variety of cartridges, Russian commanders in the Russo-Turkish War still viewed the bayonet as the primary infantry weapon. This in 1877, about a decade after formal musketry and competitive rifle programs had been formed in other countries. Imperial officer Captain Sergei Ivanovich Mosin and Belgian designer Léon Nagant created the then-modern bolt-action repeater that bears their name.

Harriman, a retired auctioneer of militaria and firearms as well as avid collector, details the Mosin-Nagant's development and history well. Small arms evolved quite a bit since then. SA80 Assault Rifles by Neil Grant details the development of the current British family of 5.56mm NATO weapons. Beginning with experiments following World War II, Great Britain trialed a series of small arms that led to the SA80 series in the 1980s. Like our AR-15, it experienced a number of flaws upon initial release.

However, an improvement project done in partnership with Heckler & Koch led to the A2 version that has proved quite effective and reliable. Having competed with UK troops in Service Conditions events for over a decade, I can attest that British shooters and their rifles are consistent winners.

ORIGINAL SOURCE PAGE

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PISTOLS

Working Inexpensive 1911s

1911 parts compatibility is sometimes an issue. Here's what I've found about parts interchangeability and reliability working with 1911s from Armscor/Rock Island, High Standard, and Cimarron.

BY ROBERT K. CAMPBELL JUNE 2017

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After some forty years of working with the 1911 I realize that parts interchangeability is always a concern. No matter how reliable or well made a pistol, it will break or it will be modified. Inexpensive handguns end up in the shop most often. One of the most popular inexpensive handguns—and by all reports, a best-selling 1911 in the world—is the Armscor/Rock Island Armory 1911.

Recent figures indicate there are more Rock Island pistols sold than any other 1911 and I sometimes get questions concerning aftermarket parts and the compatibility of the pistol with these parts. These handguns are patterned after World War Two GI guns but with several changes. “The Rock” features along trigger and flat mainspring housing, making it easier to fit a beavertail safety compared to the original GI arched housing and short trigger.

The pistols are finished in a dull Parkerized finish and are Series 70 without a firing pin block. After working on sixteen or more of these pistols during the past few years I am able to make several observations. While we call them Series 70, we often mean GI mil spec. Rocks accept most 1911 parts with a minimum of fitting. Incidentally,

1911 handguns that are less likely to accept aftermarket slides, barrels, and other parts without fitting are high end handguns as they have a tighter fit.

Off spec, economy handguns sometimes suffer the same complaint. My purpose in writing this report is to share my experience with Armscor/Rock Island, as well as the nearly-similar High Standard and Cimarron pistols. Many of us were skeptical of the newer economy 1911s. After all, we had seen the terrible Llama, which wasn't a true 1911 clone, and other 1911s from the Philippines. Over time, the Rock earned a good reputation.

I have observed quite a few 1911 handguns in my training classes and many of them were Rock Island Armory pistols. Like most quality 1911s, when they arrive for class lubricated and with good magazines and ammunition, they prove reliable. I had a .38 Super needing the extractor tuned and the ejector properly staked. Another student 1911 needed anew extractor at less than one thousand rounds. However, I find these incidents unusual. One student subjected his pistol to a heavy practice schedule without a complaint.

Another suffered the indignity of having a handload blow in the chamber of his High Standard 1911, which is really a Rock by another name. The slide lock was blown out of the frame, the magazine was wrecked, and the floor plate never found. The shooter had to pick brass out of his cheek. Thank God he wore shooting glasses. The culprit, he believed, was a bullet that was jammed into the cartridge case upon feeding due to a poor cartridge crimp. The pistol was reassembled and it fired and functioned normally.

Since the magazine was blown out along with the slide lock, this was no proof load—it was well above that standard!—but the pistol did not suffer permanent damage. The Rock seems free from a loosening firing pin stop, a problem sometimes found in GI guns. The front sight seldom comes loose, although it did with my test gun, which is the only Rock I have seen suffer this indignity. The plunger tube also seems properly attached. As for feed with JHP bullets and handloaded lead semi-wadcutter bullets, I have

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yet to see a problem with the Rock Island Pistol. The typical Rock is reliable while the atypical Rock is easily repaired with an extractor or changing magazines. There are versions with adjustable sights and ambidextrous safeties but the prospect of upgrading the Rock with quality aftermarket parts was my concern. There are many that prefer the 1911 as close to GI as possible as there is little to go wrong, less weight, and less protrusions.

If the Rock is your recreational or competition shooter, some of the modifications listed are not needed. If you carry the Rock for personal defense—and many do—and wish to bet your life on the pistol, these upgrades are needed. I would be confident upgrading a customer's gun on his request. While there are pistols I would not recommend to anyone regardless of the modifications made, the Rock is worth the effort. Let's look into parts interchangeability.

Test Gun The test gun was a stock High Standard GI pistol purchased at a retail outlet. It was fired for function and accuracy and proved both service grade accurate and reli-

able with JHP and SWC ammunition in 500 test rounds fired. Proven to be of good quality, I decided to test compatibility with a number of quality aftermarket parts to give a pistol worth more than the sum of its parts. Most were purchased from Brownells.

I added the new Challis hex head grip screws, which I consider the standard on a hard-use handgun. Then, I dropped in a Wilson Combat, Colt, and Ed Brown Series 70-type firing pins. Each fit as designed, though I stuck with the original firing pin as it fit and worked just fine. A problem observed in a previous Rock was a "clocking" extractor that rotated in the extractor tunnel. A new extractor is a typical cure, but in that pistol the extractor looked fine and the firing pin stop was loose.

The pistol functioned but brass was thrown back into the shooter's face. The original firing pin stop could have been peened for improved fit but a Wilson Combat oversize firing pin stop was fitted. Filing was minimal—small strokes with a jeweler's file with the stop lubricated and bumped into place—and a good tight fit was achieved, adding a little

expense but cheap life insurance for a carry gun. Complete field stripping required more effort due to the tight fit but this is secondary with a defensive handgun.

I had a rather simple problem come to my attention with another Rock. The magazine did not drop free when the magazine catch was actuated and the magazine had to be removed by hand. The problem was the trigger bow was contacting the magazine. Careful, light filing on the bow solved the problem. A standard of custom pistolsmiths is to tune each magazine to the trigger and this is the reason.

Although we do so because we wish the trigger not to bind on the magazine for a smooth trigger action, achieving the proper drop with the magazine is also a good reason. Another problem—one that may also be addressed with training—are shooters using the thumbs-forward firing grip sometimes raising the palm off the grip safety, resulting in a failure to fire. It is simple enough to tune the Rock Island 1911 to release the grip safety a bit easier. We never deign to make the

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All worked well in the Armscor gun. grip safety inoperable, just tune it for easier activation. First, understand how the leaf spring works. Looking at the back of a 1911, the leaf on the right pushes to the rear and exerts pressure on the grip safety. Bend the leaf forward to reduce the pressure needed to depress the grip safety. Replacing the grip safety is another option but to retain GI appearance (or to save money) bending the spring is an option.

Care must be taken as the likelihood that inertia of the grip safety can overcome the spring in the case of a dropped pistol increases. It may be best if this modification is limited to competition pistols, such as a handgun for the Wild Bunch division in Cowboy Action shooting. The grip safety doesn't really need much pressure to be activated but it does need movement. Remember the contact area is where the bump on the grip safety contacts the trigger stirrup.

Safety Check Let's go over safety checks that must be done when any work is performed on a 1911. It is a shame but sometimes the safety operation of 1911 handguns leaves

something to be desired. The home gun butcher is responsible for much of this but occasionally it's a haphazard factory worker. Check the safety with method first used around 1912. Confirm the gun is unloaded with the hammer cocked and thumb safety on. While pressing the grip safety, pull the trigger. The hammer should not fall.

Try to move the cocked hammer to the rear; it should show no movement. If a faint click is heard, the sear moved slightly when the trigger was pressed with the safety on. One particular brand of 1911 often has this problem even though the trigger action is sometimes good. The safety is quite soft and spongy on these pistols and should be replaced with quality aftermarket parts. Next, take the safety off; the hammer should not fall. Some further testing.

I had a pistol was fitted with Cherokee Hills (Cherokee Hills.biz, custom grips. The design is a bold and personal one, and the adhesion during firing was excellent. Good aftermarket units like this can be a good idea. Rock Island Armory pistols often have cheap slabs that are not the best fit. High Standard

1911s have checkered grips that fit better. I ordered a Wilson Combat Extended Thumb Safety from Brownells (965- 600-007WB).

This safety seemed to demand more fitting that is usual with the 1911, but it was done and maintained a good sharp action. Trouble came when I fitted the Unotch rear sight I also ordered. From Harrison Design & Consulting, the Retro Rear Sight (100-004-784) is sometimes called the "old man's sight" as its open rear notch allows real ease and speed in finding the front sight and is recommended for fast shooting at close range. Advertised to fit the GI rear sight notch, the sight did not fit the High Standard notch.

Considerable file work was needed to file down and mount the sight, too much for practical use in my opinion. The Retro Rear was simply too wide for a GI rear dovetail. Sometimes, and it depends on the individual pistol, you'll need to remove 0.008 to 0.010 from the bottom of the this sight and it takes time and care to keep the surface even. Make the cut, bevel the front

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At least it did not fly off, and rear corner of the sights, then lubricate the sights and try to get it started in the dovetail. You will probably make the cut and then have to file with a large bastard file some more. File a little bevel into the dovetail in the slide to relieve pressure on moving the sight in. Be aware of this amount of work before you take such a job in. While a difficult operation, the Retro Rear sights are good and work well once installed properly.

After working the High Standard up, I had a Colt 1911 come in with a damaged rear sight. This was a GI gun that was a good shooter but not worth a lot of money. The pistol had been dropped on the rear sight and there was practically no rear sight notch. The rear sight was bumped out with a brass hammer and the rear sight that had been on that High Standard was bumped into the Colt. All the better but also more expensive. Notch, fitting well as the High Standard rear sight is GI type.

Trigger Thoughts Smoothness found as improved function of trigger compression is most evident after takeoff and before the hammer falls. Stoning the sear is fine but maintain 0.020 engagement in the hammer hooks. It is easy to see if the hammer hooks

are taller than 0.020 using a feeler gauge. At the same time, the hammer hooks must be checked to be certain they are perfectly square. When performing this type of work I set the stone in the vise rather than the part to be stoned, working the part over the stone.

I have had better results with this technique. Of course, if you purchase aftermarket parts, stoning and polishing must not be undertaken. As an example, I simply install Ed Brown parts as is because they are properly cut for engagement and do not require additional smoothing. Such work is contraindicated for smoothness and proper function. Leave known-quality factory parts from reputable makers as they are delivered. For standard guns, study the hammer hook and sear and how they fit together.

When polishing, it is fine to produce a smoother surface but always maintain original angles. And it is not all in the hammer and sear. The sear spring is another part that bears close study. The sear spring places resistance on the trigger bar and on the bottom or foot of the sear. I have checked many factory sear springs and found variations. Become familiar with what proper sear spring is supposed to feel like.

The spring can sometimes be adjusted by bending to reduce pressure on the trigger, an expedient that works. The owner enjoyed the excellent results after putting his High Standard pistol together. The sights were what he wanted and the pistol exhibited a personal look that he found pleasing. However, less than 200 rounds after the modifications the staked-in front sight came loose.

Since replacing a single tenon front sight is problematic for longevity, the decision was made to cut a front sight beavertail and permanently modify the slide. This was a good answer, however, it was expense not originally expected. While I haven't seen the front sight come loose on a Rock personally, this was a miscalculation since the Rock is a GI gun and this could have been expected. In the end, are Armscor/Rock Island 1911s and the similar High Standard and Cimarron pistols compliant with GI mil spec parts?

Yes they are. Are they worth modification? Yes, as the projects turn out well. Could a good quality pistol with equal features, such as a Springfield 1911 Loaded Series as an example, have been purchased for the same outlay? Yes, but it would not have been as unique. AG

FROM THE ARCHIVE

Encyclopedic Error

Debunking old wives' tales in gunsmithing the AR-15.

BY JOE CARLOS JUNE 2017

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Google doesn't offer a "book definition" and I don't claim to have coined the phrase, but I define "encyclopedic error" as an explanation that seems sensible and is accepted as true because it's repeated often but isn't actually tested and doesn't hold up to scientific scrutiny. While I've included examples of encyclopedic error as subtopics in previous articles, I have enough examples for an entire article. Some examples of encyclopedic error have flourished for decades, largely unchallenged.

Cartridge Concentricity Cartridge concentricity is important and I dedicated an article to it ("Better Ammunition", April 2016.) Concentricity is alignment of the bullet to the center axis of the case. If not done right, no firearm will perform to its accuracy potential. When I started with the Army Reserve Shooting Team in the 1980s, shooters were "spinning" (measuring concentricity) long range ammunition but not for 200 and 300 yard rapid-fire events.

It was thought that the violence of feeding from a The more modern Hornady Lock-N-Load Ammo Concentricity Tool on the right will both identify run out and correct it. magazine during normal operation, instead of slow-fire hand feeding, deformed ammu-

nition enough to make concentricity management a waste of time. Like all encyclopedic error, it seems logical, especially for people not willing to measure and test things. Something caused my skepticism, so I set up a little test.

I selected ten rounds of .308 factory match ammo, spun them, and recorded their concentricity measurements. Charging them into a M14 magazine, I cycled all ten using the operating rod as violently as possible. Spinning the test rounds a second time indicated no change, not even a 0.001" difference! I repeated the test with several other rifles and magazines and never measured a concentricity change. From then on, I managed concentricity at all yard lines and my scores went up.

Fast forward a decade later when I was the team's Armorer and we were shooting AR-15s. That encyclopedic error about magazine-fed bullets knocked out of alignment still had not died. To be thorough, I repeated my test with AR-15s with the same results. Those managing their concentricity saw scores improve at all yard lines over those that didn't. This assumes an AR-15 as Stoner designed it with a 20" barrel, appropriate gas port and gas tube, and internal piston (direct impingement) operation.

It's important for the upper and lower to align to prevent damage to ammo. Older (more than two decades ago) components didn't align well, especially in parts guns assembled with unmatched components by non-gunsmiths. Quality control from different manufacturers and foundries has greatly improved so mixing different brands of upper and lower receivers is not nearly the kiss of death it once was.

Also assumed is that magazines are clean, properly adjusted, and the internals (spring and follower) are of modern design and not fatigued or worn out. See "The Art And Science Of Magazine Maintenance" by George Harris in the March 2014 issue. Gas Ports Gas ports in standard 20" AR-15 barrels are drilled about two-thirds of the way down the barrel.

People, I assume that don't own chronographs, continue to claim that a gas port drilled about seven inches from the muzzle robs enough gas pressure to effect muzzle velocity. With light beer in hand and feet propped up in an easy chair, they pontificate bolt guns with 20" barrels will have faster muzzle velocities. I installed a JP Enterprises adjustable gas block to test this. With a state-of-the-art Oehler chrono-

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graph I measured velocities with the gas block wide open and with it completely closed. Despite using known-quality ammunition from the same lot and testing in consistent lighting conditions, there was no increase in muzzle velocity with the gas block shut off. I repeated this test with a 26" barrel on a Match Rifle and had the same results. Derrick Martin, owner of the custom gun shop Accuracy Speaks and author of *The Complete Guide To AR-15* Accuracy conducted a similar test with the same results.

More encyclopedic error debunked! Jump Proof Bullets High Power competitors shooting the Service Rifle division in sanctioned National Rifle Association and/or Civilian Marksmanship Program events usually employ two bullet types. The closer 200 and 300 yard stages requires magazine-length (about 2.25") ammunition, commonly a 77 grain bullet or similar. For long range stages (600 and 1,000 yards) they switch to longer and more wind resistant 80 or 90 grain bullets seated closer to the chamber's throat.

The common Wylde chamber needs a Cartridge Overall Length (COL) of about 2.475" with 80s and about 2.50" with the longer 90s. Despite the differences, some jumped to the conclusion that 77 grain bullets are jump proof, despite the sizeable distance. However, these bullets are nearly unsupported during this travel and can enter the throat at an angle to the center line of the bore, becoming deformed. This jump measures about 0.090" in Wylde chambers, a veritable football field for a bullet!

Every fired round erodes the throat forward, increasing jump and usually decreasing accuracy, though the amounts are quite variable. Far Most Wylde chambers have an accurate service life from 2,000-4,000 rounds. By the time most barrel throats have eroded enough that 77 grain bullets are jumping about 0.25", groups have inevitably worsened enough to demand rebarreling. Fire cracking and roughness from erosion also degrade accuracy.

Hand-fed cartridges with heavier bullets can be longer and seated closer to the throat, reducing jump. Smart hombres can periodically lengthen their long range ammunition to compensate for throat erosion.

Thus, a rifle that is "shot out" for 300 yard rapid fire can still perform well at 600 yards. This is a little counter intuitive as shooters tend to expect long range performance to be the predictor of barrel wear. National Match Course tournaments are won by the aggregate of all yard lines, not just at 600 yards.

I frequently remind customers to assess both 300 and 600 yard performance in determining when to rebarrel. So, shooters can be confused where to watch for signs of degraded performance. Throw in encyclopedic error and the waters are muddied further. Here, the claim is 77 grain bullets are somewhat "jump proof" and the increased distance doesn't effect performance. Testing and observation proves that 77s are better described as "jump resistant." Jumped too far and performance degrades.

Magazine-length 77s aren't the only types susceptible to this. Military issue 55 and 62 grain loads are also degraded by jump. In fact, my first research about bullet jump centered on military applications. I was a competitor with the Army Reserve Shooting Team in

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Far This picture illustrates how far the lighter bullet is jumping which negatively impacts accuracy. the 1980s and we often competed against foreign military teams in Service Conditions matches using issue M16-series rifles and ball ammo. M16s have NATO chambers designed for reliable function in dirty battlefield conditions, sloppy in all dimensions with more freebore than civilian chambers. This causes along jump, seriously degrading accuracy.

I began to experiment with shorter chambers and groups tightened considerably (see "Improving Rack- Grade AR-15s", December 2014.) I wasn't the only researcher doing this. Derrick Martin, then with the All Guard Shooting Team, was as well. Because we were competing on 01 grain was used to prove there is no relationship between brass weight and velocity of Lake City brass in 20" and 26" AR-15 barrels. different teams then, I didn't know of his re search or conclusions at the time.

Reading his book I found we conducted similar tests and conclusions on this and other topics. Like me, he found that accuracy with

military ammunition was enhanced with shorter freebores. Later, as the USAR Armorer I remembered those chamber experiments and conducted another study. I had 34 new eight twist barrel blanks from two respected makers intended for shooting 77 and 80 grain bullets due for processing by Frank White at Compass Lake Engineering.

I had Frank chamber half of each brand with his shorter CLE chamber and the others with Wylde chambers. I then built temporary guns around the 17 barrels with CLE chambers, broke them in with a noninvasive process, and machine rest tested them with known lots of magazine-length ammo. When finished, I cleaned everything up, tore the guns apart, and reassembled with Wylde-chambered barrels. Same receivers, float tubes, components, torque specs, ammunition lot, everything!

When the gun smoke cleared, the shorter CLE spanked the longer Wylde by a substantial 23.3% average reduction in group size! To further test, I dug out my throater reamer and rethroated some of the CLE chambers (2.450" long) to Wylde specs (2.475"), then

again to 2.50", and finally to a NATO length of 2.550". Retesting under the same conditions, the additional the 0.025" length from CLE to a Wylde spec of 2.475" increased these barrel's group size about 23% larger, just as in the initial tests.

The additional 0.025 to 2.50" made the groups worse, and increasing again to the NATO length was even more horrible. The obvious conclusion is another example of encyclopedic error. Despite the initial claim of being jump proof, this isn't the case. Barrels chambered with longer freebores will wear out sooner. Brass Sorting Competition shooters and handloaders love to sort things. They spend countless hours doing so trying to gain an advantage.

While these sorting chores don't seem to hurt anybody, I am not sure that it really makes ammo any better. A common sorting activity involves weighing brass. The encyclopedic error in this endeavor is the conviction that heavy brass has thicker walls, thus having less internal volume which should pressure more and perhaps producing a little higher velocity.

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Long Palma barrel (top) showed only a 7 fps improvement in velocity consistency due to brass weight sorting. Consistent velocity is a good thing. Inconsistent muzzle velocities will lead to vertically stringing and egg-shaped groups, especially at long distances. Faster bullets will hit higher and the slower bullets will impact lower.

A quick mental calculation fairly accurate with 80 and 90 grain .224 bullets is every 10 feet per second velocity change results in a vertical displacement of an inch at 600 yards and three inches at 1,000 yards. Given a rifle capable of one minute groups at 600 yards, a 30 fps velocity spread will yield a six-inch wide group nine inches tall. The MR-1 target shot at 600 yards has 12-inch 10 ring. This leaves much less room for error. Reducing this is valuable, hence the interest in sorting.

I am not the only skeptic regarding weight sorting brass. Others have conducted tests but most of them are similar: Weigh the empty case, fill it with water to the case mouth and weigh again. I don't know if this was borrowed from race car engine builders who have been using a similar technique to "true" engine heads

for decades. I don't claim to have read all ballistic studies, but of those I have there does not seem to be a 1:1 correlation between case weight and water volume held.

At best, it's a casual relationship. I didn't repeat these water tests. The real point is determining a velocity relationship between varying casing weights to justify time spent sorting. At the time I was considering this, members of the USAR Shooting Team were sorting tens of thousands of cases each year to 1/10 grain increments so I had access to a large range of cases of varying weights.

For my test, I selected ten cases, one each from the five bins on the heavy side and one each from the five bins on the light side. Those ten casings were all different weights and as far apart in weights as possible. The second batch of ten cases were of identical weight in the middle of the bell curve. To ensure equal propellant weight, I measured with a lab-grade scale accurate to 0.01 grain, more accurate than typical powder scales accurate to "only" 0.1 grain.

ENCYCLOPEDIC ERROR CONTINUED

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Uniform bullets were seated and measured to equal depth and a reputable, state-of-the-art Oehler chronograph measured velocities fired under equal lighting conditions. There was no difference in velocity spread between the two samples! I repeated the process using several other guns with no change. I was using 20" AR-15 Service Rifle uppers with Wylde chambers initially and have repeated this test with other setups over the years, all with no changes in the result.

I have wondered why there wasn't a velocity difference. Initially, I thought 20" Service Rifle barrels with fat gas gun chambers might not develop enough consistency for case variations to matter. I was using brand new Lake City brass with primers crimped in place at the factory. Manufacturers of military brass don't perform all the fancy flash hole work that more expensive custom brass makers such as Lapua claim to do. Also, some commercial primers have reputations for better velocity consistency than others.

I considered that perhaps primers had some vote in the matter. Regardless, I was a military shooting team armorer at the time and felt obligated to run the study with what we actually used. I did address the barrel length variable in subsequent testing with 26" Match

Rifle uppers. In keeping the ammunition and chamber the same, I found the additional barrel length didn't matter there. The normal 20" Service Rifle configuration is the most common AR configuration with 26" Match Rifles second.

Since leaving the Reserves, I have built 30 and 32" Palma configurations. Given no need for magazine feeding, I use tighter chambers similar to bolt actions. In building such a rifle for a customer with a 32" barrel and tight chamber, he knew of my previous velocity spread tests and offered to provide sorted Lapua brass for a new test. He used a sorting method similar to mine and loaded with a slower burning powder (Vihtavuori N150) instead of Reloder 15 or Vihtavuori N140 more common in 20 and 26" barrels.

This test was with a longer barrel, tighter chamber, Lapua brass instead of military L. C. cases, and different primers. I admit this is too many variable changes for a test but that's the hand I was dealt. However, the ammo loaded in consistent, same-weight cases chronographed 7 fps better than those loaded in cases with purposely-different weights. I readily admit this slight improvement may be random and within normal margin of error.

I used multiple uppers in previous tests and would like to repeat this one in more than one rifle. It is possible the modest improvement in this recent test may be with variables other than brass weight, such as the tighter chamber. Lake City brass is commonly used by Service Rifle and Match Rifle shooters, the stick powders I tested (RL-15 and VV N140) are often used with 80 and 90 grain bullets, and Wylde chambers are popular in match AR-15s. My tests influenced me to discontinue weight sorting of L. C. brass for

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use in 20" and 26" barrels with fat gas gun chambers, however, anyone that feels such variables justify a retest, please do so! Cooking Ammo One of the stages in the rifle National Match Course is 20 rounds for record from prone at 600 yards fired in 20 minutes. Obviously, chambers can heat significantly.

It has been posited for decades, going back to at least the M14 era, that allowing around to reside in a hot chamber for too long heats up the cartridge and it will shoot at a faster-than-normal velocity, resulting in a flier. While I don't remember everything from my college chemistry courses, I do recall that most chemical reactions do take place more vigorously in higher temperatures. Many have noticed on hot days that ammunition achieves higher muzzle velocities and pressures.

To test "ammunition cooking", I went through a 50 round box of Black Hills 77 grain match ammo, picking out the two most concentric rounds and charged them first in a 30 round mag, making them shots 29 and 30 when firing. Because I was actually shooting a group, I didn't want poor cartridge concentricity to throw those final two "cooked" rounds out of the group. I filled the magazine with 28 more rounds from the same box.

I was testing in Pennsylvania just after Christmas on an unseasonably "warm" day of 40 degrees so I had to warm up the barrel as it started colder than guns are during the summer heat at most big High Power competitions. Warming up with 28 rounds exceeds the number that would normally be fired. Following those shots, I left the last

two rounds in the chamber for two minutes each, a longer delay than would normally be encountered in a match.

The group of 28 rounds ended up being a respectable 1 1/8" wide by 1 1/8" but a bit fatter than it should have been as the test gun consistently shot ten rounds groups around 9/16" during previous testing. The buffer spring in my lower had recently split and I had just thrown out the broken section, inserted the buffer in the long remaining section, and driven on.

Well, that decision came back to sort of bite me in the butt during this testing as I encountered over a half dozen failures to chamber in this test firing. I ended up messing around getting rounds chambered to fire, which may have caused them to be positioned less than uniformly in the chamber. Given that uniform positioning is important, this group could have been tighter. I fired the first 28 rounds as fast as I could, pushing the machine rest forward and back into battery while clearing the failures to feed.

Round #29 cooked with the bolt closed for two minutes and it went 1 3/8" away from the group toward 5 o'clock, more than doubling the size and with a velocity of 2,827 fps. I chambered round #30 and waited two more minutes. It also went out at 5 o'clock at 2,816 fps. If fired at 600 yards on an MR-1 these likely would have ended up in the nine ring. That is mild compared to cooked-round fliers I've observed through the spotting scope. The average velocity 2,753 includes the cooked rounds.

Discounting those two, the average was 2,746 fps. Subtracting the fastest cooked velocity of 2,827 a thirty round 2,753 average is a significant 74 fps difference. This gives

credence to the cooked round theory. Beyond a test, cooked rounds absolutely demonstrate changes in practice and any experience shooter has seen this happen.

Spotting shooters at various matches over the years, I'd sometimes use a stop watch to time how long someone let a cartridge sit in the chamber before firing it and could accurately predict if they'd have a flier! I've experienced this as a competitor myself. Don't let a cartridge sit in a hot chamber! I believe the velocity increase of cooked rounds is only part of the cause.

If velocity increase was the only factor, all cooked rounds would go high, however, my formal test verifies this isn't always the case as my tested cooked rounds impacted low, being out at 5 o'clock. This is consistent with what I've observed in decades of range observations. Although I didn't keep formal records of these various range observations, I've seen cooked rounds deviate in all four quadrants of the target with corner shots being common.

I don't remember high fliers as more common than low at 4, 5, 7, and 8 o'clock. Although the two fliers in my machine rest test would have scored 9s, I frequently saw fliers out in the 8 and 7 rings, even from Master and High Master competitors that should have known better. Competition shooting causes stress on everyone and even champions can make mental mistakes occasionally. Beyond velocity changes, I wondered if casings were changing dimension due to the heating.

I took four dimensional readings of a .223 match round before putting it in a ballistic oven for two minutes. Remeasuring revealed those four readings increased by 0.0005" each, indicating heat causes ammo to swell.

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This goes back to the importance of uniform positioning of the cartridge in the chamber and on the bolt face. One of the four measurements was the diameter at the neck which influences neck tension. Brass isn't perfectly uniform regarding case wall thickness and may be relevant to cooked round fliers. I would expect that brass on the thin side of the neck to expand more than the thicker side when heated, releasing the bullet more when fired and tipping as it enters the rifling.

Since the shooter does not know which side of the neck is thinner, cases are positioned randomly and cookedround fliers could go in different directions. Changes in brass dimensions causing varying positioning of the case in the chamber and on the bolt face may conspire with changes in neck tension on the bullet. With all these factors conspiring with changes in velocity as well as factors that many of us haven't thought, it may paint a full picture of fliers due to heated ammunition.

Nobody seems to talk about it, but I believe another factor of cookedround fliers is shooter error and fatigue. While that round is trapped and cooking in a hot chamber, the shooter is likewise trapped in a heavy "iron maiden" shooting coat and also "cooking." A leather sling is tightly constricting his support arm, cutting off circulation, and making his hand numb. Vision is suffering, causing issues with sight alignment.

During those periods of cooking, light and wind conditions may also change and missed unless the shooter is being very vigilant. Regardless of the actual mechanism,

cooked-round fliers do occur. In case you're wondering why I include an assessment that has proven true in an article on encyclopedic error, many folks claim velocity increase is the sole culprit but that isn't true. The fix is to avoid chambering around until you're ready to fire.

This is especially important later in longer strings when the chamber is heated up more. Should firing be delayed with a chambered round, unchamber it, put it last in your ammo queue for record fire, and substitute a cool round in its place. Each rifle will behave individually when it comes to cooked rounds. Ammo will also have a vote. I fired commercial ammo in my test loaded with ball powder which has a reputation as being more susceptible to temperature changes. However, most of them burn a little cooler.

Most folks handload stick powders for use in long range slow fire strings where ammo cooking is most common and these propellants are reported to be a little less susceptible to temperature changes but burn hotter, potentially heating up chambers a little more. Chromoly vs. Stainless Barrels Several decades ago, stainless steel barrels began making inroads in the hunting fraternity. This made some sense as hunters are sometimes out in inclement weather and wanted the corrosion protection for their rifles.

It wasn't long before gun writers published articles extolling lavish claims for stainless. One of those claims was superior accuracy. Barrel manufacturers jumped on the bandwagon. Stainless is easier to machine using the button rifling method so barrel makers

were quick to promote it. Plus, they found the market supported them charging extra for it. When I started as Reserve Team Armorer we didn't have spare barrels or parts.

When I did receive a budget to purchase replacement barrels, I bought equal numbers of stainless steel and chrominum-molybdenum alloy and over the years worked with match AR barrels from every custom barrel maker in the country. As I installed them I tested using known ammunition lots and kept meticulous records regarding group sizes and fliers. After testing hundreds of match barrels I finally analyzed my accuracy results.

From every manufacturer offering both stainless and chromoly barrels, the chromoly shot better. They consistently had tighter groups with less fliers with 50 percent of those tested shooting better than average while only 41 percent of the stainless could make the same claim. 28 percent of stainless barrels shot fatter than average groups while only 15 percent of the chromoly barrels did so. When all the groups were compared, chromoly shot 9.6 percent tighter than stainless.

Despite these measured differences, I'm not trying to convince you against stainless barrels. I am hoping that you won't dismiss chromoly. Customers have been conditioned by years of encyclopedic error that stainless is more accurate when tests show otherwise. All we gunsmiths can do is offer facts as a balance. At the end of the day, we'll build whatever the customer wants and can afford.

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Tight upper-to-lower fit in Stoner rifles is equally important to obtaining high accuracy performance. Upper/Lower Fit I dedicated an article on this topic and will only review the high points here. It's accepted that slide-to-frame fit is important in precision handguns and tight bedding aids in bolt action rifle accuracy. However, for some reason, some people are convinced the fit between the upper and lower receiver of an AR-15 doesn't matter.

I believe firearms have more in common than many realize and suspected that AR-15 upper-to-lower fit also mattered. Early on as USAR Team Armorer, I was machine rest testing all of their competition Service Rifle uppers. I used the same Colt lower with all and would characterized its fit to most of these uppers as average. Accuracy results were horrible, with most uppers shooting ten shot groups with match ammo in excess of one minute. With several dozen uppers tested, I had a nice sample size.

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I cleaned the bolt carrier assemblies and bores of these uppers, then installed a tight Accu-Wedge in the lower before resting all of them. Even in a machine rest, the tighter upper-to-lower fit with the Accu-Wedge reduced group sizes an average of 26 percent! The Accu-Wedge is a cheap and easy method of dealing with slop in this fit and more can be done, but this fit does matter. Conclusions We've covered a number of encyclopedic errors common to the AR-15, a firearm that has been around for about a half century.

The over twice that old and the M1 Garand falls right about in the middle. I'm betting that firearms in circulation that long have encyclopedic errors attached to them as well. If you know of other encyclopedic errors associated with firearms you work on, why not take a little time to test and write them up? Submit your observations to this magazine so the rest of us can be better informed. AG

MAINTENANCE & REPAIR

Model 94 Custom Repair

An analysis of a non-functioning Model 94 Winchester followed by an unusual repair puts the revered old gun right back into the deer woods.

BY NORMAN E. JOHNSON JUNE 2017

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It was well into the 2015 Wisconsin deer hunting season as a hunter greeted me with his Model 94 Winchester lever action .30-30 in hand. “Sure hope you can put this one back in service, we’ve come too far to even think of becoming separated.” As I queried him regarding the problem, he pointed to the loading ramp—a trap-doorlike piece of metal extending upward through the cartridge loading port—obviously out of place. This presented a real problem in successfully loading the tubular magazine, resulting in a jam.

During normal function, the loading gate allows thumb-fed cartridges to be pushed fully into the spring-loaded magazine beneath the barrel. Loaded correctly, the cartridge is placed lengthwise, nose first, onto the load-

ing gate and the typical round-nose bullet is pushed downward and inward until the case rim is received by the magazine.

This locks each cartridge in place, ready for successive pickup. Below left and center: The problem was solved by forming and installing a semi-circular piece of steel into the front of the loading port to reduce opening size. Though the loading gate is depressed, a malfunction in loading will ensue, and chambering. Each cartridge then goes through the same process. As the finger lever is worked and the bolt goes rearward, a single cartridge is released and pushed back by the magazine follower.

It is then received by the cartridge guide, which in turn lifts it at an upward angle allowing the forward motion of the bolt to push it forward and into the chamber. The process cocks the hammer all ready to fire, or to let it down to the half-cock safety position. A quick glance at the history of the old Model 94 Winchester lever action repeating rifle places it in a class by itself.

It was designed by John Browning in 1894, initially for a black powder cartridge, and was the first rifle chambered for the use of a smokeless power round: The 30-30 Winchester Center Fire. The eight-round lever action rifle, built between 1894 and 2006, was the first commercial sporting rifle to sell over 7,000,000 units, making it the best-selling, high powered rifle

MODEL 94 CUSTOM REPAIR CONTINUED

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Properly used, J-B Weld is like penicillin for some ailing rifles. Above center: A common ice pop stick is used to hold the part in place while the weld is bonding. in U. S. history. While undergoing a number of changes and ownership, the much revised Model 94 is now produced in Japan by Miroku Corporation but the vast majority of the old Model 94s are still out there serving hunters and shooters well, and usually with only minor repair.

Correcting Loading Problems Precision measurements of the old gun strongly indicated anew loading gate would not solve the problem. While the loading gate had worn some, the forward margins of the Below center: Finishing touches of the repair used to prevent the loading gate from popping up through the loading port. But the customer

immediately noticed the improvement as he headed for the deer woods. loading port had worn even more. Years of use can have some unusual effects on the guns we use.

I informed the customer that a loading gate, complete with anew pin, would likely not correct the problem. I pointed out where the front borders of the loading port were badly worn from years of use. There was a full 0.010-inch gap between the front of the loading gate and the port. I suggested that I could make and install a thin, semi-circular piece of metal at the port to solve the problem. On that he gave me the go-ahead.

Making The Part The small semi-circular part installed at the front end of the loading port was made from apiece of sheet metal 0.070" thick x 0.450" long x 0.090" wide. I used a

special round-nose pliers to bend the part to fit the front end of the loading port. The special part was bonded in place using J-B Weld, which has very high bonding and tensile strength. The part was held firmly and squarely to the front of the loading port with a rounded, wooden stick as the J-B Weld set.

The part was then smoothed out using a machinist file and 400grit polishing paper, then touch blued with Brownells Formula 44/40 Instant Gun Blue. On testing, things worked out perfectly as the rim of each cartridge easily slides by the new part. Conclusion Sometimes those little things can mean a lot in repairing a firearm. A bit of innovation can mean the difference between junking a gun or restoring it back to full service. The customer also stands to save a lot of money in the process. AG

PEOPLE & COMPANIES

Remington Model 24: Old Or New Style?

Here's how to recognize and work with the differences between old and new-style versions of the Remington 24.

BY MARK R. HOLLENSEN JUNE 2017

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Recently, I had a Remington Model 24 semi-automatic .22 Short rifle come into the shop for some much needed work. The owner conveyed to me that the gun had been in the family for a number of years ever since the gun was purchased new. At one time it worked well but it may have been “worked on”—to the point that it no longer functioned properly. This was “one of those guns” that often a gunsmith will not take on due to the fact that repair costs could exceed the value of the gun, and in quick fashion.

We all have taken guns in that had one problem after another that led to either the cost being too prohibitive to repair or the customer decided to stop all work before the Make sure you order the correct part for the gun you are servicing or plan on replacing both when converting from the old-style to the new. costs reached a certain cap they had placed on the job. In this case, I

knew from the customer that he just wanted the old gun working again if at all possible so I took on the repair job request.

I began by combining what the customer had told me was wrong with the gun along with my own function testing process to determine what was wrong with it. After visually inspecting the gun and function testing it with a couple of dummy rounds, I found that the original extractor in the bolt assembly had been broken. Someone had reshaped and filed it down into the shape of a cover or plate that served to retain the extractor spring plunger assembly in the bolt.

This worked fine, but trying to extract alive round (or fired casing that had become stuck) from the chamber meant having to push the live round or stuck casing out via inserting a cleaning rod down the bore while holding the bolt open. This, of course, is a very dangerous thing to do and one that should be avoided due to obvious

safety reasons. This is where the repair process began with more and more issues creeping in.

First, I researched what I could about a replacement extractor and found one available from a parts source. When the new part arrived, it fit the slot made for the extractor in the bolt face, however, it could not be properly retained in place. I did some more in-depth research, coming across the article “Remington Model 24 and 241 Rifles: A Parts Source Directory” by Dan Baldwin in the October 2003 issue.

That article framed the fact that the Remington Model 24 had old and new types of extractors made for it but didn't have close up photos of the differences. I inspected the original broken extractor closely that had been filed into a cover plate and realized it was the new model extractor. I then found that the extractor spring plunger in the gun was the old model extractor spring plunger. This told me that the gun originally had the old-style

REMINGTON MODEL 24: OLD OR NEW STYLE? CONTINUED

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Also notice the firing pin protrusion. The firing pin is no longer in the cocked or ready-to-fire position. extractor system and that someone had installed anew-style extractor in the bolt. What they did not do was replace the extractor spring plunger and that more than likely caused the damage to the extractor. The replacement extractor that I had ordered had a cut or lip in the base that is used by the new-style extractor spring plunger to secure the extractor in position when properly installed.

Therefore, the old-style extractor spring plunger was next on my list to be replaced. The old-style plunger has a rounded contour on both ends while the new-style has a hook on one end that secures the extractor in the bolt. The old-style extractor has a detent depression in the back of the extractor where the old-style extractor spring plunger (rounded end) fits into that recess and holds that styled extractor in place by spring and detent power, placing constant spring force against the rear of the extractor.

During my research, I ran across a couple of drawings of the two different types of extractor assemblies for the Remington Model 24. The new-style extractor has a cut along its bottom edge where the new-style extractor spring plunger has a recessed cut

or hook on one end of it that latches up with the base of the extractor, securing it in the bolt slot.

Note the relationship of how this extractor spring plunger interlocks with the bottom of the newstyle extractor when installed in the bolt face in the illustrations. Those drawings I ran across that clearly show the differences were created and copyrighted between 2004-2006 by Wisner's, Inc. However, I wasn't able to obtain permission to reprint them here. So far, and to date, I have not located any other source material that fully explains or illustrates the distinct differences between the two.

Getting back to the repair job at hand, I was able to fit and complete the extractor installation and all seemed well until I put more than three live rounds into the magazine tube. This gun is nearly identical to the Browning Auto-22 in that it has a magazine tube that feeds through the butt stock. I quickly found that by loading up the magazine tube with more than four cartridges caused a failure to feed.

I disassembled the magazine feed tube and the coil spring quickly came out in six pieces—being broken, rusted, and covered with gunk—and the magazine follower spring was “sprung”, appearing as though

someone had stretched it out, most likely to add extra or lengthened spring tension to help with feeding, all while the coil spring inside the tube kept failing. Replacement parts were found and ordered. Note, this particular gun is chambered for .22 Short only and the magazine follower assembly was ordered for that.

However, I ended up receiving one for the .22 Long Rifle model which has a magazine follower plug too long to feed cartridges up and into the chamber. The plug, being too long for the action, would stick inside the receiver, preventing the feeding of any cartridges into the chamber. After some calls and checking, I was unable to return the assembly and couldn't locate a follower specifically for the .22 Short from any source.

I removed the .22 LR magazine follower plug on the new spring assembly and replaced it with the original .22 Short follower plug. Once the magazine tube was deep cleaned, lightly oiled, and reassembled, function testing continued. I filled up the magazine tube and the gun functioned flawlessly. Since it has been awhile since the articles outlining disassembly for cleaning purposes have been published here, I'll add that information. For routine disassembly, when cleaning these rifles I begin

REMINGTON MODEL 24: OLD OR NEW STYLE? CONTINUED

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The original spring was broken into six pieces, covered in rust and gunk, and was replaced. Often it is best to replace a coil spring as they tend to weaken significantly over the years—especially on older .22 rifles and especially in cases where the magazine feed tube had been stored full of live ammunition. 22LR which is too long for use in the .22 Short rifles.

The new plug was removed and replaced with the original .22 Short follower plug (also shown on the left end of the old spring) for proper cartridge feeding. Failure to change this out will result in feeding issues as the longer plug gets stuck in the top of the receiver, preventing proper cartridge feeding. by ensuring the gun is unloaded. Work the action, remove the magazine feed tube, work the action again and visually inspect the chamber to ensure no live rounds exist in the chamber or feed line.

Once certain, grasp the receiver in one hand and pull back and hold the bolt in the open rearward position with the thumb on that same hand. Disengage the barrel latch by moving it forward (away from the receiver) with the other hand. The latch is located under the barrel at the bottom rear of the forearm and latches with the front of the receiver.

While still holding the bolt to the rear, use the other hand to turn the barrel counterclockwise about a quarter turn and remove

the barrel forward and away from the front of the receiver. The forend can be removed by removing the screws that hold it onto the barrel, however, this is not normally required for cleaning. If the barrel feels loose in the receiver when locked into place, tighten the barrel fit by removing the forend and tightening the barrel nut so that no slop remains.

When the barrel is tight to the receiver, replace the forend. Take caution when removing the forend and keep a finger or something on the barrel release latch so that the latch and spring does not jump out of its slot. This assembly is probably the most lost part (or set of parts) on all of these Browning-designed rimfire rifles. Once the barrel is removed from the receiver, remove the magazine tube feed from the rear of the butt stock if it wasn't already done during initial inspection and clearing.

Moving on to the trigger group, place the safety to the "on" position, take a hold of the trigger assembly with the fingers on one hand. Using the thumb, pull back on the bolt about half inch or so. With the trigger group clutched in hand while depressing the bolt back some, slide the trigger group forward and downward, pulling it out of the receiver in one un it. Notice the action is cocked and the firing pin is at the full rear position, locked with the trigger.

To remove the bolt, push the safety to the "off" position, hold onto the bolt, pull the trigger to release the firing pin, then maintain control of the breech bolt block as you ease it forward. You will see a small detent pin that is spring loaded near the front of the bolt that needs to be depressed when removing the bolt from the trigger group. This detent prevents the bolt from coming out when removing the trigger guard for cleaning. Take your time and ease the bolt free from the trigger group.

This amount of disassembly will allow you to work on or replace the extractor assembly. If you are not doing any repairs, there is no need for further disassembly. Deep clean the bolt and trigger group. Pay close attention to powder residue and build up in the bolt face and extractor assembly area, around the firing pin, as well as inside the bolt body. Once cleaned, replace the bolt back into the trigger group.

Don't forget to compress the spring-loaded pin on the front of the bolt when reinstalling it into the trigger group. Once the bolt is back inside the group, cock the bolt all the way to the rear so that the firing pin locks with the trigger to the rear, then set the safety back to the "on" position again. The main reason for having the safety in the "on" position is that when grasping the trigger group and removing

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The firing pin notch locks into place with the trigger hook shown in this photo when in the cocked position. The firing pin is not shown and is still inside of the breech bolt. or reinserting it into the receiver, you may accidentally depress the trigger which will kick the bolt forward and out of position. Once the trigger is set (cocked) and the safety applied, put the trigger group aside for installation when the rest of the gun is clean.

Moving on to the receiver, make sure it is clean and free of all powder residue, especially in the feed tube path or tunnel inside the receiver at the top. It is beneficial to run a few lightly-oiled patches through the entire length of the magazine tube to remove remaining dirt and powder residue, and to prevent rusting. After the receiver is clean, reinstall the trigger group into the receiver. Grasp the trigger group again with one hand, use the thumb on that same hand to depress the bolt back about a half inch.

Insert the trigger group into the receiver from the bottom, angling the rear of the group upward as it goes into the receiver. Slide the front portion of the trigger group into the grooves located in the receiver and seat the group in place. Don't force the assembly into place, work it in slowly and it will drop into its proper position. Once the barrel chamber area and bore has been

scrubbed clean, take the assembled receiver in one hand and use the thumb on that same hand to depress the bolt back a bit.

Insert the barrel into the receiver with the forend at the three o'clock position away from the right side of the receiver. Turn the barrel clockwise to seat it into the receiver, ensuring the barrel take-down latch is snapped back into place. The barrel should fit snugly without wobble in the receiver. If it feels loose, remove again and tighten the barrel adjusting nut until a snug fit is achieved. Finally, replace the magazine feed tube and she is ready for another day of shooting.

Unfortunately, the cost of this repair job had exceeded my original quotes to the customer, due mostly to the fact that the customer had to pay three separate shipping charges on the parts needed as three parts orders ended up being needed. I think this repair job illustrates why gunsmiths often hesitate or outright refuse to work on certain guns. In this case, prior to starting the customer had assured me that the gun was working fine other than a few jams due to the extractor not working.

This was absolutely not the case. Had he let me know that feeding from the magazine tube also had issues, I could have saved him some costs. In this case, I kept the customer informed every step of the way and received his full blessing before moving for-

ward with each purchase order. This kind of communication is paramount in preventing a "monetary surprise" at the end of a repair job.

For such an old "gallery gun" that no doubt had thousands of rounds shot through it over the years, it was back to working again, and surprisingly well. I found that the Remington Model 24 and 241 has been covered in several American Gunsmith articles, including that article in the October 2003 issue.

That particular article focuses on parts resources, discusses the differences between the old and new-style extractor assemblies, and goes on to state that new-style extractors and extractor spring plungers can be fitted to all either version of the Remington Model 24. The September 1996 and July 2000 issues have articles on the Remington Model 24 and Model 241 that fully describes detailed disassembly and reassembly of this gun along with the Browning .22 Auto.

For that reason, I decided not to incorporate that level of disassembly detail into this article. My goal herein was to clearly show the differences between the two extractor assemblies in case one crosses your bench in the future. This tired old workhorse found new life and I imagine it will be handed down through the family again and again! AG

METALWORKING

Spring Making Made Easy

Spring making is no mystery. Here's how you can add this to your gunsmithing services.

BY ROBERT E. FRIED JUNE 2017

ORIGINAL PP. 20-22

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When I first started gunsmithing, spring making was one of intrigue and mystery. Of course, this was before American Gunsmith and other media existed. Articles on the subject seemed vague on certain things, as if the author didn't want to give up his "secret recipe." One notable tidbit of information I found in a compilation of gunsmithing helpful hints was (paraphrased) "Take an oil can, make a dent in it, place your part on the can, cover with oil, and light it afire.

When it burns out, cover with lime, and you either have a spring or you don't." Huh? Well, the good news is, at the end of this article you actually will have a spring with no element of luck needed, provided you follow the procedures. Among the most important items is your material. I keep on hand various sizes, widths, and thicknesses of spring steel available through Brownells.

I also stock sheets of 12x12" annealed steel sheets of various thicknesses from McMaster-Carr (McMaster.com). Sheets in sizes of 0.020, 0.025, and 0.030 cover just about all I need. When do you make a spring? Most springs I make are simply not available anymore, or urgency in the job being completed demands it, or in the unlikely event an ordered replacement spring turns out not to be a spring. For example, some time ago I ordered an extractor for a Savage 340, which is a small, flat spring.

Upon installation, pushing it in to install the retaining pin collapsed it. Because it was not a spring as it was supposed to be, I had to make one and did so a little stronger than necessary. It does not matter what shape your spring is to be, the procedures are all the same. I always cut my spring stock a little long, with one end being my reference point, so as I'm shaping it I know

the other end will at least be long enough and have to be trimmed prior to final fitting and heat treating.

Prior to shaping, if your stock is too thick (which is probably the case) you'll have to take it down to the proper thickness. With a surface grinder, take it down before cutting the outline utilizing all the material on the magnetic chuck. Otherwise, do it by hand. I've used both methods and purchased a used surface grinder just for this purpose. Layout the part using a layout fluid such as Dykem to mark the outline of your future spring.

Some of the spring making material will be wider than the majority of your part so you will have metal to remove. An example would be a Vspring for a muzzle loader with a retaining stud. There are several ways to do it, depending on the machinery you have available. You can use a mill, a drill press with a small bit to drill around the out-

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line, or a Dremel followed by a file. It's also possible to use several hand files for the whole thing but not recommended as that'll wear you out. Of course, it eventually will come down to the hand files, so have a good set. I cut the thin sheets I use for making a spring with aviation snips as a Dremel cut-off wheel heats up the metal too much. Drill and tap a hole if needed for a flat spring.

With a Vspring, measure for the proper location on the bend and put it in your vise with appropriate vise jaws, I use bronze vise jaws from Brownells to prevent marring the part. Apply heat from a propane torch to the part and start bending using a ball peen hammer until it's at least ninety degrees.

I have fabricated some tools to assist in shaping Vsprings, such as a metal block for drilling and tapping two holes for a strap of metal to hold either the part or a hardened

rod placed to put special bends into the part. I also use a metal block with a relief cut the same size as the rod to make these bends. To cut a slot for the hammer stirrup, I use a Dremel cut-off wheel very carefully.

In studying old springs, it appears that this part of the spring is probably hot forged in a die and I've found it's the most difficult part to Once the part has been shaped to final size and all cuts made, remove all tool marks. Failure to do so will lead to the part failing in the future. With the part shaped and polished, the next step will make this part a spring. The heat source needed depends on the size your final spring is to be.

Most springs require oxygen/acetylene and small, thin parts work with MAPP gas. You will have to make that call when you are doing it. If it is difficult to keep hot and red, you need a hotter heat source. Large parts can be

wired up to be heated. I heat small parts on a metal strap approximately 9/64 thick. Sometimes I use direct heat and others I use indirect heat from the bottom, depending on the size.

You will need a cooling medium, I have been using Tough-Quench (Brownells 083-027-032) for all my spring making. I pour it into a metal can for large parts and for small parts I use a one cup measure or an aerosol can lid so I can recover the part easily. The part is ready for the first of two make look like a factory-made spring. heat treatments. Take it to "bright red" (approximately 1500 degrees) and hold it there for a few seconds.

Immediately quench it in your oil, stirring it around and getting it uniformly cool. With a large part, such as a Vshaped mainspring, you can actually feel and hear the agonizing of the metal molecular structure chang-

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ing. It will pop and seem to wiggle. This is why the part is brittle after quenching. The molecular structure is not aligned and has been very disrupted. Remove your part from the quenching oil, let the oil drain off, then gently wipe off the excess. Your part will be a dull silver and black. Remove the black material with light sanding, steel wool, and a Cratex wheel in one direction. The Cratex wheel will take it to a highly shiny, polished appearance.

Do this carefully as your part will be brittle and prone to breakage. The next step is where the polishing really shines (pun intended.) Temper the brittle, agitated part and align its molecular structure by heating it to a precise temperature and color. Your heat for this final step does not need to be as hot. I use MAPP or propane depending on the size. I place one end of a piece of metal 1 1/2" wide, 10" long, and 9/64" thick into my vise.

Apply a small amount of heat to warm it up if the shop is chilly as you don't want to shock it before applying the heat treatment. Lay the part onto the metal so as much of it is in contact as possible. Most parts lay on their sides while small flat parts lay flat.

Once the part is on the flat piece of metal where you want it and you can see it comfortably and from straight on, apply the heat to the underside of the metal strap in the vise, keeping it moving around the perimeter of your part and slowing bringing it directly underneath the part. As you do this, depending on the size, change of color can happen very rapidly, so be alert. Colors will range from dull gray, straw yellow, purple, then blue. When it starts to turn purple, you are very close.

Blue, or 575 degrees, is where you want to be. When it immediately turns blue, flick the part off the metal and on to your bench. Let it completely cool before testing. I know you'll be anxious but patience is a virtue when doing this. Once cooled to room temperature, place your spring into a padded vise. With a Vspring, slowly close and open the vise. The spring legs should follow the vise out and retain its original shape without breaking. Flat springs can be put in the vise and then bending them.

If these parts bend and snap back, congratulations, you're a spring maker. If it breaks, something in your heating process went awry. Don't despair, as I've had failures too. It's a learning process. Once learned, you'll be glad you stepped into another facet of gunsmithing and can provide another service for customers. AG

MEASUREMENT & INSPECTION

Reader Forum

BY AMERICAN GUNSMITH EDITORS JUNE 2017

ORIGINAL PP. 23-24

Group Gauge There it is again, one of those “Why didn’t I think of that?” articles. Paul Mazan’s “Making A Group Gauge” in the April 2017 issue has given me another interesting shop project. I have always carried a small pocket-sized steel tape measure to measure the target group size along with the distance to move the group center on the target to where I want it to be by adjusting the sights. Now I’ll use this. This brings up an age-old question of how group size is supposed to be measured.

I have been shooting rifles for a little over 77 years now but never shot in competition except for my military training during the early 1950s. The target pullers marked the targets and I don’t remember exactly how they measured the groups. I have mostly thought the groups were measured as the distance between the center of the farthest two holes, which can leave plenty of estimating an exact location if it’s a very tight “one hole” group.

Not so long ago I read that an alternative is measuring the span of the outside distance of those two holes and subtracting bullet’s diameter to arrive at a more exact center-to-center distance. Another “why didn’t I think of that” piece of information. According to your directions in the article, you are measuring group size as the distance between the inside edges of the bullet holes. I think maybe you’re using the old target rule of “if it touches the line, it’s in” here.

Perhaps that means my fabulous 300 clean wasn’t all that good after all? Author Paul Mazan responds. I would love to take full credit for the Group Gauge idea but

Brownells sold them years ago. If memory serves the idea came from Reid Coffield who was also working there at the time and shot High Power with me. Years later, I lost mine and went to buy another but couldn’t find them listed so decided to make one for myself.

I found it so handy I then made a couple more for friends and thought others might like to have a quick project to make a handy tool. Regarding group measurement, you are correct. I was a High Power shooter for many years and shots were scored based on the inside edge of the bullet hole in the target. In fact, when the AR-15 became the preferred Service Rifle the rule was changed to score .22caliber holes as .30 caliber because the AR shooters felt they were at a disadvantage using the smaller bullet.

I felt they already had the advantage of lower recoil and faster shot recovery in rapid fire and always joke that I stopped shooting High Power when it became “centerfire Smallbore.” Not knowing how others measure groups, I went with the only rule I’m familiar with and measure to the inside edge of the holes farthest apart. Anyone that disagrees is certainly free to use any method they please for their own records. The real key to measuring accuracy with a particular bullet/ powder combination is consistency.

I use the same method all the time and that allows me to get accurate feedback on whether anew load is performing better or worse than what I was using. It doesn’t matter if I’m shooting .17 caliber or my .577 Snider, I always use the inside edge of the two holes farthest apart in a five-shot

group just so I’m comparing apples to apples. Colt 1917 I have a Colt 1917 with a cylinder that wouldn’t completely turn to lockup from a cocked hammer and would only finish rotation when the trigger was pulled.

I installed anew pawl and the revolver was perfect on four cylinders, however, there remains a bit of resistance at the end of a double action trigger pull on the other two. Fletcher M. Pool Ordway, CO I believe the corresponding notches on the cylinder need to be dressed but I’m hesitant to do it myself as I haven’t worked on 1917s before. How would you go about fixing this? John Tate RK Campbell responds. Two thoughts without close examination.

The hand may have peened with use and could be shortened or polished a very small amount to fix this. The other possibility, the cylinder is wobbling on its axis. I am certain ejector rod shims for the Smith & Wesson will work the same for this gun. Brownells stocks shims from Power Custom. It sounds like that finishing rotation isn’t being powered by the trigger being pulled, but rather somehow pressure is being released and then the cylinder turns. I would look to the hand and then check cylinder wobble.

Remington 513T Trigger I have a Remington Model 513T .22 rifle that I’ve sent to two gunsmiths to adjust the trigger as the pull was inconsistent, varying from 2-3.5 pounds when measured. Is it possible to get a diagram of the trigger system and any information on this kind of problem related to the Model 513T? I am concerned about any alterations to

READER FORUM CONTINUED

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the trigger system and parts. Also, is there any replacement triggers or parts for this rifle that will provide a good target trigger? We think you should call Brownells and order in a copy of their venerable book, *Encyclopedia of Modern Firearms-Hardcover Edition*. It's a massive collection of technical detail on out-of-production firearms and includes a section on the Remington 513/513T taken straight out of a factory-issued field service manual.

Disassembly/reassembly is thoroughly covered as is the correct way to increase or decrease trigger pull. As for an aftermarket trigger, ask to speak with one of their in-house technicians when you have Brownells on the phone about the *Encyclopedia*. He'll know right off whether they have one in stock or which aftermarket trigger maker could sell you one. **Browning BAR Problem** I have a Browning Bar II Safari that a customer brought in with a complaint was that it was damaging the brass cases upon ejection.

He showed me several that were dented right where the taper meets the main body of the case. He also said it wouldn't fire reloads that he had. I inspected the rifle and, like most, found that it was dirty and fouled. I lightly cleaned and lubed the action, firing three factory rounds and three of customer's handloads. The rifle worked, placing a small, double set of scratches on one factory case and a small dent in the taper of another.

With the handloads, the rifle put two slightly larger dents in the tapers of the cases. **R. Rothnie** Some research online revealed this problem is reported quite often. Some recommend backing down the gas pressure but I'm not leaning in that direction because the heavy carbon fouling found would indicate that the gas push may be not up to snuff now. I have since thoroughly cleaned and fully disassembled the rifle, looking for wear or rough spots. It is chambered in 7mm Remington Magnum and has a muzzle brake.

I have redone several Remington semiautomatics but this is the first BAR I've been into. My generation was the M14, M16, and M60. If a quicky clean up job got off six mixed rounds with no problems, a thorough cleaning might prevent them showing up again. Include everything in that thorough cleaning, including the muzzle brake. Gas ports are not to be excluded either but do not enlarge port diameters in the process. The suggestion given you on "backing down" gas pressure would likely lead to operating malfunctions.

Namely, short cycling of the action, less than ideal levels of extraction, failures to feed, and misfires. **Change Shot Impact** How do you change the pattern placement with a shotgun since you don't use the sights? **Rob Starczy** Do you mean change the point of impact or the density of the shot pattern? We only ask due to a long-standing belief that the pursuit of arising pheasant or swiftly passing mallard indicates a shotgun is not aimed, rather, it is merely pointed.

Whether or not the pointing is successful depends entirely on how much the moving bird, be it feathered or of clay, is led. Sometimes, the chance of success is enhanced by allowing wider dispersion of a shot charge with a lesser restrictive choke. Conversely, when the bird being sought is wild turkey, a more restrictive choke is favored. A shotgun being used in pursuit of deer leans more to being aimed. This is primarily ammunition related.

Slugs have been gaining in popularity among whitetail seekers who have no qualms regarding scopes, rifled shotgun barrels with or without integrated cantilever mounts, or other aids to enhance point of aim. **Joseph English** Citadel Arms Finally, crafters of custom-made stocks take upward of twenty measurements of a client. When combined, these ensure the resulting stock will be properly shouldered regardless of being pointed or aimed. AG

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