



FEB 2017

DIGITAL ARCHIVE
EDITION

PRECISION ARMS WORKSHOP

AND THE AMERICAN GUNSMITH ARCHIVE

A TECHNICAL JOURNAL OF CRAFT, REPAIR & RESTORATION

022

ARCHIVE ISSUE NUMBER

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REACTIVATING DRILL RIFLES

CLASSIC FULL AUTOMATICS • GENESIS OF THE HENRY RIFLE • GUN BARREL HONING • J. C. HIGGINS RESTORATION

ORIGINAL METHODS. MODERN ACCESS.

ARCHIVE EDITION 158

DIGITAL ARCHIVE EDITION

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AMERICAN GUNSMITH

DIGITAL ARCHIVE EDITION • FEBRUARY 2017

ISSUE RECORD

ORIGINAL DATE	February 2017
VOLUME	Archive volume not stated
ISSUE NUMBER	02
SOURCE ID	ag-30523ae4c32b0ed33b2fed64

DIGITAL EDITION

PUBLICATION	American Gunsmith
EDITION	Digital Archive Edition
ARCHIVE STEWARD	Innovation Network LLC
CONTACT	editor@gunsmithmag.com

Editorial fidelity. Article titles, author attribution, issue relationships, source-page references, and article text remain bound to the archive corpus. Layout, covers, navigation, and conversion notes are newly produced for this edition. Historical statements remain part of the original editorial record.

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HISTORY

Classic Full Automatics

BY AMERICAN GUNSMITH EDITORS FEBRUARY 2017

ORIGINAL PP. 2

Osprey Publishing (OspreyPublishing.com) has an entire line of technical books covering firearms, military history, board and card games, models, and fiction from every era. Various fully-automatic weapons area popular topic. Despite sharing characteristics like self-loading mechanisms and cyclic rates of fire, full autos are intended for and best used in specific roles. One important example of fully-automatic weapon is the machine gun, of which Hiram Maxim's design is among the most important.

While rapid-firing weapons such as the mitrailleuse (designed by Belgian Army Captain Toussaint-Henry-Joseph Fafchamps with gunsmith Joseph Montigny and used in the Crimean War) followed a decade later by the Gatling were designed and used first, the Maxim was the first self-acting rapid fire weapon. Hiram Maxim was an American inventor that had brought to market curling irons, mills, engines, and electric devices before designing the gun that would make him famous.

The "Devil's Paintbrush" proved so reliable and effective it became a "World Standard" and was used by nearly every military in various forms during World War I. German Machine Guns Of World War by I Stephen Bull is a history of Germany's use and modifications of Maxim's design. The MG08 and MG08/15 were mainstays of the German military through WWI and highlighted here, along with their variants.

Equally important is the chapter "Impact, The Beaten Zone" which overviews concepts important to understanding gunnery with machine guns. Not every full auto is a machine gun. As cyclic-rate became common through WWI, designers sought ways to make volume of fire more portable. Submachine guns—full autos firing pistol cartridges—fulfill a role different from machine guns. They were most useful when typical issue rifles were manual repeaters by adding a rapid rate of fire handheld at close targets.

First generation designs, exemplified by Thompson's M1 "Tommy Gun", were well made but required a fair amount of material and machining to build. Second generation SMGs focused on making the cheapest, easiest, self-loading pistol-caliber firing weapons possible. In this regard, fully-automatic designs are easier to build than semi-automatics. Various designs were tried with varying results, but the winner in the U. S. was the M3.

Chronicled The in M3 "Grease Gun" by Leroy Thompson, these were stamped out (literally) for about \$20 a copy. Despite the "cheap" look garnering creative nicknames such as "Cake Decorator" and "Grease Gun", some U. S. units in WWII issued these almost exclusively. The M3 proved reliable enough to see service beyond Viet Nam.

PEOPLE & COMPANIES

Genesis Of The Henry Rifle

How a little S&W pistol grew up to be “That-Damn-Yankee-Rifle-They- Load-On-Sundayn-Shoot-All-Week” and more.

BY CHICK BLOOD FEBRUARY 2017

ORIGINAL PP. 3-6

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Horace Smith and Daniel Wesson teamed up in 1852 to form the Volcanic Repeating Arms Company. The lever action firearms they developed was designed around a caseless Rocket Ball cartridge consisting of a hollow base bullet containing a powder charge, reported by some sources as fulminate of mercury, and capped with a primer. It was a terribly unreliable round producing large belches of gassy flame.

Much of the havoc was due to the gap between the bolt and breech, a fault that has long since been eliminated in lever action rifles by the addition of a locking bolt aft of the primary bolt to press it into tighter contact with the barrel breech. It might have been due to all the fire and smoke it produced with every shot that Horace and Daniel decided to call their pistol “Volcanic” and named their new company after it.

Despite being revolutionary in its use of caseless ammunition and le- (A) indicates the follower. Pictured below the Henry is the Volcanic Arms lever action pistol. ver action technology, the Volcanic was a failure. It was unreliable, not always effective

due to the loss of propellant gas, awkward to operate and it had no extractor. Each misfire required using a separate rod—not included—to dislodge a stuck round from the barrel.

It is reasonable to assume the problems with the pistol played no small role in the demise of Volcanic Repeating Arms. Before that fateful day, a shirtmaker entered the scene. His name was Oliver Winchester. He came to know and greatly admire Volcanic’s leading technician, first name Benjamin, who had been working closely with Smith and Wesson in eliminating the problems with their firearms, not the least of which was the caseless ammunition.

Like Benjamin, Winchester believed a highly profitable future was to be had with the perfecting of self-contained cartridges. He bought the S&W patents and “encouraged” Benjamin to leave Volcanic and join him at New Haven Firearms. There, he promised, Benjamin could continue work on ammunition full blast. As a bonus came the opportunity to devote ample Atime to eliminating the mechanical problems of the Volcanic design by transforming it into anew lever action rifle.

Benjamin Tyler Henry accepted and joined New Haven. What resulted was the ancestor of a legendary line of Winchester lever action rifles. If you haven’t guessed by now, it was the Henry. The year was 1860. The faithful duplicate of that rifle being featured in this article is made in the U. S. A. by Henry Repeating Arms, an admirably appropriate undertaking.

Ah, you ask, “How faithful is it?” Putting it mildly, Henry Repeating Arms went about the project as though Benjamin Tyler Henry was supervising it every step of the way. H. R. A. did make improvements. The 1860 Henry had a bronze receiver. So does the 2016 Henry, but it’s of proprietary composition and much stronger. The caliber stamped on the 1860 was .44-40. Ditto the 2016. The 1860 was a black powder rifle capable of firing thirteen .44 caliber rounds without reloading.

The 2016 Henry can fire the same number of rounds of .44 caliber S&W Special Smokeless Cartridges. Why not chamber the 2016 Henry for .44 Magnum you may ask? Because there was no such thing in 1860. So, it isn’t.

GENESIS OF THE HENRY RIFLE CONTINUED

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(A) indicates the lever release. Right now I want to mention a caution most owners of tubular magazine-fed rifles have been aware of for years. For the most part, they have avoided using spitzer/pointed tip bullets. Why? Recoil can cause the tip to impact the primer of the cartridge in the magazine ahead of it. If the impact ignites the primer a chain reaction begins in the lineup of rounds remaining which no tubular magazine can withstand. Get the picture? It's catastrophic.

The best way to avoid it is using only flat or round nose bullets. Field Stripping This is a first. There are no instructions given in the owner's manual, or elsewhere, for field stripping the The two screw indicated (C) play key roles in removing the side plates from the receiver rifle. Here's the best suggestion I can make. A Henry has been brought in soon after it has been fired.

Be certain the magazine is empty by cycling the action several times, pull the hammer back one click, leave the action open, and reach for your Otis Technologies insulated .44 caliber bore-to-muzzle cleaning cable. If you don't have one for the most popular calibers brought in to you for cleaning, you really should. Bore to muzzle is the best way to clean up the barrel or cylinder of any gun. Otis makes the job an easy one. Easy and well done.

On the other hand, if the Henry hasn't been maintained by its owner, read the detailed field stripping details included here. You'll need them in order to rid the gun of its accumulated crud. The minimum you have to learn and recall is how to remove the side plates. Owner's Manual Notes A quick commentary on the Henry owner's manual. There's an inherent, right-out-of-the-box problem with the 2016 Henry: The owner's

manual that comes with it. I'm going to be working with Henry Repeating Arms to improve the content.

Presently, the manual fails to live up to the quality of the gun. One improvement will be to spell out the correct way to load and unload the rifle. The way it's related at present is insufficient. Until the manual is republished, keep the directions appearing next here on hand. Copy and present them to any Henry owner. It is my initial contribution to the rewrite. Unloading/Loading The Henry Begin to unload by disengaging the lever hook (#45) with the lever (#23). Swing the lever forward to open the action.

Move the magazine follower (#38) forward until its brightly colored buffer (#39) has cleared the narrow seam between the barrel (#36) and barrel sleeve (#32). Hold on to the follower. Turn the barrel and sleeve clockwise to-

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Henry Repeating Arms Henry Rifle (Specifications subject to change without notice) 01 Receiver 02l Side Plate, Left 02b Side Plate, Right 03 Hammer 04 Trigger 05 Left R_Link 06 Left F_Link 07 Right R_Link 08 Right F_Link 09 Trigger Spring 10 Trigger Pin 11 Hammer Link 12 Hammer Link Pin 13 Hammer Spring 14 Hammer Screw 15 Lock Extension 16 Bolt 17 Firing Pin gether as though you were observing the rotation from the muzzle point of view. This will open the magazine to the outside world.

Tilt the rifle downward over a padded surface to allow any cartridges within to slide out. Cycle the action two or three times or until no cartridges are extracted/ejected and none appear on the carrier. A secondary method is simply to cycle the action until no cartridges appear on the carrier. Slower? For sure.

But that could be the safest way to confirm there's an empty gun in the immediate vicinity. 18 Extension 19 Extractor 20 Firing Pin Spring 21 Extractor Pin 22 Bolt, Rear Link Pin 23 Lever 24 Lever Pin 25 Lever Spring 26 Lever Screw 27 Carrier 28 Carrier Feed Lever 29 Spring,

Carrier Feed Lever 30 Screw Lever/Carrier Spring 31 Link Pin 32 Sleeve, Barrel 33 Sleeve, Latch 34 Sleeve, Latch Rod 35 Spring Sleeve Latch In loading, the Henry differs not from its myriad of lever action, tubefed descendants lacking aside door in their receivers.

It happens up front. The rifle is tilted slightly upward, the follower grasped and moved forward until the buffer clears the barrel/sleeve seam. Said barrel/sleeve is then rotated clockwise while the follower remains firmly held captive to allow the feeding of a hungry magazine tube. Maximum capacity is 13 rounds. The follower remains under considerable pressure from the compressed magazine spring (#37).

Load 36 Barrel 37 Magazine Spring 38 Magazine Follower 39 Buffer, Magazine Follower 40 Front Sight 41 Blade, Front Sight 42 Screw, Front Sight, Trigg. Spr 43 Screw, Hammer Spring 45 Lever Hook 46 Spring, Lever Hook 47 Screw, Spring Lever Hook 48 Tang Screw GBH1053 Buttplate Screw 50 Buttplate 53 Stop Screw, Follower 55 Buttstock 61 Rear Sight Ass'y

GENESIS OF THE HENRY RIFLE CONTINUED

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A B R. A. plus the author recommends Otis Technologies breech to muzzle cleaning system on all Henry rifles. in the number of rounds desired after easing off a little on the tilt to slow the travel of the rounds being introduced. Control the follower. Do not allow it to slam into any live ammo building up in the magazine. After its buffer comes into contact with the last cartridge to have been loaded, release the follower.

Firing The Henry When firing the Henry, as the magazine is emptied the follower will be pushed back by the magazine spring. Avoid placing your hand between the follower and receiver. Should you cause an interruption of the follower moving cartridges back to the carrier, you'll be rudely advised you have messed up when the hammer falls on an empty chamber. Detailed Disassembly Position the rifle trigger side up. Loosen but don't remove the two lever/carrier spring screws (#30).

Back out the tang screw (#48) and lever Both were generously provided by the NRA National Firearms Museum (NRAmuseum.org, screw (#26). Remove the left hand side carrier spring screw. Push upward on and remove the left side plate (#22). Caution, its edges are very sharp. Pull out and set aside links #5 and #6. Remove the lever spring (#25). Flip the rifle over to its right

hand side and pull out the lever pin by hand. Remove the carrier feed lever (#28) from the receiver.

Restore the rifle to upright and extract the carrier (#27) downward. Slip your hand under the rifle to retain the right hand side plate (#02R). Be careful of more very sharp edges. Slide the plate up and off the receiver. Lay the gun down with the exposed links showing. Pull out #7 and #8. Remove the second #30 screw, then the carrier feed lever spring (#29). Locate the hammer spring screw (#43) on the left side of the gun. Back it out. Next are the hammer spring (#13) and hammer screw (#14).

Lift out the hammer (#3) to the top. Drift out the front bolt pin (#22) left to right. Do the same with the aft bolt pin. This frees up the bolt and lock extension (#15). Press inward on the extension (#18), angle the bolt out, and slide the extension to the rear. The firing pin (#17) may join it. Undo the trigger spring screw (#42). Drift the trigger pin (#9) left to right. Remove the trigger (#4) downward. The lever hook (#45) is next. It's spring (#46) and screw (#47) come out right afterwards.

The butt plate screw (#1053) plus two more (#50) retain the butt plate. A very small screw (#53) connects the buffer and its fol-

lower. About all that remains of your detailed disassembly on the bench are the butt stock (#55) and rear sight assembly (#61). Only one component among all those you've drifted, slid, lifted or unscrewed from the 2016 Henry is restricted. The bolt. Can you order replacement parts for anything attached to or housed in it, such as an extractor (#19)?

Yes, but only if ordered with an entire assembled bolt. Otherwise, such apart has to be replaced at the factory. Recommended Reading One of the most valuable gunsmithing volumes in my reference library is the profusely illustrated *Antique Firearms Assembly/Disassembly: The comprehensive guide to pistols, rifles & shotguns* by David Chicoine (pronounced "shequin"). The author was an old acquaintance of mine, a master restorer of old guns, and American Gunsmith contributor.

A stroke forced him into early retirement and I, as well as many others, miss him and his wise, freely-given counsel. Appearing in the volume are 45 pistols, 16 rifles, and 5 shotguns, and every one of them is considered a prized addition by the majority of collectors. The book is published by Gun Digest (GunDigest.com) and available on Amazon.com and other book sellers. AG

MAINTENANCE & REPAIR

Reactivating Drill Rifles

Restoring deactivated drill rifles preserves American military history. Here's how a Springfield 1903A3 was brought back to life.

BY ROY SEIFERT FEBRUARY 2017

ORIGINAL PP. 7-13

The Springfield 1903A3 rifle was the World War II variant of the venerable Springfield 1903 rifle from World War I. To expedite production, it used many stamped parts instead of milled components. The most notable difference was replacement of the barrel-mounted leaf/ ladder sight with a receiver-mounted aperture sight. Over 900,000 rifles were manufactured from 1942-1944 by Remington (707,000+) and Smith-Corona (234,000+).

After World War II many of these rifles were deactivated and provided to high school Junior Reserve Officer Training Corps (JROTC) and other cadet organizations. When I was in high school I attended a military class run by the California Cadet Corps under the California National Guard. In fact, I was the commander of the unit my junior and senior years.

We used deactivated Springfield 1903A3 rifles for drill; the barrel was plugged, the bolt face was welded, and the striker was ground down, but everything else on the rifle was functional. Most of us cadets wanted to own one of these rifles, so ever since my high school days I've wanted to have a functioning Springfield 1903A3.

As popularity and money for high school military programs waned, many of these deactivated rifles were returned to the military and eventually found their way to the Civilian Marksmanship Program (The CMP.org). In the fall of 2011, the CMP held a "junk" auction with over 80 pallet-sized lots of Springfield drill rifles with most lots containing 100 rifles. An individual who purchased one of these lots sold me one of these rifles.

Because the rifle was deactivated, not demilitarized, it had to be transferred through a FFL dealer. A few minutes of pa-

perwork plus a transfer fee put this piece of American military history in my hands. Initial Assessment I completely disassembled the rifle for inspection and to determine what work I needed to perform, and what parts I needed to replace. There was no front sight blade.

The rifles we had in high school had the front sight blade installed, but I remember numerous cadets, including myself, getting cut by them during drill exercises so that is probably why this rifle didn't have one. It looked like the magazine cutoff had been welded, but someone had worked on it to make it function again. The rear sight base was peened and bent, probably from cadets dropping the rifle multiple times, but I was still able to adjust the sight for windage and elevation.

The firing pin hole was welded on the bolt face and the striker (firing pin) was cut off so just the collar was left. The chamber had been torched and a steel rod welded in place and the barrel was tack welded to the receiver. The ejector and ejector pin was missing, the safety would not rotate, the upper band was loose and its screw was stripped. Finally, the safety plunger was broken. To my surprise, I couldn't rotate the safety, which made disassembling the bolt a bit challenging.

I discovered the shaft was broken off of the safety plunger. This shaft guides the plunger into the hole, but now that it was broken, the plunger was hitting the side of the plunger hole effectively blocking it so it couldn't move down. I used a small screwdriver to align the plunger with the hole and pushed down so I could rotate and remove the safety. Since the plunger is longer than the space between the shaft and the lever, it was installed prior to installing the shaft onto the lever.

The handguard ring would not come off because of the tack weld on the bottom of the barrel. I took a safeedge #0 narrow pillar file (Brownells #191-400-760) and filed down the top of the weld until it was even with the rest of the receiver so I could slip the ring off of the barrel. This turned out to be a stainless steel weld and would not take Parkerizing, but this was not a problem since the weld was on the underside of the receiver and would be covered by the stock.

Many of these drill rifles had the magazine cutoff welded in the off position so the bolt couldn't be removed but cadets could still cycle the bolt. For many of these rifles this weld had to be cut through to remove the magazine cutoff. Removing the welded magazine cutoff in my rifle was much easier than anticipated. Since it was functioning all I had to do was remove the magazine cutoff screw and spindle and remove the magazine cutoff from the receiver.

Although the magazine cutoff functioned correctly, because this part was so damaged from the welding I purchased anew one. The ugliest part of this rifle was the cratered receiver where the magazine cutoff was welded. I could have had this TIG welded and then reshaped it, but I decided to leave it and just re-Parkerize it. Leaving it as is I can brag about how I recovered a drill rifle and show where it was originally welded. However, I wanted the magazine cutoff to function correctly so I cleaned up the detents.

I took a 3/32" carbide ball end milling bit and my high-speed rotary tool set to the lowest speed and opened up the welded center detent. I reinstalled the old magazine cutoff and tested it

REACTIVATING DRILL RIFLES CONTINUED

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with the bolt and everything worked as it should. The center detent was in the proper position so the bolt could be removed and installed easily. I also cleaned up the On and Off detents with the 3/32" carbide ball end bit because they had some metal splash from the welding. Now the magazine cutoff plunger sets securely into each of the three detents. So what exactly does the magazine cutoff do?

In the down or Off position, it will not allow the bolt to come back far enough to feed rounds from the internal magazine, essentially making it a single-shot rifle. In the center position it allows the bolt to be removed and installed. In the up or On position, it allows the bolt to come back far enough so the rifle will feed rounds from the internal magazine. Also when in the On position, after the last empty case is extracted and When freed, it functioned but I replaced it for cosmetic purposes.

I didn't polish out receiver weld. ejected the follower prevents the bolt from closing, thereby indicating that the magazine is empty. To clean up the rear sight base, I completely disassembled it and noticed that the sight base was heavily staked onto the receiver. I found on the Internet that this seems to

be common with rifles manufactured by Remington so I decided just to leave it alone and treat it as part of the receiver.

I took a brass punch and pounded the sides of the rear sight base until they were straight. I took a file and cleaned up the burrs on the top of each side, then used a rubber polishing tip and my high speed rotary tool to polish out the file marks. The most difficult part of the recovery process was removing the welded barrel.

The proper method is to use a lathe to not only remove the barrel weld, but to remove enough of the barrel shoulder to reduce the interference fit of the barrel to receiver face to facilitate easy removal of the barrel. I don't have a lathe so to remove the weld I used the same safe-edge #0 narrow pillar file I used previously. I started at the end of the weld and rested the safe edge of the file against the receiver face. I began filing the weld being careful not to cut into the receiver face.

After I filed off some of the weld to expose the barrel, I rotated the rifle so I could file off more of the weld, making sure the safe edge of the file was resting against some exposed receiver face to keep the file square and flat. Because the weld was so high I started filing on the other end of the weld being careful as before. I continued to file both sides of the

weld until I had a bare-metal cut in place of the weld indicating that I had removed the weld metal and had started to cut into the barrel.

I filed a little deeper to make sure I had removed the entire weld. The barrel was now ready to be removed. I already had an action wrench from Brownells so all I needed was the Springfield 1903 Head (#080-801-003). A properly fitting head is important because this prevents the receiver from warping or otherwise becoming damaged when removing the barrel. I also already had the barrel vise, but I didn't have a bushing that fit the barrel, so I had to make one.

I marked the barrel just in front of the chamber swell, and made another mark 1 1/8" farther down the barrel. The barrel diameter measured at the two marks was 0.980" and 0.942", meaning the barrel had a 0.968-degree taper. I'll discuss the math to calculate this taper below. I used Bob CAD-CAM v20 (bobcad.com) to create the CAM code, then used my MAXNC 10 CL hobby CNC mill (maxnc.net) to mill the bushing from 1 1/8" aluminum stock.

No matter how hard I tried I couldn't remove the front sight base from the barrel, so I cut off the barrel about an inch behind the front sight base. This is a throw-away barrel

REACTIVATING DRILL RIFLES CONTINUED

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I was careful not to touch the receiver face. Notice the steel rod welded inside the chamber so cadets couldn't chamber around. anyway and I ordered a replacement front sight base. I attached the receiver wrench to the front of the receiver using the Springfield 1903 head. I coated the inside and outside of the barrel bushing with rosin (Brownells #083-016-100), positioned it on the barrel, then installed and tightened the barrel vise onto the bushing.

I positioned the barrel vice in a well-supported bench vise and used a two-foot length of pipe on the action wrench to gain some additional leverage. Thanks to this additional leverage the barrel easily came loose, even after almost 70 years. As my father taught me, it helps to have the right tools!

Replacement Parts I purchased the following parts from Numrich Gun Parts Corporation (GunPartsCorp.com). All the replacement parts, except the barrel, came stamped with an "R" indicating they were all manufactured by Remington; a perfect match for my rifle. They included anew Criterion barrel (1087210), safety lock assembly (514340B), striker (514510), magazine cutoff (515370), front sight base (524910), front sight key (524650), front sight blade (524900), bolt body (514520), ejector (515760), ejector pin (515750).

I not only wanted my rifle to function like new, I also wanted it to look like new so I decided to re-Parkerize the visible parts. Parkerizing is a very simple, inexpensive process that applies a more durable finish than bluing. This is why manufacturers starting Parkerizing military guns to keep up with the demands of two world wars.

Parkerizing also covers up nicks, scratches, and other imperfections, and this rifle has almost 70 years of imperfections and cadet mishandling!

I have Parkerized a number of guns and each one came out beautifully. I purchased a jumbo combination (black and grey) Parkerizing kit from Home Parkerizing Kits (ParkerizingKits.com), and used the grey to match the original military Parkerizing on early '03-A3s. Later rifles came with a grey/green Parkerizing. I took all the parts I wanted to re-Parkerize and first removed any unsightly burrs. The new bolt body I received was blued and packed in grease.

I removed the grease by soaking the bolt body in solvent, then bead-blasted the parts down to bare metal which gave them a nice, even, matte finish. I thoroughly cleaned and degreased all the parts, and prepared the grey Parkerizing solution according to the instructions. Using nylon cable ties to suspend the parts and provide a means to remove the part from the hot Parkerizing solution, I heated the solution in a large stainless steel cooking pot to 190-degrees Fahrenheit and immersed the parts.

After the parts stopped bubbling I removed them from the pot, thoroughly rinsed them with hot water, then coated them with the provided light oil. Some areas on the receiver and the bolt sleeve wouldn't take the Parkerizing. I bead-blasted them again and then dipped them in an acid bath made of one part muriatic acid and four parts tap water for 30 seconds, then thoroughly rinsed them in tap water. This time the Parkerizing came out evenly.

After Parkerizing the parts, I polished the bolt locking lugs on the new bolt. This ensured that the bolt locking lugs mated evenly with equal pressure which can provide some increase in accuracy. This process can also change headspace, which is why I performed it before I installed the new barrel. I installed a spring onto the steel rod that was welded into the chamber of the old barrel and screwed the old barrel onto the receiver so the spring applied tension on the closed bolt.

I removed the bolt, applied some 800-grit lapping compound onto the recoil lugs, opened the bolt about 45degrees, then closed the bolt. Opening and closing the bolt numerous times lapped the recoil lugs. The spring applied rearward pressure on the bolt to facilitate the lapping process. After 10-20 open/close cycles, I removed the bolt, cleaned the locking lugs with brake parts cleaner, and examined the progress.

I applied more lapping compound and continued the open/close lapping process until both lugs were evenly lapped, then removed the old barrel and cleaned both the receiver and bolt with brake parts cleaner. Barrel Work The barrel I ordered from Numrich had a few problems. There was no alignment mark on the side of the barrel as found on military barrels, so the only way to index the barrel properly was to install the front sight base and "eyeball" it.

I discovered the slot in the barrel for the sight base key was too wide. The front sight base would not fit tightly onto the barrel because the wide slot allowed the sight base to

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I performed the same process to the bolt and other visible parts. The barrel was already Parkerized. The post welded in the chamber acted as a spring guide. rotate. I peened the edges of the slot until the key fit tightly, then silver soldered the key in place. Now the front sight base fits tightly onto the barrel and does not rotate. I screwed the new barrel onto the receiver until it was hand tight and discovered that the barrel was rotated about 75 degrees, making it way too tight.

The proper method for reducing the interference fit is to turn down the barrel shoulder on a lathe, which I don't currently have. Another method for reducing the interference fit is to use 400-grit lapping compound and lap the barrel shoulder to the receiver. This method removes metal from both the receiver face and barrel shoulder, as well as squaring these two surfaces. By removing metal from the receiver face, a new barrel won't be able to be installed on this receiver.

Not a problem because I don't plan to ever put another barrel on this rifle. I screwed the new barrel onto the receiver until the barrel shoulder was about 1/8" away from the receiver. Using a toothpick, I put some 400-grit lapping compound into that space, then screwed the receiver down hand tight while being careful to not get any lapping compound onto the barrel threads. I set the barrel straight up in a vise and alternately loosened and tightened the receiver.

After about 20 or 30 cycles of loosening and tightening I cleaned off the lapping compound with brake parts cleaner and checked my progress. A grey ring was starting to form around the barrel shoulder and receiver

face. I continued this process until the barrel was about 16-degrees off to the right. This will provide the correct amount of interference fit (tightness) for the barrel and receiver.

There was also a solid grey ring around the barrel shoulder and receiver face indicating that the barrel was lapped and square to the receiver. I coated the barrel bushing with rosin as before and slid it onto the barrel. Then, I installed the barrel vise onto the bushing and the action wrench onto the receiver. I put the barrel vise into the well-supported bench vise and tightened the receiver until the front sight base was vertical and centered.

The new barrel came with a chamber that was cut 0.005" short so I had to finish reaming the chamber to the proper headspace. I measured the headspace of the new barrel—a very important procedure when replacing a barrel is to check the headspace—and used the new bolt body so just the bolt face came in contact with the gauge. When testing headspace, there should be no extractor or ejector tension on the gauge.

I inserted a .30-06 Go headspace gauge into the chamber and gently tried to close the bolt body using just light finger pressure. Never try to force a bolt closed on a gauge; light finger pressure is all that is needed. I used the Go gauge because this was a new barrel with a short chamber. At the point where I just started to feel some friction, the bolt would not close completely. This indicated that the chamber was too short.

I rented a .30-06 chamber reamer from Elk Ridge Reamer Rentals (ReamerRentals.com), and put the pull-through rod through the

chamber and out the bore until the reamer was visible in the receiver. I liberally lubricated it with cutting oil and pulled the rod until I felt the reamer contact the chamber. With about ten turns clockwise as viewed from the muzzle (never counterclockwise as this could break the cutting teeth) I could feel the reamer cutting into the new barrel as it cut a longer chamber and new throat.

Pushing the reamer back into the action, I could see the flutes had steel dust from the reaming process. I removed the reamer and rod by pulling them back through the action, thoroughly flushed the reamer and chamber with brake parts cleaner to remove all chips and cutting oil, then ran a clean dry patch through the bore from the chamber to the muzzle. It still wouldn't close on the Go headspace gauge, so I had to do more cutting.

I repeated the cut ten more turns, cleaned and measured process until the bolt finally completely closed with the Go gauge in place. The chamber and throat were now cut to the proper length. I also measured headspace with a .30-06 Field gauge just to make sure the chamber was within specification and the bolt would not close. Reassembly After I finished reaming the chamber I completely reassembled the rifle with the replacement parts.

Everything went together as it should and the re-Parkerized parts made the rifle look almost factory new. The front sight base key didn't have a notch so I drilled a notch so the pin would fit. I made sure all moving parts were either oiled or greased before assembly.



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The lap is spun at 500-700 RPM and rotated so the lap maintains the same angle in relation to the muzzle. The upper band was very loose and it looked like someone tried to tighten it by over-tightening the upper band screw, causing it to strip. The upper band hole in the stock was too large, causing a large amount of slop and play in the upper band. This may have been done on purpose to prevent cadets from installing a bayonet. I drilled out the hole in the stock to 1/4".

I glued a piece of 1/4" hardwood dowel into the hole and sanded it flush with the stock, then drilled a hole through the dowel using a #26 drill bit. Now the upper band has no slop or movement. I discovered that the extractor wouldn't slip over the rim of a single-fed cartridge but it worked perfectly when feeding rounds from the magazine. I put a rubber polishing tip on my high-speed rotary tool and polished the face of the extractor. Originally it had a sharp edge transitioning to the bevel.

I polished that edge and the bevel, then cold blued the entire extractor. Now the extractor slips easily over a single-fed cartridge. When a new chamber is cut in a barrel, the reaming process leaves small burrs perpen-

dicular to the bore. These burrs can tear copper from the bullets which turn into plasma and are deposited in the bore as copper fouling. Barrel break in removes these burrs and polishes the bore, helping to prevent fouling.

Normal barrel break in consists of five cycles of shoot one round then clean the barrel, followed by five cycles of shoot two rounds with a barrel cleaning, followed by five cycles of shoot five rounds then clean the barrel, follow by five cycles of shoot 10 rounds and clean the barrel. Each cleaning should be performed with copper solvent to remove all traces of copper fouling. My barrel break in is a combination of hand and fire lapping to polish the chamber throat and lap the bore.

I performed this procedure with a new M1 Garand barrel and it worked very well. So well that after a range session firing 10 eight-round clips the barrel had no copper fouling and needed only three patches to come clean. The purpose of this procedure is to polish out any burrs left in the barrel throat from the reamer, and to polish and gradually taper the barrel for increased accuracy and ease of cleaning.

REACTIVATING DRILL RIFLES CONTINUED

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Traditional fire lapping drives bullets impregnated with lapping compound through the bore at very low velocities. Cases used for fire lapping have to be discarded as the case neck becomes contaminated with the lapping media. Although this method does wonders for the bore, it also lengthens the barrel throat, reducing barrel life. My method polishes the throat without increasing its length, laps the bore and I don't have to throw away the cases!

Start by loading 15 rounds of .30-06 with 5.0 grains of Red Dot behind a 150 grain FMJ boat tail .308 bullet and a large rifle magnum primer. I use magnum primers because there is so little powder in the case. Anything less than 5.0 grains of powder will cause the bullet to get stuck in the bore.

With a bore guide in the action to prevent the lap from depositing compound in the chamber, I wrapped a .45 caliber cleaning patch around a .25 caliber bore brush with the patch impregnated with USP Bore Paste (USP-BorePaste.com, I ran the tight-fitting patch back and forth through the entire length of the bore 20 times, being careful not to allow the lap to come all the way out of the muzzle or all the way into the chamber.

This performed the hand lapping part of the process and left a small amount of compound in the bore. I fired one low-velocity round through the barrel for fire lapping. Afterward, I inserted the bore guide into the action and ran an USP-impregnated tight patch back and forth 20 more times. This cleaned any powder residue and fouling from the bore and prepared it for a second low-velocity lapping shot.

After performing this lap/shoot process for five shots, I thoroughly cleaned the barrel using patches with solvent followed by dry patches. This removed any residual lapping compound in preparation for the next finer compound. Using a clean patch with J-B Bore Bright (Brownells #083-065-100) instead of USP, I performed the lap/shoot process sequence for another five times as before, then thoroughly cleaned the bore again with solvent and patches.

Finally, I performed the same hand lap/fire lap process an additional five times using Iosso Bore Cleaner (iosso.com, which has the finest grit. This process performed the final polish of the chamber throat and bore. The bore was mirror bright and smooth and now ready for full pressure loads with a polished throat that will prevent excessive fouling. The last thing I did just to make sure I hadn't picked up any nicks or burrs on the muzzle crown was to lap the muzzle.

FROM THE ORIGINAL PAGE

This removes those nicks and burrs and makes the ends of the lands and grooves sharp, and can enhance accuracy. I put some 400-grit lapping compound on the end of a brass muzzle lap attached to a variable

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Threaded brass pins will prevent the crack from spreading. I cut the pin and file it flush with the wood. speed drill. With the drill running at about 500-700 RPM, I touched the ball end of the lap to the muzzle held at an angle and rotated the drill through 360 degrees, keeping the lap at the same angle. I did this for about a minute, making sure I kept rotating my drill in a circular motion. I cleaned the excess lapping compound off the muzzle and ran a cleaning patch through the bore from breach to muzzle.

The muzzle had a bright ring around the inside and the lands and grooves were nice and sharp. I installed the new blade in the front sight base and used a 1/16" roll pin because I didn't have a solid pin to mount the blade. The pin was nice and tight so the blade didn't move. Stock Work I decided to refinish the original stock and handguard rather than purchase new ones. I've refinished a number of gun stocks and they come out looking almost like new, although this one was pretty beat up.

With the rifle completely disassembled, I removed all the metal parts from the stock and handguard. I used Klean-Strip KS-3 Premium Stripper, a semi-paste that adheres to the wood. I applied the stripper with a brush, allowed it to set for 15 minutes according to the instructions, then wiped it off with a paper towel. The first application removed almost all of the old finish. I applied a second coat of stripper and used a stiff nylon brush to work it into all the crevices, wiping off again after 15 minutes.

After the third application I soaked a green scrubbing pad in mineral spirits and rubbed down the wood to remove all excess stripper and completely clean the wood. After the wood was stripped and cleaned it appeared like someone had tried to refinish this stock once before and did a poor job of sanding. However, many of the original cartouches became visible after I stripped away the old finish. After the wood dried, I applied a wet cloth and pressed a hot iron to it. This process steamed out dents from the wood.

If this was a collectable stock I would not apply steam to any cartouches as this could remove them. I steamed the entire surface of both the stock and hand guard three times to make sure I raised as many dents as I could, then set them aside to dry. After the wood completely dried, I lightly sanded with 400-grit paper, then applied Minwax Gunstock #231. I wiped off the excess with a clean cloth and allowed the wood to dry overnight.

Then, I applied a coat of Minwax Clear Satin Fast-Drying Polyurethane to all the inside areas of the stock and handguard. This will prevent moisture from getting into the stock, especially the parts touching the metal receiver or barrel and causing rusting and pitting. Once the stain was dry I applied three coats of Birchwood Casey Tru-Oil. Tru-Oil provides a durable, easy-to-repair finish that I use on all my gunstocks.

I allowed each coat to dry for six hours, burnishing the surface with a nylon stocking after each coat. I don't usually use steel wool because it can leave steel filaments behind in the wood. The stock was cracked from

the magazine cutoff detent back to the wrist; but it was only cracked on one side. I couldn't open the crack far enough to put in any glue so I decided just to use pins. I took a 3/32" brass rod and threaded it with a 4-32 die.

I threaded enough so I could cut two pins, used a #44 drill bit and drilled a pilot hole in the stock. I made sure I didn't go through the bottom of the stock and applied a clamp to the stock to keep the crack as tightly closed as possible. I cut a piece of the threaded rod long enough so I could insert it into the chuck of my variable speed drill. Applying some epoxy to the threads of the pin, I used the variable speed drill at a very low speed to screw the pin into the hole.

I carefully cut and filed the pin flush with the wood, then touched up the wood with sandpaper, stain, and finish to match the rest of the gun. After the glue dried on the first pin I performed the same process to a second hole drilled from the bottom of the stock. This fix should prevent the crack from spreading any further. Result I was very pleased with the result of all my work. The stock was in pretty bad shape to begin with but now has a very nice finish. Everyone keeps telling me it has character.

All the external metal has been refinished and everything functions as it should. You can still see a small spot of stainless steel where the old barrel was tackwelded to the receiver, but this is covered by the stock and does not show. I left the receiver weld alone where the original magazine cutoff was welded. Because of the different consistency and hardening, the weld

REACTIVATING DRILL RIFLES CONTINUED

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This picture just doesn't do it justice. metal Parkerized differently than the rest of the receiver. So how does it shoot? With a brand new, lapped barrel and proper bench rest technique, this rifle is very accurate. And, because I lapped the barrel, it took only three patches to clean it after firing 40 rounds through it. I am now the proud owner of a piece of U. S. military history that I restored to shooting condition.

So why go through all the trouble and expense of converting this drill rifle into a shooter when I probably could have purchased a shooter for about the same price from a gun show? First of all was the challenge of the project and doing the work. Part of the pleasure was doing the work myself and seeing the result. Second, my rifle now has a brand new barrel and refinished parts.

Even if you could find anew, never-fired '03-A3 it would cost upwards of \$1,500+ whereas I spent far less than half that for parts and tools, including the price of the drill It shoots as good as it looks. rifle. A gun show rifle wouldn't have a new barrel or new finish. Best of all, I now have a functioning Springfield 1903A3 for my collection that will last for thousands of rounds.

I know I probably won't come close to putting a thousand rounds through this rifle but I do enjoy seeing those longing looks from fellow shooters when I take it to the

range. So the next time I participate in a bolt-action military rifle side match, guess which rifle I'll be taking along! Calculating Barrel Taper Gunsmithing requires some math capability; especially when it comes to measurement and dimensions. I needed to calculate barrel taper so I could make a tightly-fitting aluminum bushing for my barrel vise.

My bushing had to be 1 1/8" long to fit in the barrel vise, so I made two marks on the barrel just below the chamber swell that were 1 1/8" apart. The barrel diameter at the two marks was 0.980" and 0.942" so I made a drawing to represent the dimensions. I moved both vertical lines up until the bottom of the small vertical line was at the end of the horizontal line. This helped me to visualize what I needed to do. Now I needed to know the length of the small vertical section on the left.

To find this, I found the difference between large and small vertical lines (0.980" - 0.942" = 0.038"), then took half that because the small line is in the center of the large line (0.038" / 2 = 0.019"). So the small line was 0.019". I drew a line from the bottom of the large vertical line to the bottom of the small vertical line and now I had a right triangle to calculate the angle. Trigonometry... I can hear some readers groaning from here! First I needed to find the length of the hypotenuse.

Remembering Pythagoras, with a right triangle $A^2 + B^2 = C^2$. So now I had $0.019^2 + 1.125^2$ and taking the square root of that sum is 1.1251604330050004 029069759316584" So now I needed to find the angle A indicated by the arc in the diagram. As a reminder, SOH (Sine equals Opposite over Hypotenuse), CAH (Cosine equals Adjacent over Hypotenuse), and TOA (Tangent equals Opposite over Adjacent) helps to remember the relationships of the angles and sides of a right triangle.

The side opposite from angle A is 1.125" so I used the Sine function to find the angle. $\text{Sine}(A) = \frac{1.125}{1.1251604330050004029069759316584}$, so solving for A yields $A = \arcsine(1.125 / 1.1251604330050004029069759316584)$. Note, on a scientific calculator (or calculator program on your computer or smartphone) arcsine, the inverse sine function, is likely under the INV check box. So the angle worked out to be 89.032 degrees.

This was very close to 90 degrees which I knew was right, but would have been much too large to make my bushing. The two non-right angles of a right triangle equal 90 degrees so I subtracted 89.032 from 90 for a difference of 0.968 degrees. This was the angle I used to make the bushing. My high school math teachers would be so proud! AG Angle A was the angle I need to find for the barrel bushing.

MACHINING

Gun Barrel Honing

Honing machines can outshoot hand lapping in the manufacture of precision rifle barrels. Here's how Pac-Nor Barreling does it.

BY RAY KEMBLE FEBRUARY 2017

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What goes into manufacturing a custom precision rifle barrel? Lots of hand lapping—the real thing, the hard way. But there's another way.

Pac-Nor Barreling (Pac-Nor.com, has improved quality and reduced cost with a honing machine from Sunnen Products Company (Sunnen.com, The machine has all but eliminated the pre-rifling lap, which is the most difficult and time consuming and the hone produces a consistency in bore diameter that is head and shoulders above lapping, within two to three millionths of an inch end-to-end.

Manufacturing precision rifle barrels has always been something of an art that involves hand lapping of the bore surface twice, before, and after the rifling profile is cut or swaged in by a rifling button. In fact, a bright, hand-lapped bore is considered one of the hallmarks of a precision rifle barrel, despite the inherent variations from manual work done by people who get bored and tired from the monotonous chore.

Pac-Nor worked to improve this with the newly developed Sunnen HTE honing machine. The machine has all but eliminated Pac-Nor's pre-rifling lap, which is the more difficult and time consuming.

Pac-Nor can produce as many custom barrels as before with a slightly smaller staff. "Our objectives with the hone were to

build a better product with less labor, and the honing machine has exceeded my expectations," said Pac-Nor Production Manager Casey Dichter. "The hone produces a consistency in bore diameter that is head and shoulders above lapping, within two to three millionths of an inch end-to-end when it's really dialed in.

This, in turn, improves the consistency of the rifling process by minimizing variation in the depth of the grooves. We still finish lap after rifling, but it's easier because we just polish off the fine crosshatch finish that may be left after honing and rifling." Pac-Nor is a custom manufacturer catering to bolt-action rifle shooters for law enforcement, military, competitive shooters, and hunters.

Started in 1984 by avid shooter and company President Chris Dichter, Pac-Nor is now in its second generation under his son, Casey. In addition to barrel manufacturing, the shop installs barrels on customer actions and can add features such as muzzle brakes, bolt and barrel fluting, etc. The shop runs two shifts per day. A day shift of ten people produces 30-40 custom barrels of different calibers in 416R stainless or chrome-moly steel.

A night shift of three people produces about 50 AR-15 barrels each day for a rifle OEM. Pac-Nor's process starts with cutting and facing premium bar stock, followed by gun drilling, done by four Pratt & Whitney

twin-spindle machines and an Eldorado CNC twin spindle. After reaming, the barrels are gaged for size. Depending on the condition of the reamer, 0.0004" to 0.0007" of material is left in the bore.

This must be manually lapped out or honed out to final size for rifling. "Everyone who works here has done hand lapping," said Dichter. "It's an unpleasant job, particularly if the reamer is starting to get dull. Lapping may take 10 to 45 minutes, depending on the caliber of the barrel. We tried to shorten this, but when chatter marks get 'ironed' into the surface by the rifling button, the finish lap is even longer and more difficult, so there is no advantage.

With lapping, too, there is potential for variation, simply because it's a manual process. Lapping can also be a production limiter and in our region we have a very small labor force to draw on when we want to grow." The company had explored honing in the '90s but re-visited the idea when Sunnen introduced its HTE honing machine. The HTE is a horizontal machine that can hone small-bore rifle barrels with a diameter range of 0.150" to 0.790" (4-20 mm) and lengths up to 60".

Designed specifically for long, small bores, the machine features a sensitive drive and tool feed system that provides maximum protection against tool overload/breakage. Tool specific

GUN BARREL HONING CONTINUED

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Sunnen's Long Bore Tool uses superabrasives to quickly remove imperfections. This rack of barrel blanks awaits completion. force limits and run settings are stored in the touch-screen PC control, allowing the system to sense tight sections in the bore and correct them automatically. Sunnen also developed anew Long-Bore Tool (LBT) designed to take on industry's most difficult honing challenges in small bores of .17 caliber rifle barrels.

The tool quickly removes reamer marks, waviness, tight spots, and other imperfections left by upstream processes. The LBT utilizes metal-bond diamond or CBN superabrasives for high productivity, long life, and fast cycle times. Precision-machined of through-hardened tool steel, the LBT can produce bore The parts are inspected and gaged at various stages during manufacture. accuracies of 0.000027" (0.0006 mm) for diameter, roundness, and taper— from first part to last.

Honing is an ideal replacement for hand lapping barrel blanks before rifling. It quickly removes reamer scratches and surface waviness without labor-intensive hand lapping. A typi-

cal 600-grit abrasive can produce a 6-10 microinch Ra (0.15 to 0.25 μm) finish in a reamed barrel blank. By producing a consistent bore diameter (± 0.0001 " or less), parallelism, roundness, and surface finish end to end, honing yields more consistent performance from rifling buttons and cutters, resulting in a constant groove depth.

The ideal bore geometry reduces distortion of the bullet shape for improved gyroscopic stability in flight. "We are currently honing about 80 percent of what we make and will do more as we acquire the tools in different calibers," said Dichter. "We have learned the quality of our reaming now does not need to be as critical because we have the hone.

Although there is a trade off in cycle time and abrasive cost for additional honing, we are still able to run our reamers two to three times longer than when we lapped alone. With a hand lap, the time and effort increase when the reamer is getting dull." After honing, the barrel is inspected again before rifling with a pull-button. Pac-Nor makes its own Accu-Twist carbide rifling buttons and can provide different rifling styles, including polygonal, per the customer's choice.

A button is attached to a rod and the rod is pulled through the barrel. The company's hydraulic rifling machine utilizes a CNC machined twist bar with a helix angle that matches the twist rate requested by the customer.

The final twist rate is confirmed afterward using a Barrel-Scan electro-optical twist measurement system The barrel is then stress relieved in a tempering furnace, followed by contouring of the outer shape and final, finish lapping of the bore. "During the finish lap, you can really tell the difference between a bore that was honed before rifling and one that was lapped," said Dichter. "You can easily sense any remaining tight or loose spots in the bore.

The diameter uniformity and roundness of the honed bore are superb. The lap also feels different in a honed bore." In competitive shooting where winning scores may be separated by thousandths of an inch, a few millionths of an inch improvement in the uniformity of a Pac- Nor barrel may make a big difference for a skilled shooter. AG

MAINTENANCE & REPAIR

J. C. Higgins Restoration

Sometimes we take on jobs that aren't very pretty, but we still do them. Here's how I did a total restoration of an old, damaged J. C. Higgins bolt action shotgun.

BY NORMAN E. JOHNSON FEBRUARY 2017

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When asked if I would have a look at an old shotgun with thoughts of repairing it, I agreed to see it. The man was soon in my shop with a 1949 Model 585.22 J. C. Higgins, bolt action in 20 gauge. The sight of that old shotgun was shocking. The rusted barreled action was taped into the badly broken stock. A large wedgelike splinter of wood was broken out and missing from the right side of the stock at mid pistol grip area six inches diagonally upward and forward.

A huge piece, an inch wide, extended along the bottom of the stock, including the area of the recoil lug mortice. This was all loosely taped in place. The entire recoil lug support was missing and a child could have pulled the gunstock into two halves. Upon examina-

tion of the gun, I discouraged any attempt to repair it. We talked awhile and he left with the gun... but it wasn't over.

The next time I saw him, he said the old gun had sentimental attachment and he would really like to present it to his grandson on his birthday. I weakened and somehow the gun found its way back into my shop. The old shotgun leaned against my shop bench as I walked by it for at least six weeks. Those who came by couldn't believe I would one day take on the daunting task of attempting to repair it.

The Plan Of Attack In my experience I have learned that things that need to be done can only be put off so long, even the jobs that seem insurmountable, so one cold day I grabbed the old gun with serious intent. I removed the tape holding the barreled action in the stock. This allowed the gun to totally fall

Piece with hole in it had to be made and fitted as recoil lug support. apart. Along piece of stock extending from beneath the forend tip clear back through the recoil lug area fell out.

The piece of wood that served to retain and support the recoil lug was missing. The action retaining bolt had no support whatsoever. At that point I felt if I could somehow reposition the large piece of stock wood I would continue on with the project. Total abandonment would be the only option should I fail here. Regrettably, I hadn't even taken a picture of this shambled section of the stock, which strongly suggested there was much doubt in my mind the job would ever be completed.

I carefully cleaned up the broken wood surfaces and the piece pretty much filled all the cracks as I

J. C. HIGGINS RESTORATION CONTINUED

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The entire lower forend channel had also been broken out and replaced using Pro-Bed 2000 stock bedding material. I tried it in place. I used Score High Pro Bed 2000 (ProBed2000.com, with walnut color tone as a bond and sealant. I carefully fitted the piece into position, clamped things together, and set it away. After 24 hours I removed the clamps and The grain and texture would quite closely match on final repair. tape. Things looked quite good so I decided to continue on.

I then made and fitted a special piece of walnut that would serve as a stepped support for the recoil lug, replete with hole for the action screw. This part was attached to the recoil lug and bonded solidly into place as an inte-

gral unit, all to be finished later. I then shifted my efforts to the aforementioned chunk of wood missing from the pistol grip diagonally forward. This would require careful fitting of a piece of walnut of similar grain and color.

I keep a few old gunstocks around for this sort of transplant and found one with a fairly close match. I chose not to use a blending wood stain for any subtle change in texture or color. Fact is, I wanted this piece to sort of show off my work if it did, indeed, turn out. An hour later, I precisely fitted and bonded it in place with Pro Bed 2000. It would be shaped after 24 hours. This phase of the work was a blend between wood carving and carpenter work. On to shaping, sizing and sanding the stock.

The attached, oversized side piece, in its rough state, was plain ugly. I had shaped and finished it with a sharp chisel, rasp, pocket knife and varying grit sanding paper. The entire back portion of the round receiver channel required special fitting, as did the safety tang mortice. The specially fitted recoil lug mortice fit perfectly with Pro Bed 2000. The entire stock was later sanded and finished with 300 grit paper.

Final stock finish was applied with two coats of Birchwood Casey Tru-Oil and set away to await assembly. Buffing And Cold Bluing Overall, the functionality of the old J. C. Higgins

J. C. HIGGINS RESTORATION CONTINUED

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shotgun appeared OK. The safety worked well. It would be test fired later, however, there is a caveat here that would be pointed out to the owner/shooter. The gun is designed to fire with the safety in the rear-most position. This is opposite to most firearms where working of the safety becomes habit. Shotshells cannot be loaded into the magazine until the bolt is fully withdrawn. Anyway, I would check these things out before buffing and application of gun blue. A soft wire wheel removed the rust well enough.

I then used Brownells Formula 44/40 Instant Cold Blue, which brings out a deep penetrating, fast-action blue. The wipe-on, wipeoff technique is very efficient. The blued metal must be kept oiled for awhile following bluing to prevent further oxidizing, which is essentially what the bluing is. Having completed the metal work, the gun was assembled, this time without tape to hold it together. A single screw passing through the totally rebuilt recoil lug support held everything together.

Selection of matching wood grain is important here. Test Firing Inasmuch as the shotgun would be given to a young hunter, it was

particularly important that it would function properly. Loading of standard 2 3/4 inch shells "only" went smoothly. As mentioned, the bolt must be fully withdrawn to feed shells into the tubular magazine which is accomplished from below.

The safety can and should be in the safe position at that point and until such time the gun is fired or un- Far Its walnut tone and excellent bonding qualities were used in the repair of this gunstock. This was shaped and finished after the piece was firmly bonded in place.

J. C. HIGGINS RESTORATION CONTINUED

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loaded. This all went smoothly. One can usually see how overall design of most anything mechanical could have been improved upon, but I guess this is the reason we see and use many different things. In testing, I loaded three Federal shot shells with number six shot. C. Higgins bolt action shotgun was very close to the trash heap.

A few gun repair supplies along with a good measure of courage and ingenuity come in handy too. particularly thankful that it will end up in the hands of a youth— maybe even one of his grandchildren someday. I guess this is what's meant by mutual satisfaction. AG A close look will be required to see where major repair was made. Firing, rechambering,

and extraction went quite well. The 25-inch, full choked barrel produced a very uniform shot pattern.

A feeling of satisfaction came over me in resuscitating the old shotgun back to life. I would have had a less than clear conscience had I given this old shotgun its last rites as it was first presented to me. I'm

RIFLES

Fixing The AK

Working on and improving a Century Arms Kalashnikov-type 5.56mm rifle. Here's how to fix common AK problems.

BY ROBERT K. CAMPBELL FEBRUARY 2017

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Over the years I have used quite a few AK-47/AKM and AK-74 rifles and their variants. I find Kalashnikov-type rifles to be serviceable and reliable, though not as well refined as AR-15 rifles. Having spent some time shooting and working on them I know those believing the AK doesn't jam or give problems have attended a different church than I. Just the same, the rifle is useful and seldom gives trouble. It has a deserved reputation for reliability but isn't perfect.

I am going to cover a specific fix for the AK rifle, but let's go over basic field strip and maintenance first. The AK-47 rifle is a model of reliability, ruggedness and hardy combat ability but it also needs proper maintenance and lubrication. Just enough disassembly to clean and lubricate parts is enough. The receiver is three-sided stamped sheet metal. The rear trunnion and forward barrel trunnion are secured by rivets. Bolt rails are welded in place on the interior of the receiver.

The receiver is rigid and strong and the barrel is a hard press fit tied in with a pin. The AK-47 is a model of reliability but I have

seen plenty of problematic rifles. Poor maintenance and haphazard manufacture lead to problems. When field stripping the rifle, first remove the magazine and then double check the chamber. Press the button at the rear of the receiver cover to release it. The forward receiver cover fits neatly into a semi-circular slot in the rear sight assembly.

If not properly fitted into this slot, the rear of the cover will not drop to allow the release button to click back into place. When the button is pressed in, the receiver cover comes out rear first. The bolt carrier is retained by the receiver and recoil spring guide. The bolt carrier rides on rails in the top of the receiver. It is well secured. The cover only keeps debris out of the rifle and does not secure the action.

To remove the recoil spring guide, press it forward and compress the recoil spring into the bolt carrier. The spring guide will come out of its slot in the rear trunnion. The Century rifle also features a spring-loaded button that is pressed to release the spring guide. Lift and pull up the recoil spring as-

sembly 56mm rifle. from the bolt carrier. Grasp the bolt handle and pull the bolt to the rear by this handle.

The bolt must travel completely to the rear and into the notches behind the slide rails of the AKM-type receiver. The bolt may then be lifted out of the receiver. The gas piston remains in the gas cylinder at this point and you will not be able to lift the bolt carrier. However, you may lift the bolt carrier off the slide rails and lift it enough to get the bolt from the receiver. Carefully pull the carrier to the rear and the gas piston will slip out of the gas cylinder.

The bolt is rotated until the lug clears its raceway in the bolt carrier, and then the bolt is pressed forward and removed. A latch on the side of the receiver just under the rear sight allows the gas cylinder to be removed. The handguard and gas cylinder are removed in this manner. The maintenance work begins now. Scrub the bolt, gas cylinder, and gas piston, paying close attention to the bolt face. The previous drill will solve most AK rifle problems. A problem that isn't solved by cleaning is a

FIXING THE AK CONTINUED

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Above center: The recoil spring guide was not difficult to remove. tight safety lever. I have encountered various issues with tight levers and it seems to vary among manufacturers. The problem is that the lever is so tight that it is Bottom Bottom difficult to manipulate the safety from low ready or typical firing positions. The Century Arms AK-type

rifle I recently worked on is anew production version chambered in 5.56mm and adapted to use AR-15 magazines.

The safety was stiff at first and then seemed to loosened up in the short term. However, during a more extensive firing session the safety became so stiff that the owner had to lower the rifle and actually use a tool to move

the safety to the fire position. This isn't acceptable. Tempted at first to use the field expedient of bending the lever outward, the owner instead elected to have the rifle professionally fixed.

This isn't a repair as I would normally term it because the rifle wasn't broken; the rifle had a problem as delivered from the factory.

FIXING THE AK CONTINUED

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56mm rifle is well designed and seldom gives trouble. Upon examination, the rifle had what was the tightest AK safety I have yet encountered. Just as bad, the problem was not consistent as the safety sometimes worked properly with a bit of stiffness and other times it was far too tight for use. A firing session seemed to have made the situation worse rather than breaking the rifle in. It isn't difficult to remove the AK safety lever.

Field strip the rifle with the top cover removed and then twist the safety up and to the rear. The safety lever is then easily removed from the receiver. Doing this made the problem obvious. The opening in the lever that goes over the receiver was too tight. Part of This part of the safety did not bind. Below center: Finally, it seems the

small file worked best. It is the skill and elbow grease that seems to matter most. the lever rides on one side of the receiver and part on the other, inside and outside.

The obvious solution is to bend it away, however, bending isn't acceptable because the geometry of the safety lever is such that bending the lever enough to relieve tightness might cause binding in another area. The proper fix is to enlarge this opening, even though it was difficult to find the proper tool. The goal is to open up the gap between the two sides of the lever to accommodate the receiver, but to do so while maintaining proper tension.

Running sandpaper inside 56mm rifle seems well put together. the gap did not work well. What did work was a thin piece of metal with

coarse sandpaper glued to it and used along with a judicious amount of elbow grease. The piece was sanded, reinstalled, and re-sanded until the proper fit was found at about the seventh try. Taken slow and easy, the cut-and-try method is the proper means of doing this type of repair.

Along with the glued coarse sandpaper, I also used the flats of a thin file to carefully open this piece. The rifle was reassembled and proper function of the safety lever checked. The owner is now pleased with the operation of the safety lever. This is the first time I have fixed this problem but the solution was simple enough and will work on any Kalashnikov rifle with a stiff safety lever. AG

PEOPLE & COMPANIES

Reader Forum

BY AMERICAN GUNSMITH EDITORS FEBRUARY 2017

ORIGINAL PP. 23-24

Custom Gunsmith Casting Call I'm a casting producer for a production company out of Los Angeles. We're currently working with a major cable network to find artisan custom gunsmiths for a new TV project we're working on. We are looking for the "go-to" gunsmith for a small town or community. Does everyone in the community go to this gunsmith for buying or repairing their guns? Has gunsmithing been in their family for generations? Do they forge or repair creative custom firearms?

Gunsmiths that might be a good fit for this project should contact me. I'd love to chat with you. Luke Swinney This Is Just A Test 2nd Floor Los Angeles, CA 90006 Office: Mobile: Carlos On Sierra Bullets I have mentioned in a number of articles how the 90 grain Sierra Match King .224 bullet designed in 2005 was prone to mid-air blow ups due to jacket issues.

I talked about this most recently in my December 2016 article, "Gain Twist Barrels For Palma." Those of us who write frequently for American Gunsmith sometimes find our articles "in the pipeline" for awhile from the time they're written until they are published. Changes can take place in that interim. This was the case with the Sierra's 90 grain bullet. Sierra's original 90 grain bullet remained on dealer shelves for nearly a decade in its original flawed condition. However, it was recently redesigned.

I have been testing the newly redesigned Sierra with Berger 90 grain Match Boat Tail and Sierra's new bullet appears to be blow-up proof. I have torture tested it and have experienced no failures and am obtaining speeds of 2,800 fps in 30" and 32" Palma barrels with stellar results. I also have customers using it and they like it. Accuracy is comparable to the Berger and the ballistic

coefficient of the new Sierra is higher than any other 90 grain AR-15 bullet on the market.

I'd like to formally update the record and apologize to Sierra for statements that were correct when written but out of date regarding the new bullet when published in my December 2016 article. Readers should be careful when purchasing Sierra 90s to be certain they are getting the new bullet. I would be leery of any boxes of 90 grain SMKs that have been on dealer shelves for much longer than a year as they may be of the old design.

If the dealer will permit you to open the box, the new bullet is factory pointed (which helps attain the high ballistic coefficient) and the older bullet has an open hollow point. Thanks for your understanding and look for a full article on the new bullet in the near future. TIJAT.com J. C. Higgins And More Regarding reader William Reinhart's question about the origin of his customer's J. C. Higgins Model 101.24, my info says it was likely made by Savage/Stevens but the comparable model number was not available.

For the stuck bolt, I would start by soaking with Kroil or another good penetrating oil and tapping with a nylon hammer about every six hours. It may take a day or so but that should free it up. On RK Campbell's article on grip screws, the last paragraph says to rotate the bushing extractor clockwise to remove the bushing. Shouldn't this be counterclockwise? Norman Johnson's article indicates he may even older than I am. Ben Franklin and I went to school together... A great issue!

I always like articles from Joe Carlos and anything from Chick Blood is a keeper. I have every issue from 1993 forward. Charlie Briggs 'Smithing Since 1985 RK Campbell responds. Yes, sir. I stand cor-

rected! Thanks for reading. Model 1903A4 Referencing Mike Lawrence's "Model 1903A4" in the June 2016 Reader Forum, it sounds to me like he has a rifle assembled from parts. It would be nice to know what the barrel stamps are and more info such as is the stock cut for the A4 bolt.

I suspect that someone has installed a 1903 barrel on a Remington A3 receiver with the 1903 rear sight and base. Turning it back into an A3 is a simple matter. Remove the front sight base cross pin and drift it of the barrel with a wood block or brass rod. Drive out the rear sight base cross pin and drift it forward of the barrel the same way. Leave the rear sight in the base so as not to distort the rear of the sight base so that you may save it.

The 03A3 hand guard ring fits over the receiver so the slightly smaller diameter of the 03 barrel at the receiver does not cause any problems. Joe Carlos Install an 03A3 front sight base and sight to get the proper front sight height. I suggest a letter "A" front sight blade. Some after market front sight blades may be thinner than the correct width of .050" as was the original. You will have to drill anew hole for the cross pin as the 03A3 pin is in the middle of the sight base instead of at the rear as on the 03.

Then install an 03A3 hand guard and an 03A3 rear sight assembly. If the rifle has a milled 03 upper band for the bayonet the front part of the hand guard will have to be trimmed back slightly to accommodate it. All of these parts are still available through the various parts suppliers but are getting harder to find every year.

An 03A3 parts gun assembled with all milled parts with a nice clean stock and new Parkerizing makes an unusual conversation piece that was never produced as far as I can tell from my research.

READER FORUM CONTINUED

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An upper milled band with a Remington "R" stamped on it makes a nice touch. Great research job and commentary Reader Angst. We've passed it on to Mike Lawrence. Barrel Break-in Can properly broken-in barrels be ordered and shipped that way? If so, about how much extra is this? Do you use brushes at all, or are you relying only on patches for your break-in procedure? I've heard of a ten day breakin per barrel.

Does this mean firing around, taking the upper home to clean with copper solvent, and then repeating the next day for a total of ten days? Does it matter which bullet is used when firing for break-in? Should longer match projectiles be used during initial break-in firing? Joe Carlos responds. Break-in means break-in and that begins with the first shot and the formal process ends with shot ten.

After that, I recommend cleaning more often than normal and never allowing the Submit a question or letter to the Reader Forum column by addressing an email to or posting a letter to American Gunsmith, Alexandria, VA 22310. Send subscription questions to barrel to heat up for another 200 rounds. Barrels that have been test fired before a formal break-in are very difficult to break in. The more rounds fired, the greater the difficulty.

The breakin process is never fun but I would at least attempt to perform it on a barrel that has been test fired. Ken Angst I

don't know of any barrel manufacturer who performs a break-in for customers. As far as I know I am the only custom gunsmith who breaks in barrels for customers. It is very easy to damage a barrel due to cleaning rod flex during the break-in, especially in stainless barrels that are more easy to damage. I spend ten days breaking in every barrel.

As a professional gunsmith and former competitive shooter I have a range on my property so I simply step out the back door and fire the shot into a safe backstop. I use Montana Xtreme Copper Killer which is the most aggressive copper solvent I know of. Even at that it takes me the entire day to get the copper out (running a fresh patch about every 15 min.) from the previous shot. Hence, a ten day total investment.

I use what ever scrap ammo I have lying around for breakin shots but the use of longer match Casey Terrence bullets would likely result in a longer bearing surface burnishing the bore, which is probably not a bad thing. In the case of gas guns I can't over emphasize placing the gas port down so the solvent pools in that difficult-to-clean area. To clarify, I normally only position barrels I am breaking in with the port on the bottom. I don't install a front sight or gas block and gas tube on guns I am breaking in.

I operate them manually using the charging handle, leave solvent in the bore for 15 minutes, then run another patch wet with solvent. I continue the process until I am sure I have gotten all the copper out. I don't use any brushes or other abrasives during break-in. In part, you are trying to burnish shut the pores in the bore. Use of abrasives during break-in will open the pores which is opposite to your goal.

After break-in, however, you will want to use an abrasive every time you clean (each day you fire the rifle). The abrasive, such as a bore brush, will get the baked-on hard carbon fouling that solvents won't remove. Volunteer Commando Mk 45 The question from Steven Murfin about the Volunteer Commando MK45 in the December 2016 Reader Forum rang a bell with me because that weapon is covered in *The Gun Digest Book of Firearms Assembly/Disassembly: Part VI Law Enforcement Weapons* by J. B. Wood.

Although I can offer no help on troubleshooting, I can offer help on disassembly procedures. The book shows a complete step by step photo sequence for total disassembly. This includes a great picture of the firing pin itself on page 160. Might help determine if something is bent, broke or too short. Looks to me like it would be easy to fabricate a new pin from a drill bit shank. The process of removing it might give a clue if other issues exist. John Maka Good tip. Thanks for the info! AG

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