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THE M1 CARBINE

"BROOMHANDLE" MAUSER • REMINGTON 788 TRIGGER ASSEMBLY • ACCURIZING ENFIELD RIFLES • THE "UNTOUCHED" ...

ORIGINAL METHODS. MODERN ACCESS.

ARCHIVE EDITION 171

DIGITAL ARCHIVE EDITION

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PISTOLS

“Broomhandle” Mauser

BY AMERICAN GUNSMITH EDITORS MARCH 2018

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At a time when most handguns were limited to six rounds, the ten-shot Mauser C96 (Konstruktion 96) caught the attention of the world for its unprecedented capacity and formidable high-velocity 7.63x25mm cartridge. The C96 is a semi-loading, short recoil pistol originally manufactured by Mauser from 1896 to 1937 with copies made in Spain and China. The design originated with the brothers Fidel, Friedrich, and Josef Feederle.

Fidel was a Mauser employee, working as the Superintendent of the Experimental Work Shop for the company. He and his brothers began designing and prototyping the P-7.63 Feederle Pistol on their own as a side project. When the company decided to manufacture the pistol for commercial sale in 1896, Paul Mauser dubbed the C96 the “Mauser Military Pistol” to attract military buyers.

This saw its ultimate expression in the first-ever select-fire handgun—the “Schnellfeuer” machine pistol, fed by a detachable magazine and offering both full-automatic and single-shot modes. The C96 was the first semi-automatic pistol to see combat, arming both sides in the Second Anglo-Boer War, and seeing service with the German, Russian, Chinese, and other militaries.

Widely purchased commercially, it was carried by none other than Winston Churchill in the Sudan and South Africa, became prized by the Irish Republican Army and Soviet revolutionaries, and even armed Han Solo in the Star Wars movies. It was also a prized World War II trophy of my grandfather, Technician Fifth Grade Melvin Bollig, who displayed it above his basement bar next to his VFW Post 8447 garrison cap and American Legion Post 534 pins.

Featuring full-color artwork and photographs, this is the engrossing story of the C96 “Broomhandle” Mauser, the ground-breaking semiautomatic pistol that armed a generation of military personnel, adventurers, and revolutionaries at the beginning of the 20th century. Written by Jonathan Ferguson, the Curator of Firearms at the Royal Armouries Museum in Leeds. Based at the National Firearms Centre, his research interests are in the area of use and effect of firearms, and gun-related mythology and folklore.

Available from Osprey Publishing (OspreyPublishing.com), Amazon, and other book sellers.

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PEOPLE & COMPANIES

Remington 788 Trigger Assembly

Removing the mystery of servicing these once-popular rifles. Here's how to take care of Remington 788 and their triggers.

BY ROBERT E. FRIED MARCH 2018

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In 1967 through 1970, Remington introduced anew series of rifles with their 788, 580, 581, 540X, 591, and 592. The 788 was a centerfire while the others were rimfire but they all had a couple of things in common, such as rear locking lugs and a newly-designed trigger assembly. For this article we will be focusing on the trigger assembly as they are all the same with the exception of the single-shot 540X bolt-action target rifle. Its trigger assembly is adjustable for weight, sear engagement, and overtravel.

Now that most of these rifles are hitting the 50-year mark, they are sitting in closets, gun cabinets, or safes and pulled out, oiled, then returned time and time again until they will not function. I have seen quite a few come into the shop with common problems, such as the bolt release is stuck, the safety will not work, the trigger is locked in place, or the bolt will not stay cocked. Those problems are all related to the trigger assembly.

Before getting into all the details, the reason for this article is information on this trigger assembly is either lacking or short sighted. In one of the assembly/disassembly books for the model 788, step six starts detailing removing the housing, safety, bolt stop, and sear spring. It then states, "Remaining components comprised of the trigger housing subassembly in this unit is factory assembled by precision equipment.

Disassembly of this subassembly is seldom necessary and is not recommended." The Remington Service Manual for these rifles states, "NOTE: Factory Service is required for all trigger housing assembly related problems, return the firearm to the factory for service." This trigger assembly is not all that complicated to warrant returning to a service center. Following this article, you will be able to disassemble and reassemble this trigger assembly, putting a non-functioning firearm back into service.

The cause for those malfunctions listed is twofold. One, the trigger housing and its associated parts fit very tight in the housing. Two, oil and dirt accumulated over several years contribute to the issue. To properly correct these problems, totally disassemble the trigger housing assembly. In doing so, I have come across some changes in the trigger housing assemblies. There are two different types of sears, safety switches, safety switch detents, and safety switch retainers.

The early model sear has a dogleg on its right side, the safety switch is a slightly different shape, the safety switch detent is small in shape compared to the later model, and the early model utilizes a pin instead of a screw as the late model to retain the safety switch at the front of the trigger housing. I have also found they have used a solid pins occasionally instead of a roll pin for the sear on some models.

REMINGTON 788 TRIGGER ASSEMBLY CONTINUED

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Disassembly Using the Model 788 exploded view and parts list, the disassembly is as follows. Loosen the housing lock screw (20). Using a No. 3 (3/32) roll pin punch (080-000-244), remove the housing pin (21) and the housing is now removed from the receiver. Remove the safety switch pivot pin retaining washer (36) and safety switch retainer pin retaining washer (39) and carefully remove the safety switch retainer pin (38), safety switch pivot pin (34), and safety switch assembly (33).

This frees up the bolt stop (4), bolt stop spring (5), safety switch detent (36), and safety switch detent spring (37) which are under pressure behind the safety switch. Be careful not to lose them. Remove the trigger spring (47). Removing the pins (42, 46) frees up the sear (40) and trigger (44). Finally, completely remove the housing lock screw (20) and the housing is now completely

stripped. Don't let the word "Restricted" for these trigger and sear pins scare you. These are common roll pins.

With the housing stripped, all of the parts and housing can be cleaned. I normally use Kroil. On some occasions I've used acetone because the parts were so caked with dirt and oil that Kroil alone wouldn't work. Prior to reassembly, clean the hole threads of the housing lock screw with a 6-48 tap. There have been some instances where the screw was not bearing on the receiver due to burrs in the screw hole and not securely fastened down.

Inspect the sear and trigger for chips or other damage, such as signs of having been the source of someone's "trigger job." Check the trigger spring for signs of shortening and replace as necessary. The sear, trigger, and trigger spring are currently available from Numrich Gun Parts Corporation ([\[partscorp.com\]\(http://partscorp.com\), Make sure the roll pins fit into the housing tight, replacing them as necessary.](http://gun-</p>
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For reassembly, when installing the trigger and sear using the roll pins, use a roll pin holder punch of appropriate size, such as a Brownells Roll Pin Holder Set (080-001-132). Install the trigger, the sear with the notch in the downward position, and the trigger spring to sit on the rear ledge of the trigger. Install the bolt stop and bolt stop spring, then the safety switch detent spring (37) and safety switch detent (36).

Place the safety switch (50) onto the housing while engaging the bolt stop (4) and the safety detent. Complete the safety switch installation by installing the safety switch pivot pin (34) with the retaining washer (35), safety switch retainer pin (38), and retaining washer (39.) Prior to installing the housing onto the receiver, apply a good grade of lubricating gun oil such as Slip 2000 or Break-Free CLP. In-

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stall the housing onto the receiver using a specially-made slave pin. This slave pin will hold the housing in place and also hold the roll pin that secures the housing to the receiver. The slave pin's major diameter is 0.195 x 0.250 in length with a minor diameter of 0.050 x 0.150 in length and overall length of 0.400. This minor diameter will hold the roll pin directly in line to be properly installed securing the housing to the receiver.

To install the housing, push the sear down onto the spring with the trigger held back. Line up the bolt stop with its hole in the receiver and push the housing into position. Using your slave pin, capture the housing assembly to the receiver. With the roll pin sitting on the slave pin held by the tail, install the roll pin attaching the housing to the receiver and snug up the housing lock screw. Install the bolt and perform a function and safety check.

With the rifle on safe you should not be able to lift the bolt handle or pull the trigger. Moving the safety to the fire position you should feel and hear a click which will

allow pulling the trigger with a dummy round in the chamber. Open and pull back on the bolt and it should stop on the bolt stop. Depressing the safety switch past the fire position will allow removal of the bolt. Reinstall the bolt and do alive test fire and safety check at the range.

This simple repair should outlast the firearm's owner by another 50 years! Note: While preparing for this article several different models crossed my bench. As a full time gunsmith for a retail store, it is difficult to hold up someone's firearm for all the photos necessary for these articles. The Remington Service Manual only had the early model depicted in their book and an astute reader will notice photos of both early and late model trigger housings.

AG 1 Barrel Assembly 2 Bolt Assembly Bolt Final Assembly 3 Bolt Plug 4 Bolt Stop (Restricted) 5 Bolt Stop Spring (Restricted) 6 Butt Plate 7 Butt Plate Screw 8 Elevation Screw 9 Ejector 10 Ejector Pin 11 Ejector Spring 12 Extractor 13 Extractor Rivet 14 Firing Pin Assembly 15 Floor Plate 16 Floor Plate Screw 17 Front Guard Screw 18 Front

Sight (also .22/.250 Rem.) 19 Front Sight Screw Front Sight Washer 20 Housing Lock Screw (Restricted) 21 Housing Pin (Restricted) 22 Magazine Assembly 23 Magazine Guide Bar 24 Magazine Guide Bar Screw 25 Rear Guard Screw Rear Sight Assembly 26 Rear Sight Base 27 Rear Sight Eyepiece 28 Rear Sight Leaf 29 Rear Sight Screw 30 Receiver Plug Screw 31 Rib (Rear Sight) 32 Rib Spacer (Rear Sight) 33 Safety Switch Assembly (Restricted) 34 Safety Switch Pivot Pin (Restricted) 35 Safety Switch Pivot Pin Retaining Washer (Restricted) 36 Safety Switch Detent (Restricted) Remington 788 (Specifications subject to change without notice) 37 Safety Switch Detent Spring (Restricted) 38 Safety Switch Retainer Pin (Restricted) 39 Safety Switch Retainer Pin Retaining Washer (Restricted) 40 Sear (Restricted) 41 Sear Pin (Restricted) 42 Stock Assembly Trigger Housing Assembly (Restricted) 43 Trigger Housing (Restricted) 44 Trigger (Restricted) 45 Trigger Guard 46 Trigger Pin (Restricted) 47 Trigger Spring (Restricted) 48 Windage Screw

RIFLES

Accurizing Enfield Rifles

Sometimes reducing harmonics is the only way of accurizing a rifle. Here's how to do it with Enfield rifles.

BY SERGEY LYALKO MARCH 2018

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Rifle accurizing is a common gunsmithing task. Normally, the gunsmith would start with insuring the action is properly glass bedded and the barrel is free floating. Maybe he will install pillars and modify the trigger. All that is normal. But what would you do if the shooting is really chaotic, has a one-side, offcenter tendency and does not react to the sight adjustments? Given the barrel is already free floating and the action is tightly bedded, how could that be?

Let's consider the famous SMLE (Short Magazine Lee-Enfield) Number 4, Mark I* in .303 British. The asterisk indicates this is a version of 1942, produced in the United States by Savage. It is stamped "US Property" across the receiver with a square letter "S" for "Savage" and looks rather like a Number 5. It also has a "flaming bomb" stamp, which is the insignia of U. S. Ordnance Branch.

Serial numbers of S-made rifle. rifles produced by Savage have the letter "C" incorporated after the second digit and is a count of

guns produced. The serial number here shows this rifle was number 360,682 produced by the Savage factory since inception of the SMLE contract. This rifle is famous because the basic design was issued starting in 1895 when a longer Enfield version, called MLE, was adopted by the British Army. It had several innovations, quite futuristic for that time, superior even to the Mauser 98.

Among them is a detachable, doublestack, ten-round magazine, striker cocking Far

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on bolt-closing, and the bolt handle positioned closer to the shooter to aid fast bolt cycling. SMLE Mark 1, a shorter and lighter version of the MLE, was first approved for production in 1903 at the Royal Small Arms Factory (RSAF) at Enfield. Originally these shorter rifles were produced as conversions of MLE rifles. The history of Lee-Enfield rifles with all their modifications is well described in multiple publications and online, so no need to repeat it here. The essence of this article is accuracy of the SMLE.

In The Enfield Also shown are four bridges along the length of the barrel to improve harmonics. Rifle, Major E. G. B. Reynolds wrote, "Throughout its many years of useful service the Lee Enfield has had many critics, particularly regarding its accuracy as a target shooting weapon.

Many writers and critics appear to have overlooked the fact that it was designed as the British soldier's personal arm, not as a target rifle." Despite known difficulties

with achieving tight groups, the SMLE was widely used for conversion to sniper rifles. Even during World War I with a sporadic, emergency response to effective German sniper fire, several British companies such as Holland & Holland, Purdey, and others created optic mounts for these guns.

It's interesting to note, by the request of Army the scopes were installed with significant offset to the left to enable loading via stripper clips in spite of the presence of a detachable magazine. This forced some snipers to aim with their left eye while shouldered on the right. The SMLE was pressed into sniper use not because of its accuracy but because of its widespread use and the immediate absence of another, more suitable base rifle.

There are some references to selection of particular SMLE rifles for sniper conversions by selecting barrels based on testing at RSAF. I assume this logical step was also done by others. Barrel Vibration The rifle featured here came to my shop with the

complaint that it shot to the left and would not respond to sight adjustments. Windage adjustment on a SMLE is done by drifting the front sight since the rear sight can be adjusted only for the elevation.

The owner also said several of his rifle gurus already shot it and researched the problem with no result. I took it to the range and grouped it with a commercial load of 174 grain FMJs. All impacts were toward the left and the group was terrible. The surprising thing, though, is that all attempts to shift the shooting from left to right were unsuccessful, even after drifting the front sight to the edge.

After verifying the windage adjustment and grouping problems, I checked for a free floating barrel from receiver to muzzle, the crown for an accurate cut and lack of erosion, chamber throat, and head space. Given these seemed fine, the bad group was really puzzling. The

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next best step was to evaluate barrel vibration and harmonics. How does barrel vibration effect the bullet's flight? First, the growing pressure expands the walls of the chamber, bulging and stretching it in length. This expansion continues until the barrel steel rigidity compensates the pressure. This expansion then flexes back while the next portion of the barrel becomes expanded, which also flexes back.

At the same time, the spinning bullet in the rifling creates a local twist of the barrel tube, which also flexes back, while the next Better but still not good. portion of the barrel becomes twisted and so on. The barrel tube is fixed at the breech end and free at the muzzle. This is important. The combination of these running expansions and twists creates a complicated, wavy movement of the barrel. This vibration of the barrel is known as harmonics.

There are theories and quantitative models of this motion but they are almost useless for practical application at the range. Important is to understand that during the shot the muzzle is a free end of the barrel and flipping in all three dimensions. That creates a so-called exit angle for the bullet, an angle between the straight bore line and the direction of the bullet exiting from the

barrel. One of the usual assumptions is that this muzzle flipping is the same for identical ammunition.

The term "identical" here should be understood to potentially have a healthy portion of randomness. At this point we need to make two observations. First, since the barrel stretching and twisting is restricted by the rigidity of the steel, thicker barrels typically have smaller exit angles and smaller groups. Second, in the process of flipping the muzzle at a certain moment is either lining up with the straight bore line or passing really close to it.

In other words, at any given moment the exit angle is close to zero. Reducing harmonic amplitude always reduces exit angle and group size. While harmonics cannot be eliminated, accuracy can be improved by changing the timing of bullet exit from the muzzle. Making the bullet exit closer to an exit angle of zero is the ultimate goal. How one can do that with an already-fit barrel and all its existing characteristics? There are two major ways.

One is to put additions on the barrel which change its weight, geometry, or rigidity. The other is to vary parameters of the ammunition, such as its powder load, weight of the bullet, and velocity. Both ways are shifting the moment of the bullet exit. In the search of optimal exit moment there is

no way other than trial and error. This is why Browning's BOSS system is based on an adjustable weight on the muzzle.

The Barrel Dampener from Limb Saver (LimbSaver.com, is a heavy rubber ring that can be moved and set along the length of the barrel. Both methods are changing parameters of the barrel in trying to approach bullet exit angle to zero. This is also why Benchrest competitors try different combinations of ammunition to accomplish the same thing. Some nonadjustable ways of reducing harmonics and exit angle are directed to increasing rigidity of the barrel.

The Straight Jacket from Teludyne Industries (Teludyne Tech. com, is one of them. Mechanically, this device is a circular jacket around the barrel and filled by proprietary substance. SMLE Testing Back to the SMLE in question. There is no space on the barrel of this SMLE for installation of any damper or other device to change the barrel's geometry or weight due to the stock and handguard covering the entire length of the barrel.

My first attempt to subdue harmonics was putting four support bridges between the barrel and the stock in four locations along the length of the barrel. They are made out of electric tape and simply wrapped around the barrel. The role of these initial test bridges was to establish a

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connection between the barrel and the stock in an attempt to reduce barrel harmonics. The shooting test showed some improvement in that the impact points moved to one vertical line and the front sight could have been moved back to the middle. However, the group was still spread too wide. The pressure marks were different on each of the bridges. This uneven squeezing meant that the distance between the barrel and the handguard varied and some portions of the barrel had more pressure than the other.

This was likely a cause for the wide groups. The next step was to replace the test bridges with a total glass bedding job, making sure the pressure on the barrel is uniform everywhere. This effectively increases rigidity of the barrel since it effectively makes the barrel, bedding compound, and stock into one, solid piece. I was really excited to see the results of shooting after the bedding job, especially since this exhausted all practical options of improving the accuracy of this gun.

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Using the same commercial 174 grain FMJ load as before, I fired a final test. I am not a great marksman and had a couple of fliers but the group improvement is evident. Complex vibrations or harmonics of the rifle barrel created by every shot contribute to widening the group on the target by creating a flip of the muzzle. Reducing amplitudes of these harmonics reduces the muzzle flip and accurizes the shooting results. It can be achieved in two major ways.

One is to make the barrel more rigid by increasing its weight and thickness. The other is to change the moment of bullet exiting the muzzle so that the exit angle is as small as possible. That can be done by certain additions to a barrel and/ or changing parameters of the cartridges. All of these fixes are achievable by any skilled gunsmith and can help an ailing customer's rifle.

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RIFLES

The M1 Carbine

History and maintenance guide for America's first Personal Defense Weapon: United States Carbine, Caliber .30, M1.

BY PAUL MAZAN MARCH 2018

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American shooters have a love affair with the M1 Carbine and have had since the day it was introduced. From a purely logical point it is hard to understand why. It isn't particularly inexpensive to buy or shoot. The cartridge is marginal at best for anything larger than coyotes and the gun isn't accurate enough for use on varmints smaller than woodchucks. Yes, I know people that have shot deer with it and I've even seen .30 Carbine used on prairie dogs, but I can say the same thing about .22 LR.

Just because a thing can be done doesn't mean it should be. Given all that, we still have a love affair with the M1 Carbine and the only reasons I can give are that it's fun to shoot and it was carried in combat by some relative of just about everyone, including my father. The story of its development and manufacture is pretty well known but there persists some misunderstood facts, so I will briefly cover the history before getting into the mechanics.

Let's get the most commonly circulated and "known" fact out of the way first. The M1 Carbine was NOT invented by David Marshall "Carbine" Williams while he was in prison. What Mr. Williams invented was the short stroke gas operating system that

was used in the Carbine and later on the M14. His involvement in the development of the M1 was very limited. He was hired by Winchester to work on a program but it proved so difficult that Winchester assigned two of its engineers to do the development work and Mr.

Williams quit. The U. S. Army Infantry formally requested the Ordnance Corps to develop a light carbine to replace the 1911 pistol in 1938. Ordnance was opposed to its development because they believed the standard service rifle was sufficient for all U. S. troops. This was most likely their position due to budget limitations and logistical concerns over having to supply two front line rifles with different ammunition and maintenance.

In 1940, the Infantry once again requested a carbine or light rifle from Ordnance and with war having already broken out in Europe, the Secretary of War backed up the idea by creating the U. S. Light Rifle Program. This was most likely due at least in part by reports that the 1911 had proven ineffective in the Great War that very few casualties could be attributed to the pistol.

The Carbine Created The first step in the development was to find or design a suitable cartridge that could be put into mass

production in a very short time. The Ordnance department requested input from Winchester for recommendations of a semi-automatic cartridge and Winchester recommended their .32 Winchester Self-Loading. The services got together and agreed on the general specifications of what they wanted in a carbine and put together a rather long list of specs that I will only touch on here.

First, it was to be a semi-automatic light rifle/carbine no heavier than five pounds, including the sling. It was to be effective out to 300 yards shooting a cartridge similar to Winchester's .32 SL, firing a bullet between 100 to 110 grains at a velocity of approximately 2000 FPS. The specs go on and on specifying things like a box magazine, a safety, that the design should be simple with as few parts as possible, and easily assembled and disassembled with the cartridge being the only tool needed.

The request was sent out and all sample carbines were to be delivered for testing no later than February 1, 1941 but delays due to changing dimensions of the ammunition caused the date to be set back to May 1, 1941. There were nine initial submissions from Savage Arms, Woodhull Corp., Colt, Harrington & Richardson,

THE M1 CARBINE CONTINUED

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Auto-Ordnance, Springfield Armory, and Bendix Aviation. Trials were held on June 16, 1941 and the overall results were not encouraging for several reasons. To make the weight restrictions, some models had hollow stocks or no forearm cover. None of the carbines were what the military thought they could use, with only those submitted by Bendix and Springfield Armory considered for retesting if modified in specific ways. All the others were dropped as ineligible for retesting.

Ordnance settled on September 15, 1941 for a sudden death round of retesting to be completed by September 30. Interestingly, they allowed for new entries and improved models of the guns already dropped, so it effectively was still a wide-open competition. Winchester was aware of the Light Rifle

Program but at the time was busy with a contract to manufacture the M1 Garand and other work for the Ordnance Department. The entire situation at Winchester was complicated.

David Marshall Williams was hired to work out These are often hidden under the later windage-adjustable sight. problems Winchester was having with a rifle designed by Johnathan Edmund Browning, half brother of John Moses Browning. Browning died shortly after and his rifle, the .30-06 Winchester M2 Military Rifle, was still experiencing problems.

After looking at the design, Williams said he could make it work if he was allowed to use his short stroke gas system but he wanted to be paid royalties if Winchester used it.

Williams started working on Browning's M2 The later band incorporated a bayonet stud. This was later replaced with the windage-adjustable sight shown laying on the stock. rifle during January 1941 and had it in shootable condition by the end of May.

At that point, Winchester approached the Ordnance Department and told them they thought they could field a gun meeting military requirements. Ordnance officials gave them the go ahead. The first model was put together in thirteen days using a scaled down and modified Browning M2 Military Rifle receiver and bolt, including the short stroke gas system Williams had invented, along with the trigger mechanism from the Winchester Model 1905 modified slightly to fit. This work was done

THE M1 CARBINE CONTINUED

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Not all the manufacturers had barrel making equipment and barrels were supplied by manufacturers that did. Quality Hardware, Standard Products, Irwin-Pedersen, and National Postal Meter didn't make barrels and were supplied with them from the other sources. So, a receiver from any of those four manufacturers with a barrel marked from another manufacturer is not necessarily mismatched. by Bill Roemer and Fred Humeston, not David Williams.

Williams was extremely upset over not being involved and told Winchester that he did not want his name associated with the gun, however, he did agree to demonstrate the gun to the Ordnance Department. The people at the Ordnance Department liked the gun from the first time they saw it. A number of Ordnance officials insisted they be present for a firing demonstration on August 11, 1941 and the gun worked perfectly for the 50 to 100 rounds General Courtney Hicks Hodges, then Chief of Infantry, fired.

Hodges immediately ordered three models be ready for the upcoming trials but was told it would be impossible to have three available by September 15th. When the Chief Engineer returned from the demonstration firing, he found Williams had done little in his absence and assigned Roemer and Humeston to make a gun along the general lines of the one they had. When the new model was tested, it had operating problems and Williams agreed to get involved in the project again.

Literally at the last minute, it was discovered that the gas port was too small and by enlarging it they got the gun to operate. When the sudden-death service test started, Winchester's submission was the run-away best rifle. The only failure experienced was a bolt breaking near the right locking lug. In order to complete the test, Humeston rushed back to New Haven and found his boss and a coworker had already roughed out a bolt. He was able to finish it and rush back in time to finish the test.

On October 1, 1941 after all the test data was processed, Winchester was informed they had won the Light Rifle Program competition and their design would be adopted. Being awarded the contract to manufacture what became the M1 Carbine was the good news for Winchester. The bad news was that they ran into trouble almost immediately. The first problem was a need for more machinery to produce the guns at the rate the government wanted them.

Unfortunately, the Ordnance Department did not give them a high priority and the company had to wait. When some of the machines finally arrived, Winchester had a serious manpower shortage. In order to entice more workers, the company offered a four hour day for those unable to devote a full day to a job. The Ordnance Department continued demanding more production but still refused to give Winchester higher priority for the needed machine tools.

When it became obvious that Winchester was never going to be able to keep up with the ever-increasing demand, it was decided to bring on other manufacturers. The first was the Inland Manufacturing Division of General Motors, soon followed by Saginaw Steering Gear Division of GM, IBM, Underwood, Rock-Ola, Quality Hardware, Standard Products, Irwin-Pedersen, National Postal Meter, and Commercial Controls.

The history of the startup of production of the Carbine at each of these companies, most of whom had never made a gun, would fill a book. Each had its share of problems and none of them made all of the parts. The subassembly and parts suppliers list is extensive and really shows how much industrial capacity the United States had in the 1940s. Of these manufacturers, some had little trouble making M1s that met the government inspector's standards, others had a very difficult time.

Rock-Ola needed extensive help before they were able to produce Carbines that passed the quality control standards, while Irwin-Pedersen and Commercial Controls never did. The approximately 3,500 M1 Carbines Irwin-Pedersen made were never accepted by the government, their contract canceled, and taken over by Saginaw Steering. It appears Saginaw assembled some M1s on Irwin-Pedersen marked receivers that were to spec

THE M1 CARBINE CONTINUED

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High pressure gas bled from the barrel forces the gas piston back. The gas piston pushes the operating slide back with enough force to move the bolt to the rear far enough to eject the spent round and cock the hammer. The bolt is propelled forward by the recoil spring with enough force to pick up the next round from the magazine, chamber the round, and lock the bolt closed. and finding one to add to your collection will cost you a pretty penny.

National Postal Meter changed their company name to Commercial Controls in 1944 and produced fewer than 250 receivers marked with the new name and are very rarely encountered.

The amazing thing is that despite labor shortages, difficulty in getting material, startup problems, rejected production guns that didn't meet specifications, a steep learning curve for manufactures that had never made a gun before, and literally hundreds of subcontractors and suppliers, in less than four years over six million M1 Carbines were accepted by the Ordnance Department. Even more amazing, in an age without CNC machinery, computers, or computer-assisted drafting, all the parts were interchangeable.

If you take 100 Carbines from all the different suppliers, disassemble them, and mix up all the parts, you will be able to assemble 100 Carbines that all work. No small feat in the middle of a world war. Throughout production numerous modifications both large and small were made. One of the persistent problems was bolts breaking near the right locking lug, just as had happened during testing.

In February 1944, Inland got permission from the Carbine Committee to manufacture 1,000 round bolts to see if they could solve the breakage problem. Function and endurance testing were performed with three M1s and 6,000 rounds were fired. The results were disappointing and On the far left is a gas piston wrench, a handy tool for removing the gas piston nut after extended firing. all that was reported was that two of them finished the test satisfactorily while one did not.

War was declared after Pearl Harbor and it was determined that the requirement for the M1 Carbine would be at least one million units by the end of 1943. With Winchester and Inland only able to each produce 1,000 per day, they wouldn't be able to reach that capacity until June 1942

and it became clear they would have to find other manufacturers. Underwood, Quality Hardware, Rock-Ola, Irwin-Pedersen, and National Postal Meter were put under contract to produce 35,000 Carbines per day each. A note on barrels.

Not all the manufacturers had barrel-making equipment (such as Quality Hardware, Standard Products, Irwin-Pedersen, and National Postal Meter) and were supplied barrels by other sources. A receiver from any of these four manufacturers with a barrel from another manufacturer is not necessarily mismatched, it's how they came from the factory. Design Changes Many changes were made to the original design as time went by. The original flip-type rear sight was replaced by a windage-adjustable model.

A bayonet lug was added to the forward barrel band and a bayonet was procured (just in case you wanted to spear a can of Spam and heat it over a fire.) A folding wire stock paratrooper version was added. Eventually, the round bolt was adopted to reduce the bolt breakage problem. As far as the troops were concerned, the vast majority of them loved the little gun. It was light, easy

THE M1 CARBINE CONTINUED

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to carry, and held 15 rounds of ammo in a magazine that could quickly be changed out for a full one. On the down side, as described by Lt. Col. John B. George in *Shots Fired in Anger: A Rifleman's View of the War in the Pacific* about fighting on Guadalcanal and with the Marauders in the CBI (China, Burma, India) Theater, the M1 Carbine was OK for the most part but needed a carrying handle and a more effective cartridge as the issued one wouldn't penetrate much jungle and lacked both accuracy and stopping power.

During the Korean War (I don't care what anyone else calls it; when armies are maneuvering and shooting live ammo at each other, it's war enough for those involved) many of the M1 Carbines were converted to the M2 with full auto capability and a 30 round magazine. Unfortunately, it had more reliability issues. After the war, S. L. A.

Marshall talked to troops that were armed with all the small arms available at the time and concluded that the M1 Carbine was much better as a semi auto than it ever was as a full automatic. We also supplied hundreds of thousands of them to the Koreans and later to the Vietnamese. The Carbine went on to serve well into the 60s and probably beyond.

In 1969, I was in the Air Force and stationed in England and we were still doing our annual qualification with M2 Carbines because all the M16s were still going to Vietnam. After the war, many Carbines were sold as surplus through the NRA and the DCM (Director of Civilian Marksmanship), which became the CMP (Civilian Marksmanship Program.)

Demand was so strong that even with six million having been produced, available supplies sold out quickly.

You would think that with so many Carbines in circulation, the market would be saturated but you'd be wrong. The demand remained so high several civilian firms have made copies of the gun commercially and still do. Today, many collectors and shooters are eyeing all the Carbines still in Korea and waiting for the import ban to be lifted so they can come flooding back into the U. S. The CMP, famous for selling M1 Garands as the DCM had previously, occasionally has them for sale but availability is always limited.

An official M1 Carbine Match has existed since being fired during the National Matches in the early 1950s and the CMP continues to host the M1 Carbine Match today due to continued interest. The American shooting public's love affair with the little M1 Carbine hasn't dimmed a bit even if she has turned 75 or so. She is still sweet, beautiful, and as slim as she was in youth.

Maintenance To field strip the M1 Carbine for cleaning, remove the magazine and be sure the gun is not loaded by opening the bolt and visually checking the chamber. Remove the sling if present. Depress the forward Alexandria VA 22310 band lock spring and slide the band forward. You will probably need a tool like a small screwdriver as the spring is typically very strong. Remove the upper handguard by pulling it up and forward.

Remove the barrel and receiver group from the stock by pivoting it upward at the muzzle so the rear of the receiver unhooks

from the recoil plate in the stock. Remove the recoil spring and guide by pulling to the rear and then moving the front of the assembly away from the slide and pulling it forward, out of the hole. Remove the trigger guard retaining pin from the front of the trigger guard assembly and slide the assembly forward until the slots at the rear of the assemble clear the ears on the receiver.

Move the operating rod to the rear until it reaches the retaining groove at the rear of the receiver and rotate it counter clockwise to remove the slide from the receiver. The bolt can then be removed by moving it about an inch to the rear of its closed position. Lifting the front of the bolt up and turning slightly clockwise. "Reassemble in reverse order" is one of those things writers like to say and it sounds both logical and simple.

In this case, it isn't difficult once you get the feel for all the things that need to line up. I suggest disassembling and reassembling several times until you are familiar with how it all works. For further history on the M1 Carbine's development, modifications, and the aftermarket makers, check out Larry Ruth's three-book series, *War Baby! The U. S. Caliber .30 Carbine*, Vol. 1, *War Baby! Comes Home*, The U. S. Caliber .30 Carbine, Vol. 2, and *War Baby III: The U. S.*

Carbine into the 21st Century published by Collector Grade Publications. For repair and gunsmithing the Carbine, I suggest *The U. S. 30 Caliber Gas Operated Carbines: A Shop Manual* by Jerry Kuhnhausen. AG

MAINTENANCE & REPAIR

The “Untouched” Martini-Henry, Part One

A cautionary tale of restoring a classic single-shot battle rifle. Here’s how I restored the stockwork and wood.

BY PAUL MAZAN MARCH 2018

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Martini-Henry rifles are breech-loading, singleshoot, lever-actuated rifles that replaced the Snider-Enfield as British Army issue. Martini-Henry single shot rifles imported from over 100 years of storage in Nepal are on the market in both “Cleaned” and “Untouched” condition. This is what you should know before you tackle an untouched example. The .577/450 Martini-Henry is an interesting piece of firearms history.

After “starring” in the 1964 movie *Zulu*, it has become a much sought-after addition to military firearms enthusiasts and collectors. The influx of the Enfield-made rifles has reduced the price of shootable examples to just under \$1000 and the rough “Untouched” examples are available for a couple of hundred. The stock was cut under the barrel band and a new piece spliced in, inletted, contoured, and stained to match the cleaned-up stock, dollars less.

That has tempted many to seriously consider if the lower priced “as found” rifle is a good deal. Recently, a friend of mine, who happens to be a talented gunsmith, thought he would like to pick up one of the Enfield-made Mark IV long-lever Martinis. Speculating that since the Mark IV was the last model and only in service use for a few years, he thought he would have a better chance of getting a gun with a good bore. I have emphasized “Enfield made” for a reason.

Many of the imported guns were made in Nepal and I have no idea of the grade of steel, level of fit and finish, headspace, or the heat treatment the Nepalese rifles were given. They may be wonderful bargains or they may be dangerous even at black powder pressures. I simply do not know. My friend and I reasoned that at least with the Enfield builds we knew they started out as

wellmade, properly-fitted, headspaced, and heat-treated firearms. The rifle was ordered and arrived in a couple of days.

Service was friendly and prompt. The rifle had a very nice bore but the rest was indeed “untouched.” A century of sitting in what amounts to an unheated stone barn left its mark, as did whomever handled and packed the gun for shipping from Nepal. The stock was nearly black with oil and dirt and the wood showed many signs of having been roughly handled both in the past and recently.

Besides the normal dings and chips expected from service use, there were some new gouges and scratches that could be identified by not being full of oil and dirt. The metal showed various degrees of pitting, most severely along and under the forend. Rust was evident most everywhere else. All the parts appeared to be present but the action would not cock. Bad as it sounds and looks, this rifle was not

THE "UNTOUCHED" MARTINI-HENRY, PART ONE

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This must be repeated, beyond salvaging but it is certainly not a job for a hobbyist or beginning gunsmith. Starting Restoration The first step in the restoration to make the gun shootable again was to complete disassembly and examining the parts to see what we actually had. My first tip to anyone tackling a project like this is to be patient. The wood is old, soaked with oil, and rotten in some places.

Screws that have been in place for over 100 years are going to be reluctant to come out and some may simply be impossible to unscrew. Driving out a pin that is surrounded by oil-softened or rotten wood presents the problem of keeping the face of the punch on the pin. It will want to slide off the pin and go through the softer wood. The solution is

to use cup-tipped punches or at least a nail set to at least get them broken free and started.

Screws should be soaked in penetrating oil if there is any hope of removing them. In extreme cases, be ready to drill them out. Fortunately, the internal parts of the receiver were only covered with surface rust and cleaned up relatively easily. In fact, the face of the breech was so smooth and pristine it looks like it had been shot very little. The mystery of the refusal of the gun to cock was cleared up when the firing pin was found to be missing.

In one case, we had to saw the pin clamping the barrel band around the stock in half in order to remove the band as the head of the screw was gone. Inspection of the wood after it was removed from the gun and all the

hardware was stripped off showed a solid buttstock and forend that required a lot of restoration work.

In fact, we discussed simply making a replacement forend but decided to use some armorer's techniques to show you how it might have been repaired "back in the day." The first order of business was to start cleaning the stock. With an old military stock that is oil soaked and dirty, there are several methods that can be used to salvage it. The first step is to attack it with hot water, soap, and a reasonably stiff brush.

It is a simple solution the won't get to "like new" condition but will remove oil and dirt from the surface and make the next steps faster. Once scrubbed and dry, the wood can be evaluated and a decision made on how to best proceed. My

THE "UNTOUCHED" MARTINI-HENRY, PART ONE CONTINUED

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If you look closely you can see the 45 degree line where the replacement wood has been spliced and glued to the forend. You can also see the wood added to the top of the forend just below where it meets the barrel. The bottom tang is rusted in place, the screws are rusted in place, and the wood has rotted away. friend is always afraid of damaging the wood with harsh chemicals and is blessed with the patience of a rock. He heats the stock over a hot air gun and wipes off the oil that bubbles up out of the wood.

Frankly, I don't have the patience for that method because it's possible to draw oil out. Glued on, the cleaned-up bottom metal is in-letted. The next step will be to contour the new wood to match the line of the forend. This was replaced with new walnut. the stock and lays it out in the sun. Then every 15 min-

utes or so he goes out with a rag dampened with acetone or mineral spirits and wipes the oil off.

Given that I have the patience of a four-year-old that wants it now, I usually lay a stock out in the sun to get it hot, then spray it with oven cleaner, wash it off, and let it heat up again before repeating the process. Unfortunately, both of these methods are time consuming, laof the wood for weeks. On hot days, he puts aluminum foil under bor intensive, and only remove the oil from the surface of the wood.

Oil that has soaked into the stock deeper is going to migrate back to the surface and the gun will end up just slightly less oil soaked than before. I normally use three steps to remove the oil and dirt. First is washing in hot soapy water, followed by the heat and oven cleaner. The stock is washed and scrubbed again to remove the oven cleaner and then

followed up by soaking in turpentine. In an old bluing tank, pour in two gallons of turpentine and weight the stock down to keep it covered.

Let it soak for a week or two and then hang it outside or in the garage for another week or two until you can stand the smell before bringing it into the shop. I'm told the same thing can be done with odorless mineral spirits and that removes the need for a two-week hang to quit stinking, but I haven't tried that yet. While all that time passes, the metal work can be done. I'll cover that in Part Two.

After pulling as much of the oil out of the stock as it was ever going to give up, we found much of the forend wood was rotted or broken away. It was so bad I suggested we save the buttstock and simply make anew forend but my friend would have none of it. This was a res- (Continued on page 23)

THE "UNTOUCHED" MARTINI-HENRY, PART ONE CONTINUED

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toration project and he was bound and determined to restore, not replace. The end of the forend where it met the barrel was unsalvageable as were the steps in the stock where the barrel bands had trapped moisture under them and rotted the wood away. In each case the rotted wood was cut away, anew piece spliced in and glued in place, and then inletted for the hardware. Most of the top edges of the forearm where it meets the barrel was simply broken away and hid the worst of the barrel pitting.

My friend whittled out new pieces and made them a bit higher than the original. As I mentioned, he is an excellent craftsman and he can make wood splices that are nearly undetectable. When I try my hand at it the results are pretty awful. With all the wood pieces in place and the glue allowed to set up, everything has been

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sanded down and inletted. The repairs leave a piebald stock. To make the new wood match the old in color is something of an art in itself.

The trick is to buy a dark walnut stain and apply it to the new wood until you get the color as close as you can to the old wood. I want to emphasize the stain should not be a normal walnut stain but specifically labeled as dark. The goal is to match the old wood that has been oil soaked to new, unfinished wood. You can always sand the darker color back to achieve a lighter tone but it is hard to darken a stain that is too light.

Once you have come as close as you can to the color of the original wood, put a final coat of stain over everything and wipe it down with a soft cloth. It's up to your judgement on whether to apply some linseed oil or tung oil. When finished you should have an interesting Martini-Henry that looks like it held off the Zulus at Rorke's Drift. AG

RIFLES

Knight DISC Extreme Bedding

When a rifle begins to fail in accuracy, action bedding is often the best course of action. Here's how I applied receiver bedding to a Knight DISC Extreme muzzleloader.

BY NORMAN E. JOHNSON MARCH 2018

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Some time ago a hunter brought to me a Knight Rifles DISC Extreme muzzleloader that was troublesome. The 209 shotgun primers were showing erratic ignition. This was traced to faulty primer percussion and corrected by reworking the firing pin nose tip. The same muzzleloading rifle was also producing double groups with vertical shot stringing. Such problems can often be traced to poor action and/or barrel bedding. Close inspection of the targets brought in with the rifle strongly suggested this.

The barrel fit loosely in the forend with uneven bind along the sides. This prevented the barrel from settling uniformly into the stock channel shot-to-shot. There is but one action bedding hold-down screw with none at the rear, as typically used on similar actions. This tends to cause greater downward pull of the barrel to the front. The entire stock forend was channeled out

as a place for the ramrod. This condition was pointed out to the owner and a remedial course of action was discussed.

Bedding Procedure Analysis The action is held in the stock on the Knight DISC Extreme muzzleloaders by a single 1/4-20 bolt threaded directly into the recoil lug. The recoil lug is welded to the barrel 4 1/4 inches forward of the rearward part of the receiver. Absence of a rear receiver hold-down bolt tends to produce a weaker bedding system. This is particularly true where a free-floating barrel in the stock forend channel is planned, as was the case here.

A channel cut out for the ramrod its entire length didn't really help matters either. Close measurements of the stock and action showed that a 4 3/4-inch span of bedding central to the recoil lug would provide a sufficiently solid action bedding resulting in a totally free-floating barrel in the process. This would provide a full 7 3/4 receiver bedding span with 2 1/2-inch lateral-

ly positional support pillars forward of the single action bedding screw. Strong enough.

Performing The Work I chose Brownells Steel Bed as bedding material. This is the most durable bedding medium that I have used in solidly bedding scores of rifles and pillar beds. It creates bedding that is virtually as strong as steel, as the name implies. I removed a thin layer of stock wood in all areas where Steel Bed would be applied. Ample release agent needs to be applied to the action where contact with Steel Bed is present.

A 1/8 inch spacer is attached to the barrel near the stock forend tip as a means of elevating the barrel while installing Steel Bed. This elevates the barrel at the front providing ideal free floating. Following installation of bedding material the barreled action is precisely lowered into the stock. The stock is held in a padded vise at this time. The action screw is then used to draw the action into the stock. Here we

KNIGHT DISC EXTREME BEDDING CONTINUED

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This area of support along with the integral rearward bedding provide very solid bedding. Bedding support wings are bifurcated to make room for the ramrod. want to draw both the entire action into the stock, including its contact with remaining wood at the rear and the newly applied bedding material. Don't over tighten the stock screw as it is slowly torqued, evenly dis- Rifle target at left shows erratic accuracy on shots one through five. The post bedding target shows two 50-yard groups with very good accuracy.

Proper action bedding along with a free-floating barrel commonly solves accuracy problem in a number of bolt action-style rifles. Far tributing the bedding material. Remove all

bedding material that may ooze out along the barrel channel. I normally apply masking tape here which can be removed as the bedding is cleaned up. Allow at least five hours for the bedding to set up at room temperature, at which time I normally remove the action from the stock. The bedding material can then be trimmed, if required.

Later it will be fully as hard as steel. Following preliminary clean up, replace the barreled action to the stock and allow it to set for a full 24 hours. The barreled action can then be removed from its bed and the bed further cleaned up, if needed. The barrel-to-stock forend spacer can be removed to test for barrel clearance with the stock.

There should be sufficient barrel clearance so the weight of the horizontal barrel allows at least the thickness of a dollar bill to be slid between stock and barrel with the action screw fully torqued. Target Testing For testing, I returned the rifle to its owner who had all the paraphernalia for testing muzzleloaders. A most positive report ensued. The annoying vertical group stringing immediately disappeared. Groups were around minute of angle at 200 yards, which is good for a muzzleloader in this class.

The right decision was made as a measure to alleviate the erratic accuracy problems. AG

RIFLES

Barrel Bore Lapping

An effective method of bore lapping is a fundamentally sound step toward establishing or restoring rifle accuracy and overall improved performance.

BY NORMAN E. JOHNSON MARCH 2018

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Rifle builders and shooters alike must understand that bullets propelled by burning powder gas leave carbon and bullet jacket deposits in the bore and also cause bore erosion. Repeated firing exacerbates the condition. The rougher the bore, the more difficult these accuracy inhibiting conditions will be to prevent or correct. In most cases, a well-established form of bore lapping may be the best approach to the problem.

This may include conditioning anew rifle bore that has not been lapped, particularly those of lesser quality, or bores with some use. In any case, a knowledge of bore condition must precede any attempts toward corrective measures. The premise behind lapping is to dress smoothly the bore metal surface. We are seeing a pretty good looking bore finish on this production rifle here. Faces to a high degree of refinement and accuracy, thereby allowing a more uniform bullet passage up the bore.

A rudimentary familiarization of the mechanics involved in bore production should precede any form of lapping or bore break-in attempts. The final condition of a bore may be dependent on such understanding. Following deep drilling, a barrel is reamed to form the surface of the lands. This smaller diameter will comprise the inside surface diameter of the bore as the bottom surface of the lands or the resultant depth of the rifling engraved on a bullet.

Following this deep drilling and reaming, the rifling grooves will be formed, resulting in the groove diameter essentially the same diameter as the bullet. This is typically expressed as 0.256/0.264 or 0.300/0.308 for 6.5mm and .30 caliber bore/groove diameters. The grooves are formed by varying processes which typically include button rifling, cut rifling, broaching or hammer forging. This leaves the overall diameter of the grooves very close to bullet diameter.

As evidence of this work, bores are left with residual machining marks incurred as a result of the reaming and rifling processes. Such barrels may be delivered to the shooter or gunsmith as rifles or barrel blanks with a wide range of smoothness or finish. The better barrel makers produce a high quality, essentially finished bore usually requiring minimal break-in for best shooting. Most of the others may require varying degrees of attention in this area.

The better quality bores undergo a lap finish to extreme tolerances in diameter and uniformity as well as surface finish or refinement. But even these will require varying degrees of shooter break-in as a preventive measure of accuracy-robbing copper fouling. Bore Condition Internal bore surface evaluation may be performed in a number of ways. This may include the use of a bore scope, excessive cleaning brush drag, greenstained cleaning patches while using cop-

BARREL BORE LAPPING CONTINUED

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per removing solvent, or actual visual evidence of copper or bore roughness. Arguably, the modernday borescope will be our best aid in bore surface evaluation. The reputation of your barrel maker or firearms manufacturer is also very important. Having determined the state of the bore, the approach may vary in getting it smooth and shooting at its best. The better bores may only require a prescribed shoot/clean regimen, and others some form of lapping or dressing.

One should never dive in and try to better the lapping quality of those better bores. The method of lapping that I have used and will demonstrate here will lap and polish the outer surface of the lands where they have been reamed, as well as the grooves which may have been formed in different ways. Both can be accomplished with a special caliber specific lapping button of which I will describe.

Making Lead Laps All that is required in making these precision laps is some soft lead slugs and short pieces of 8-32 threaded bolt stock to fit a standard cleaning rod. Here I begin with an oversize flat-base lead slug, in the form of a bullet, and place it in a lathe chuck and drill and tap for a short 8-32 bolt. Thread the bolt in-line about 3/8" into the slug. These slugs are then sized according to the exact bore size.

I then place the screw lightly in the lathe chuck and use a sharp pointed tool bit to turn the laps to precise bore groove diameter as needed. An oval taper is formed at each end of the lap. This will aid in starting the lap into the bore as well as retaining some of the lapping medium for distribution. Annular rings on the lap will also retain lap abrasive as needed. I make up several of these caliber specific lead laps.

For lapping of the grooves and lands, the lap will need to be of bullet size for that bore or about one thousandths over. These slugs can be easily turned to size in a lathe. Be very precise about this. Some actually melt the lead lap into the bore. Whatever works for others; I have no quarrel with this. Forms of fire lapping are also used. Some of the barrel makers void the warranty in instances where firelapping is used.

As a perennial research-minded experimenter I have developed a method of "shoot lapping" whereby the bore is anointed with a viscous lapping compound and the bullet is shot over it, thereby lapping the entire bore. This has received some favorable acclaim by some good names and I may cover it in American Gunsmith at a later date. But for now the threaded slug will be the subject of this treatise.

BARREL BORE LAPPING CONTINUED

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Bore Lapping Abrasives Many chapters could be written on this subject alone but I will keep it as concise and meaningful as possible. My association with one of the best metallurgists and rifle experts in the business, Mr. Fred Barker, has been of much help to me on selection and use of abrasives. We both were staff writers for Precision Shooting Magazine until its closure. A lapping medium is essentially an This technique is inherently uncomplicated and effective as a means of bore lapping.

The bore is then ready for a prescribed method of shoot-and-clean bore break-in. This is sometimes performed via fire lapping where a grit-impregnated bullet is used, but not in my rifles. abrasive used to dress or polish a roughened surface. Such lapping mediums are composed of varying degrees of abrasion which must be well understood and

used correctly. In lapping I seldom use a grit courser than 400 U. S. Mesh, which is 30 Micron grade.

A good choice here is J-B Non-Embedding Bore Cleaning Compound, a non-embedding, pumice-type abrasive that will readily size or lap bore metal. Evidence of the use of grit is seen as the stria pattern in a professionally-lapped rifle barrel. The choice of lapping medium is often a thing of experience and is learned. Lapping compounds can be purchased, but be sure of grit size. Never use a grit that is too coarse as it can score the metal.

With a correctly selected lapping button for the bore being lapped, attach it to the cleaning rod or shorter shafted starting mandrel. Screw it on firmly so it won't turn off. Then, with the barrel held horizontally in a vise (preferably removed from the action), the

abrasive coated lap is passed forth and back through the bore. Always fully complete each pass, but not fully through the muzzle.

The first passage of the lap will actually show grooves cut into it by the rifling lands, offering a fairly firm resistance. You may need to tap the cleaning rod or starting mandrel with a plastic mallet to get it going. Then, while carefully guiding the rod, push it into the bore to the end, but not through. You may feel varying resistance in different sections of the bore due to bore diameter difference or bore surface smoothness.

Pass the lap fully forth and back a few times to get a feel for things before applying additional lapping medium, but don't use too much compound—a little goes along way. A cleaning rod guide is recommended, or minimally, a cham-

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The four groups at left were shot pre-lapping with a 30BR MAG, a cartridge designed by author by necking the .25 Winchester Super Short Magnum case to .30 caliber. The four groups on right were shot post-lapping with the same load of a 150 grain Berger FB Target bullet. Lapping and bore break-in was conducted between groups over a week-long period. bered drilled-out cartridge to help guide things along. Never allow the cleaning rod to contact the muzzle of the bore.

As the button wears down, install another one following the same procedure. A practice session on an old barrel may prove helpful for some. Typically the bore will take on a noticeable smoothness permitting easier passage of the lead lap. Careful examination with a bore scope should show things much more clearly. But be advised, no matter how smooth and shiny the bore ap-

pears following lapping, it still must go through a well-established shootclean, break-in regimen on its way to its best shooting.

Bore friction is by no means an inconsequential factor in our shooting and must be recognized. For example, a 50% reduction in overall bore friction allows an increase in velocity of about 10%. Further extrapolated, this has the potential for an additional 175 foot-pounds of muzzle energy. Of course, this depends on bullet configuration and coefficient of friction, which is a study in itself. In my own experience, accuracy is the greater derivative of lapping.

There is a great deal of learning and experience that must be applied in our quest for better shooting. Bore lapping and barrel break-in are but a single link in the chain. AG

FINISHING

Reader Forum

BY AMERICAN GUNSMITH EDITORS MARCH 2018

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M16/AR-15 Blueprint I need a blueprint that shows the location of sear pin holes for the AR- 15. I have Class III license and ama dealer and gunsmith in Arizona. Ken There are those outfits that sell “off the books” AR lowers that are 80% finished, thus negating a required serial number, and only require a couple of steps by the owner to finish them. Included are drilling the holes for the trigger and hammer pins.

Some of these outfits send along a plastic template with the hole locations so the customer runs less of a chance of messing up the location. I’ve been told one such company also includes the location of the trip sear pin hole but I may be remembering incorrectly as I wasn’t particularly interested in any part of the project. Contacting some of these companies might be worthwhile.

If they don’t offer this hole location with their templates they may be willing to include one on a special order basis or furnish a blueprint or lend some assistance in where to fine one. Articles Request Turn your gunsmithing ideas and expertise into a check sent to your mailbox. Send your article ideas to us. Contact our editorial office. AG

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