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INSIDE THE ARCHIVE

AR-15 BARREL HARMONICS

OSPREY PUBLISHING • PHOENIX HANDGUNS • 1851 LONDON NAVY • HOLEMAKING TECHNOLOGY

ORIGINAL METHODS. MODERN ACCESS.

ARCHIVE EDITION 154

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HISTORY

Osprey Publishing

BY AMERICAN GUNSMITH EDITORS OCTOBER 2016

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The Flintlock Musket: Brown Bess & Charleville 1715-1865 by Stuart Reid analyzes the flintlock musket as one of the iconic weapons in history. Reid worked as a librarian, was a soldier, and had ancestors who fought at Culloden, Bunker Hill, and the Texas Revolution. These arms were used on the battlefields of the Thirty Years' War and the English Civil War, carried by both sides at Bunker Hill, Waterloo, and the Alamo, and dominated warfare for more than 150 years.

Until the advent of cartridge ammunition and breech-loading weapons in the 1840s and 1850s, muskets were still being widely used as late as the American Civil War in the 1860s. Featuring full-color artwork, this tactical study examines the flintlock in close-order combat on European and other battlefields, employing first-hand accounts to show how tactical doctrines were successfully developed to overcome the weapon's inherent limitations.

Eighteenth century military flintlock muskets were typically based on the French .69 caliber Charleville or the British .75 caliber model "Brown Bess". Their tactical use is explored by individuals in irregular warfare, chiefly in North America, and by massed usage. The Barrett Rifle The Barrett M82 is a notable anti-materiel and sniper rifle in current service.

Now entering its fourth decade of service, the short recoil, semiautomatic rifle fires the .50 BMG and provides devastating accuracy over distances of more than a mile. Unconfirmed reports from Afghanistan in 2012 credit the Barrett with one of history's longest ever kills at 2,815 meters.

In The Barrett Rifle: Sniping and anti-materiel rifles in the War on Terror, weapons expert Chris Mc Nab gives the technical history of a rifle initially commissioned as an anti-materiel and explosive ordnance disposal tool, but which has since been adopted by snipers across the world. Barrett rifles have seen active service in the First Gulf War, Iraq and Afghanistan, and have become an addition to both police and Special Forces units alike.

In addition to details on the history of the Barrett, this is a good overview of long-range sniping.

ORIGINAL SOURCE PAGE

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PISTOLS

Phoenix Handguns

The inexpensive Phoenix Arms HP22A and HP25A are .22 LR and .25 ACP pistols with similar characteristics.

BY DAVID W. MANNEY OCTOBER 2016

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Customers have varying budgets and some will want or need an inexpensive handgun. The following instructions will work for the Phoenix Arms HP22A .22 LR with any of the available switch barrels and the HP25A in .25 ACP. There is a firing pin block along with a magazine safety on these guns. It is obvious the lawyers were involved with the design of the gun, so be sure to read the manual anytime you work on these. To field strip, unload the gun and rotate the firing pin block to cover the red dot.

Pull and hold the slide back, then place the magazine interlock in the safe position. This will hold the slide back and allow the magazine to be removed. With the magazine in, pull the slide back and lower the magazine safety. A1- 22 LR comes in three and five-inch barrels. The .25 ACP HP25A is available in a three-inch barrel only. The magazines are not interchangeable between

.22 LR and .25ACP models. low the slide to go forward. Check that the hammer is cocked. Now the hard part.

Push the take down lever forward and rotate the barrel up from the front. The lever is so small I had to firmly brace the pistol while pushing the lever as I rotated the barrel. With the barrel out the slide comes off by lifting up and pulling forward. The recoil spring and take down lever can be removed now. Put the magazine safety in the safe position and remove the magazine. For detailed disassembly we'll start with the slide. Taking out the rear plate screw requires a 0.050" hex wrench.

Unscrew the rear plate screw and put the firing pin block in the fire position. Push in on the firing pin with a flat blade screwdriver and pry the rear plate up. If it cocks it will catch on the rails inside of the slide. It is a tight fit to get it out of the slide. The firing pin and firing pin spring will come out of the back off the slide. Using a fine

hooked pick, pull the block spring out the back of the slide. The firing pin block will come out to the left.

The extractor is removed by pushing the extractor pin down into the slide. This is slightly smaller than 1/16" and I turned down a 1/16" punch for this. The rear sight can be removed by unscrewing the sight screw and removing the sight and sight spring. For the frame, insert the magazine and lower the hammer under control. Put the magazine safety back on safe and remove the magazine. Unscrew the right grip screws and grip panel, then lift out the disconnecter.

Remove the left side and lift out the magazine safety and spring. Push out the barrel pivot pin and the disconnecter pin behind the trigger pin. Push out the trigger pin and retrieve the trigger return spring as you pull the punch back out. The trigger can be taken out by pushing

PHOENIX HANDGUNS CONTINUED

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Original caption: Top: The slide completely disassembled. ing small needle nose locking pliers, compress the strut spring on the strut and lock the pliers on the end.

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1 Rear Plate 2 Rear Plate Screw 3 Firing Pin 4 Firing Pin Spring 5 Block Spring 6 Firing Pin Block 7 Sight 8 Sight Spring 9 Sight Screw 10 Extractor Pin 11 Extractor 12 Extractor Spring 13 Slide 14 Hammer 15 Sear 16 Sear Pin 17 Ejector 18 Hammer Pin down on the trigger bar and pulling the trigger rearward in the frame. Push the sear pin out and remove the sear pin. Use a screwdriver tip to lift up the leg of the sear spring and remove from frame..

When removing the hammer, control the hammer as there is pressure from the strut spring. Remove the hammer pin and the hammer, strut, ejector, and strut spring out the top. The safety block and cross pin are staked into the frame and should not be remove unless to replace.

The magazine button is an assembly and requires a kit from the factory to replace. 19 Cross Pin 20 Magazine Button 22 Barrel pivot Pin 23 Sear Spring 24 Magazine Safety 25 Left Grip 26 Magazine Safety Spring 27 Safety Block 28 Catch Spring 29 Recoil

Spring 30 Take Down Lever 31 Frame 32 Trigger 33 Trigger Spring 34 Trigger Pivot Pin 35 Trigger Return Spring 36 Trigger Bar Pin 37 Trigger Bar The magazine can be disassembled with a punch and pushing in through the hole in the magazine base.

With the base lock pushed in, slide the magazine base to the front and off. The follower takes some fiddling with to get it out the top of the magazine body. Reassembly is reverse of disassembly. Start with the slide. The short end of the block spring goes down, putting it back in the slide. Make sure the long end goes into the firing pin block lever before seating in the slide. For the frame, reinstall the hammer, sear and sear spring.

Us- Phoenix Arms HP22A and HP25A (Specifications subject to change without notice) 38 Strut 39 Strut Spring 40 Disconnect Pin 41 Disconnect 42 Magazine Catch 43 Right Grip 44 Grip Screws (4) 45 Standard Magazine 46 Base Lock 47 Standard Magazine Base 48 Extended Magazine Base

49 Magazine Spring 50 Extended Magazine 51 Follower 52 Magazine Body 53 3" Barrel (22 LR or .25ACP) 54 5" Barrel (22 LR only)

This will allow you to put the strut into the slot in the hammer before releasing the spring. Use your thumb to hold the spring down in the frame and a large punch to push the spring into the frame securely. The trigger return spring goes in with the long leg up. Put the take down lever in the frame. Put the slide on the frame and push as far forward as it will go. Insert the recoil spring on to the stud of the take down lever and the front of the slide.

Using the barrel backwards in the frame, hold the spring in place while pulling the slide back and locking with the magazine safety. Then remove the barrel and hook it on the barrel pivot pin and rotate and lock in place. I have found by using the left hand to hold the barrel down on the frame the slide can be pulled back with the right hand to lock it. AG

HISTORY

1851 London Navy

Cap and ball revolvers are still great shooters. Here's how to prep a Uberti/Cimarron London Navy for black powder.

BY RAY ORDORICA OCTOBER 2016

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Original caption: Top: "Ringer" is a good word to describe Uberti/Cimarron's London Navy.

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Quite a few years ago Colt offered its second generation cap and ball revolvers with a serial number range supposedly continuing from where they left off a century or so before. I acquired several of them and found them to be mighty fine guns. One which I shoot often is the I've made a few modifications to it that make it a more enjoyable gun but I've always had a problem with it. Its trigger guard is the square-back version (second version of the original Navies) which is just too small for me.

It's always been tight on my trigger finger. There's another version of the gun that has always appealed more to me and that's the London-London 1851 Navy. These were made entirely in England and feature a large trigger guard on an "iron" frame instead of silver-plated brass, as on my 2nd Gen. Colt. I looked for an original for along time but never found the one I wanted.

Unfortunately, prices for the good old original ones from the Civil War era have gone higher than I'd like to pay for a gun I want to shoot, so I was compelled to do something entirely sensible: I bought a Uberti London Navy from Cimarron Arms. This gave me a brand-new gun that looked pretty much exactly like it ought to look. My finger fits the trigger guard nicely and my bank account has not been sucked dry.

With along, hard look in Nathan Swayze's '51 Colt Navies, the bible on the original 1851 Navy Colts, I see that Uberti did an extremely good job of copying the London-made Navy, with most of the details done exactly right. Uberti, most likely under the direction of the good folks at Cimarron,

This .36 caliber cap and ball sixgun exactly matches in most details the original London-made "London" Colt Navies, including the all-steel grip straps... except this one is brand new. It needed some coaxing for easier and more-fun shooting.pots.

The author worked some simple magic on it to make it even better. correctly created the thick lug at the back of the barrel where it attaches to the frame; the correct later-type latch for the loading lever; the correct V-shaped loading notch on the right-rear side of the barrel lug; and matched quite a few other details. Of course Uberti could not duplicate the Colt markings, but the Uberti does have "LONDON" on the top of the barrel.

Happily all the Uberti manufacturing nomenclature is hidden on the bottom of the barrel under the loading lever. So I have the Cimarron/Uberti in hand and it's about as slick and

1851 LONDON NAVY CONTINUED

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smooth as my 2nd Gen. Colt Navy, which is saying something because that Colt Navy feels as smooth as a Swiss watch in all its operations. Uberty builds some mighty fine guns and has done so for along time. So with a slick gun right out of the box, I knew I would not have to tinker with the action. The trigger is extremely good, a clean break at just under a pound. The timing is excellent, the gun locks up securely, and it seemed to be all ready to go. But I don't shoot black powder in untreated guns.

Having learned the hard way over many years, I go to the trouble of anointing the guts and garters of all my blackpowder guns

with Ox-Yoke's amazing yellow product called Wonder Lube 1000 Plus. You can get it from RMC & Ox-Yoke Rmc Ox Yoke. com), Track of the Wolf, Inc. Below center: The more-common nipple wrench is a T-handle tool. Be sure it fits your gun because the wrenches come in different sizes. This one has a knurled brass nut on the top that features a stiff wire to poke through the nipples.

This one is an antique I've had for about 50 years. The long leg ends in a screwdriver that fits the rest of the gun. Track Of The Wolf. com) and other places. I suggest getting some because I have found nothing like it. Ditto the lubricated Wonder Wads that go

over the powder in the chambers, though one can make something similar at home. I have used Wonder Lube many years now on all my black powder guns and there's not a trace of rust on any of them. I'm most certainly not a stickler for obsessive maintenance.

Heck, I've put black-powder-fired guns away for years after a basic simple cleaning and have encountered exactly no problems, Far Then take off the cylinder from the main pin.

1851 LONDON NAVY CONTINUED

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I recommend replacing the originals with non-rusting ones. There are several versions on the market. Above center: Loosen the upper two screws first and the lower one will be easier to remove. The wood was a single piece of walnut carefully inletted. Kudos to Uberti for that. This was easily corrected with the gentle poke of a center punch where the edge of the dovetail meets the latch. no rust, nothing. I live in an area where lots of humidity might be all of 60 percent, but it's still significant.

Ox-Yoke products work well and they vastly simplify the cleaning procedure. So before I shot the Uberti London Navy I prepared it and what follows is exactly how I did it. Besides anointing the guts The ram is loose enough that oil can easily be washed out and Wonder Lube 100 Plus can flow into it. This

is how it's seated within the frame. of the gun with goo, there are some simple tricks that make for easier and more fun shooting, easier loading, and something you can do to get the gun to shoot where it looks.

Take It Apart The first task is to remove all the oil inside and out with hot soapy water and that means complete disassembly. Full disassembly might seem like a pain, but with Wonder Lube in place you'll have to do a complete tear down only about once a year instead of every time you shoot the gun. Taking the old guns apart is pretty simple. First give the wedge a mighty blow with a suitable non-marring tool. I've used my Brownells screwdriver handle, a block of wood, and even a made-for-the-task brass tool.

The latter, or tool made from an old toothbrush handle, is handy if the wedge doesn't fly out the far side of the frame. With the wedge out to its limit put the gun on half-cock and use the loading lever against the cylinder, between chambers, to shove the barrel off its pin. Pull off the cylinder and you have the three basic pieces of these early guns, barrel, cylinder, and frame. Each must be taken apart fully. Barrel: Undo the wedge screw and remove the wedge.

Take out the rammer's axle but not the screw between the rammer and lever. It's generally locked in securely. Cylinder: If you don't already have a suitable nipple wrench you'll need to get one and keep it close to your gun. I have two types, one a modern T-handle wrench and the

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You're almost done. There are a lot of parts to the single action sixgun but they're straightforward and relatively simple. other an ancient L-shaped device with the wrench on one leg and a screwdriver on the other. Make sure the T-handle device fits your cylinder. While it's not mandatory to replace the nipples with stainless or other non-corroding ones, it's a Mighty Good Idea. On the subject of nipples, a good tool to help clean them after a shooting session is a pipe cleaner.

Frame: Loosen the rear screws that hold the rear grip strap to the back of the frame, then remove the single screw on the bottom. The top two screws often create some tension Cold bluing hid the bare steel. on the bottom one. If the top two are loose the bottom screw comes out easily. Remove the wood and the back strap. A pleasant surprise was

finding Uberti's wood grip to be a true one-piece stock, not the common two chunks of wood glued together with a spacer. Nice.

Next, take off the long hammer spring by removing its screw. Mine was Loctited, which I didn't know, so I used force. Heat would have helped. Now take off the trigger guard (three screws, the two rears being longer) and then remove the two-fin- Boil all the parts in soapy water and dunk 'em into clean, very hot water so they'll dry quickly. When they're dry and still warm, anoint them all, inside and out, with Wonder Lube 1000 Plus. Now it's time to go to work.

Fix It Up The first thing to do is remove all the little burrs at the edges of the various parts with a file or threecornered scraper. This includes the sides of the hammer, the razor-sharp cutting edge of the loading vee on the right-rear end of the barrel lug and anywhere else you find nasty edges. The edge

of the loading-vee notch on my gun was sharp enough to cut paper and it'd do your fingers no good. By the way, the London Navies do not have the deep gouge commonly seen on the later U.

S.made Navies at that point. Uberti got it just right. gered spring. Then, in order, take out the trigger, the bolt, and the hammer. The hammer must be pulled downward to free the hand and its spring from the recess. The hand lifts off the hammer once it's out. Be careful of that small leaf spring. One of the nastiest group of sharp edges is at the front end of the wedge. Gently bevel the entire leading edge of the wedge so it can be driven more easily back into place.

More sharp edges are commonly found on the top edge of the frame just under the cylinder, particularly between the end of the cylinder and the back of the barrel where your fingers will be during loading. The

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A bit of work with the Dremel gave a smooth, polished inner surface. main lump of the loading lever on my gun had sharp “flanges” on its edges that had to go. You can do as much or as little of this deburring as you want, inside and outside the gun. If you don’t do any of it, your gun will eventually cut you long before the razor-sharp edges wear away. By the way, it is not necessary to grind off these sharp edges. The so-called case hardening is not very hard on this Uberti.

The casehardened parts cut easily with a file. The colors on there are mostly decoration or window-dressing, though in fairness the parts are not dead soft and the case colors look really right. Gone are the days when they looked like blue paint. They ought to be file-hard, like they are on my 2nd Generation Colt Navy, but they’re not. Another area I like to redo is the checkering on top of the hammer.

I used a small square file with sharp corners to point-up the existing cuts there, which made for a more secure grip. Some 44-40

cold blue from Brownells on all the exposed edge- Some gentle work with a file fixed that. I left the tiny bare edges white. It is pulled gently into the forcing cone and cleans up any roughness there. Be careful you don’t go too deep as it works efficiently. es—or not, as you personally see fit—fixes the white-metal problems and it’ll wear soon enough to look just right.

Be sure the fronts of the chambers have a slight chamfer. This permits the ball to be more or less swaged instead of cut during the seating process. Uberti did a good job on my gun. I had to cut chamfers on my Colt’s chambers. Again I recommend stainless niples. There are several versions today but I have no experience with any of ‘em. A few decades ago I used Uncle Mike’s on my Colt but they are no longer available. Do you want to remove the finish on the grips and rub ‘em with linseed?

Now’s the time to do that, but be careful to maintain the perfect edges there and the fine fit to the metal. I’d suggest that if you have little to no experience in stock refinishing

you leave ‘em alone. I did one more thing to my gun, which I heartily recommend. Get one of Brownells Revolver Chamfering Tool Kits and recut the forcing cone and polish the recut area. Go lightly! This eliminates all roughness and thus all leading in that area. Should you fire-lap the bore? I don’t think it’s necessary.

Shooting and careful maintenance will generally get you a mighty slick barrel. The next thing to do is put it all together and go out and shoot it. I use a full charge of FFFg Goex (nearly 24 grains) with a Wonder Wad over the powder, then swaged 0.375-inch lead balls. What you’re doing is twofold. You’re working the Wonder Lube into the pores of the barrel and also checking the point of impact. My gun shot about three inches high at 15 yards and on the money for windage.

You can cut the top edge of the hammer down easily to lower the impact point and can then cut a larger vee into

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the hammer to make a better, more easily seen set of sights. Remember I told you the case hardening is not that hard? I used a coarse sanding wheel on my Dremel to lower the top edge of the hammer, maintaining the same angles, and then cut the vee-notch deeper and wider with a triangular file. It went easily. Of course one tests the impact point as I used a file and some 44/40 Cold Blue. one goes along. I settled for one inch high at 15 yards. Now comes the fun part: Cleanup.

I use Ox-Yoke Originals Liquid Wonder Competition Bore Cleaner. All the Ox-Yoke products have been kind to my hands, unlike the nasty stuff required for smokeless powder. Track's Best Black Powder Bore Cleaning Solvent seems to be similar, though I have not tried it. CVA's Barrel Blaster is another possible watery juice, as is Birchwood Casey's No. 77 Muzzle Magic Cleaner, but I have no experience with these.

The Brownells tool did a superb job of smoothing it up, which eliminates leading there and helps accuracy and cleanup. Some of them may not interact well with Wonder Lube. Don't use any oil-based cleaners, and that means any products designed for smokeless powder, such as Hoppe's No. 9, nor any common gun oil. These will destroy all the hard work you did to get Wonder Lube 1000 Plus onto and into your gun.

After your shooting session a couple wet patches and a dry one will generally be all the cleaning you need to do on barrel and chambers and then shove a patch with Wonder Lube on it into each chamber and through the cylinder-pin hole and the bore. Wipe down the rest of the gun in a similar manner. You can even wipe down the grips with Wonder Lube. That's it. No boiling water, no huge mess.

There's no major disassembly needed, except you might want to do that once a year, or maybe every two years, depending on how much you shoot. Best of all, there's no need to clean after every few shots. I made a test with my 2nd Gen. Colt Navy awhile back and shot 42 shots in succession with zero cleaning along the way. The gun was just as easy to load, cock, and shoot, and just as accurate at the end of the test as it was at the beginning.

And that, fellow shooter, is why I go to all this trouble with each and all of my cap and ball sixguns. One final suggestion: Don't fill in the notch in the hammer. It is there because it permits the safe loading of all six chambers. Rest the hammer between chambers with one of the cylinder's pins locked into the hammer notch. Colonel Colt knew more about that than some of today's You Tube "gunsmiths." AG

FINISHING

Holemaking Technology

Increasing efficiency, quality, and precision in firearm manufacturing.

BY KEVIN VANDERBECK & JUSTIN KRUSKO OCTOBER 2016

ORIGINAL PP. 11

Selecting the right holemaking tools for firearms manufacturing is key to improving efficiency while maintaining quality and precision. New technology improves straightness and finish, while reducing cycle times. Other innovations combine multiple tools, reducing cycle time and tool changes. Holemaking is a crucial part of all segments of firearms manufacturing, including rifles, shotguns, handguns, and revolvers. Holes must be straight, meet tight diameter tolerances, and have the proper surface finish.

Holemaking operations must be done quickly to meet manufacturer's production demands. There are dozens of drilling, threading, and reaming applications on parts, ranging from barrels to sights, to upper and lower receivers, and slides. Most manufacturers are looking for a reliable process that gives them the capability to run more efficiently with minimal intrusion. This makes it easier to manufacture quality parts.

One of the most important machine requirements for the firearms industry is a high pressure coolant delivery system to help evacuate chips generated during hole drilling, which is critical to successful drilling as failing to do so may cause "walking", affecting hole straightness, and the finish. Innovative holemaking technology reduces cycle times, improves tool life, and reduces Total Indicated Runout, which affects hole diameter and straightness.

Engineers at Allied Machine (AlliedMachine.com) have developed tools to reduce TIR, enabling improved hole size and straightness. For example, the T-A Stealth Drill (because it runs quietly) was designed with an adjustable setup that removes runout. This enables the tool to drill straighter for longer, produce truer holes, and wear more evenly. The technology has been used for drilling rifle receivers and uses brazed guide pads for straightness, and a higher coolant flow capability to improve chip evacuation.

This design has also been found to reduce cycle times and increase feed rates compared to other drills. The T-A Stealth Drill was used by New England firearm maker that was experiencing issues with their current drilling process. They had a two-year contract for 10,000 rifle receivers per week and were having issues with hole concentricity in 30% of the parts.

Allied's T-A Stealth Drill includes an adjustable locating pin and additional coolant outlets in the brazed carbide bearing area to decrease TIR and hole size variation. The new drill performed well, time of 40 seconds. The holder life is above 210,000 inches and the process is reliable, saving the customer \$0.15 per piece and reducing one eight-hour shift per week from the job.

This drill design was also used for a major firearms manufacturer producing 9,000 shotgun barrels per week with parts made of 4140 low-alloy steel and 28-32 Rc hardness. The customer was experiencing TIR

issues and insert/holder failures. Tool life was only 105 minutes (1,155 inches of life) with chip packing, requiring a peck cycle and providing a 125 finish on the part with poor hole quality and 30 percent reject rate.

The T-A Stealth Drill in combination with a newly-developed Ultra T-A drill achieved improved chip evacuation with a zero part reject rate. They got a 19 finish on the hole and tool life was increased to 170 minutes (2040 inches of life), an increase of 76%. The Ultra T-A insert is made from C1 carbide and uses Allied's AM300 coating, increasing wear resistance and tool life.

Another innovation in firearms holemaking operations are high performance finishing tools, like replaceable head reamers, enabling manufacturers to produce more parts quicker. In an application making upper receivers for AR-style rifles, Allied uses its ALVAN line of replaceable head reamers to remove the need to hone or roller burnish parts in high production runs. The replaceable head reamer can achieve about 20 IPM, compared to standard reamers achieving only about 3 IPM.

Using ALVAN replaceable head reamers provides the required finish and size while increasing the feed rate and reducing cycle time. With insert tool life of 4,000 inches in 4140 lowalloy steel with a hardness of 32-35 Rc with a cycle New tooling maximizes machine speeds and better machines improve holemaking for manufacturers to improve their production quality. AG

MILLING

Mini Machines For Gunsmiths

Gunsmiths may not have the need (or the capital) for expensive machining equipment. Here are examples of small and affordable machines for your shop.

BY JERRY SPADORCIO OCTOBER 2016

ORIGINAL PP. 12-13

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Want an inexpensive lathe or mill? Ones that don't need elaborate or permanent installation or require sacrificing half your meager workshop space? Something that will work for occasional small jobs that won't break the bank? I own a gunsmithing shop and have been doing gunsmithing for about 12 years. While I do use a large lathe and mill for bigger work, I find that mini machines are more than adequate for many gunsmithing tasks. When being used they run very smooth, just like a large lathe or mill.

They are machine operated with a belt drive to the head stock. Their motors run smooth and are powerful. For smaller work, my small lathe is by Sherline (sherline.com) which costs about \$700 new. Despite its size, it operates the same as a large lathe and will cut titanium steel when using a carbide cutter. I make firing pins, small screws, gun pins, and bore small holes and other cuts. For some jobs I like to cut back a small firing pin to allow more firing pin protrusion.

I've also found that turning a piece of round stock for slave pins can be set up just as fast as a big lathe. This small lathe moves in increments of 0.001" for cuts and is very accurate. In fact, I've found it to be as accurate

as a large lathe. My lathe has a 3-jaw chuck that is self centering, though you can also get a 4-jaw chuck and adjust each jaw. There many accessories available depending what you need to turn and cut. Sherline makes a high quality miniature machine.

I've been able to turn a diameter close to the chuck on the lathe within 0.0002". My particular lathe is a model 4000 series at 3.5"x8". Sherline also makes their 4500, which is the same size but features adjustable "zero" hand wheels, and a larger model 4400 with a 17" bed. The hand wheels are precisely laser engraved in graduations of 0.001 inch. I have been very happy using this bench lathe for small jobs. In addition to lathes, Sherline also makes mini milling machines and CNC packages.

They're all fully capable of precision work within their size capacity. I also use a mini mill made by Unimat out of Australia that can be had for around \$600. I use it to cut very small gun parts and to surface grind them. This mill will also do the same work as a big mill within its smaller capacity. I have used it to cut dove tails in barrels for mounting better and bigger sights for a customer I had that was assembling a kit gun.

MINI MACHINES FOR GUNSMITHS CONTINUED

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I've also cut weaver sight bases. The same variety of square and ball end mill cutters, other cutters and collets sizes are available for this mill as bigger units. As a bonus, they can be changed faster on the smaller unit. These small mills can use right and left hand cutting tools for HSS steel, or you can get the same in carbide cutting tools. Most gunsmiths, especially small and one-man shops, are not doing any kind of production work.

Bigger machines will be needed to set back rifle barrels, reline barrels, put muzzle breaks on rifle barrels, thread barrels, and make

large parts or tools. However, you can put pistol or revolver barrels on a mini lathe or mill. Mini machines can't do everything, but they work for me and I have fun working on them. The cuts are clean and smooth on the metal with no vibrations with either the lathe or the mill. Full-size machines are nice but mini machines may be all you need.

I believe these mini machines have a place in the gunsmith shop as we are often working on small gun parts, not crank shafts. They take up little room to work on and can do much of the same work as a big lathe or mill.

For anew gunsmith, especially one just graduating from a gunsmith school, these might be an ideal way to start. A full-size machine is a substantial investment and will take along time to get your money back. I know how that goes!

Even with access to larger machines, I still find that I use my mini machines more often. If you're not operating a machine shop, small and less expensive machines may fit your needs perfectly. AG

FROM THE ARCHIVE

AR-15 Barrel Harmonics

BY JOE CARLOS OCTOBER 2016

ORIGINAL PP. 14-22

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Physics Nobel Laureate Richard Feynman once said, “If you think you understand quantum mechanics, you probably don’t understand quantum mechanics.” I believe most shooters, handloaders, and gunsmiths could substitute “barrel harmonics” for “quantum mechanics” here for an accurate assessment. Although I had to take physics classes in college, barrel harmonics weren’t discussed.

I won’t arm wrestle a physicist pointing out some of the points in this article aren’t due to barrel harmonics, but I do know they will significantly tighten groups. The downside of these techniques is a time and range firing effort to establish correct settings, angles, and pressures. These are not simple “drop in” solutions and many won’t have the time for testing. Some of these modifications require gunsmithing and this will help maximum accuracy tuning.

For decades, shooters have tailored handloads for optimal accuracy with different powders, charge weights, bullets, and bullet seating depth. I perform a load work up for A box of ammo with bullets set to the sweet spot is included. Below center: Too much or

too little torque on an unmodified barrel nut will cause the gas tube to bend sideways. This is sometimes difficult to see.

Shove the tube in further and any misalignment will become more obvious. every rifle I build or rebarrel and the customer receives a box of that ammo which will yield good results if properly duplicated. The ammo approach doesn’t improve harmonics much, it’s tailoring ammo to perform with the gun as is. Not everyone can tune ammo. Factory-only ammo and requirements of magazine-fed rifles allow less variables.

American Rifleman published an article about varying the torque on the pillar screws of a pillar bedded rifle to tune for better accuracy. Although I primarily work on Stoner platform rifles lacking conventional stocks and bedding, I sought a similar approach. Torque can be varied on the barrel nut. Begin by properly stabilizing the barrel extension in the upper receiver.

Note, Stoner designed the gas tube to pass through one of the barrel nut’s “teeth” and too much or too little torque on the nut results in a bent gas tube, causing the bolt carrier key to misalign. To avoid this, grind down the offending tooth on the barrel nut and hit the area with a little touch up. This

doesn’t weaken the barrel nut and it can’t unscrew because the next raised tooth would be stopped by the gas tube. I have performed this minor modification to hundreds of ARs without incident.

Assembly is finished with an initial torque of 47 ft-lb for heavy barrel (one inch under the handguards) National Match 20" Service Rifles and 26" Match Rifles. Rack grade, skinny barrels use an initial torque of 60 ft-lb. Any time the barrel nut is timed, run the nut forward to whatever position or torque desired or a bit heavier, back off about a 1/4 turn, then to the desired torque or setting.

Some gunsmiths advocate checking for a “false stop” found with a slight machining burr or imperfection in either the barrel nut or receiver thread that stops the nut prematurely. I’ve only encountered this problem once with a Team rifle in Australia where the barrel nut appeared about one notch short. The upper receiver was a discounted factory blemished piece that zeroed and shot well once this procedure was done.

Also, a removed, offending barrel nut tooth will be concealed by the delta ring assembly and handguard. Bison Armory (bisonarmory.com) offers their AR-15 Barrel Nut Shim Set

AR-15 BARREL HARMONICS CONTINUED

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Above center: Set initial torque on heavy barrels, such as the top three, at 47 ft-lb. Light barrels (bottom two) need a slightly heavier 60 ft-lb of torque. with three 0.001" shim washers that fit on the barrel extension to influence the timing of the barrel nut. Use of shims in AR gun plumbing has increased. Peel washers to time flash suppressors came first, then shim washers were used to correct windage slop in rear sights. Ron Power designed shim washers to reduce accuracy-robbing slop in the front pivot pin.

Bison Armory's offering is the next step. I believe there is room for more fixes via shim washers in helping deal with timing up barrel extensions to existing gas ports in AR barrels. Before leaving the shop, attach anything that will normally be on the barrel before testing, such as a large target front sight. Given a six ounce weight, it could likely influence harmonics. Likewise, the back of the barrel must also be considered, such as with bolt carrier weights.

Start with ten round groups with known-quality ammunition, preferably with what the shooter intends to use. Adjust the torque setting by 10 ft-lbs after each group if needed. It doesn't matter if the initial adjustment is up or down. My range is next to my shop, but a portable vise Cclamped to a shooting bench works otherwise. If the torque change yields a smaller second group, you're in the correct direction. Otherwise, go the other way. Let the results dictate the adjustment.

Continue testing and re-torquing until the groups start to open up to find a sweet spot. I don't go below 27 ft-lbs and add Blue 242 Loctite any time I go below 30. Having made a graph of these settings from various rifles, the average setting is 47 ft-lbs for heavy barreled guns and 60 for skinny barrels, though I've had a few that went as high as 77 and 90 ft-lbs, respectively. Torque changes on issue guns is easy because the handguards can be removed to access the barrel nut.

Likewise, National Match guns with 1 1/4" Compass Lake float tubes have easy barrel nut access. Most 1 3/8" National Match Service Rifle float tubes are two piece and require time consuming partial disassembly to get the wrench on the barrel nut. The front sight assembly has to be freed to allow it to move forward, then the actual float tube body must be unscrewed so the wrench can be placed on the barrel nut.

Once the new torque has been applied, the float tube is reassembled and the front sight located to its original position. Given this added hassle, I swap 1 3/8" float tubes temporarily for a 1 1/4" tube for testing, replacing afterward. Worse than the 1 3/8" float tubes, many Match Rifle and tactical handguards will not let you change or measure torque. I've found the JP Enterprises Modular Hand Guard System to be a user friendly choice.

Notice I suggested torque changes in 10 ft-lb increments, which may seem too coarse for fine tuning. Let's say we test a skinny barrel

A2 upper with an initial setting at 60 ft-lbs, then try 70 for group two. If the second group is better, 80 ft-lbs is next. Should that group get fatter, it's simple to conclude 70 ft-lbs is the sweet spot.

You're free to try further test groups in 5 ft-lb (or less) increments but I've found 10 ft-lb changes to be all the guns can "see." Regardless if you're building a Service Rifle, Match Rifle, or tactical rifle, expect to harvest about a 20% reduction in group size by following these steps. I've lamented that Stoner's barrel nut design is flawed for maximum accuracy. This method of barrel fastening is fast and easy but promotes accuracy-robbing movement of the barrel extension inside the upper receiver.

As long as these rifles attach the barrel with a barrel nut it will be difficult to achieve maximum potential accuracy that the barrel makers are giving us. Varying torque on the very thing that limits our accuracy allows some significant accuracy strides. One last note here. I described how to slightly modify the nut by removing a tooth to allow a range of torque settings. A2 handguards time up to the barrel nut.

Depending on the amount of torque that the gun wants, the top handguard vent holes may be positioned either a little clockwise or counter clockwise from the normal 12 o'clock position. No big deal to the shooter because the handguards are round but it can be a big deal to the gas tube because it

AR-15 BARREL HARMONICS CONTINUED

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Author uses JP Enterprises handguards (shown) that allow easy access to the barrel nut for torque adjustments on a Match Rifle. passes through a narrow channel in the back of the top handguard. Neither side of that channel should touch the gas tube because that can throw it out of alignment with the bolt carrier key. If you find either side of that channel crowding the gas tube, relieve it with a file or grinding wheel. Many shooters lack the gunsmithing skills and tools to make torque changes on the range.

Not to worry! There are other techniques that are more user friendly and offer similar accuracy gains. Old School Tech Prior to Viet Nam, I spent my youth hunting deer. I still remember stories from the woods about some hunter's deer rifle shooting terribly and some smart guy fixed it with a section of match book cover strategically positioned in front of the action where the barrel attached or near the front of the stock. According to lore, the subject firearm magically turned into a tack driver.

As with many of these urban legends, nobody ever stepped forward to proclaim personally witnessing this. In spite of whatever en-

hanced accuracy those matchbook-cover gunsmiths achieved, the deer population easily survived. Reading Harold R. Vaughn's Rifle Accuracy Facts reminded me of these matchbook modifications. Dr. Vaughn discusses a modification he called "The O'Connor Bedding Approach" involving two epoxy-coated cardboard shims positioned at 4:30 and 7:30 at the front of a wooden rifle stock. Dr.

Vaughn thought it a good idea from a physics standpoint but had concerns about environmental conditions changing the pressures on the barrel, with such warping moving the rifle's zero. I strongly second that motion and predict changes in the grouping characteristics, however, I confess this gives some credence to that old hunting lore. The shim idea ties in with varying torque on pillar-bedded stock screws.

Aftermarket Innovations Stocks-Rifle.com) is marketing and installing their Smart Stock Accuracy System, a tuning device that mounts in the barrel channel near the front of the stock and applies upward pressure against a specific section of the bottom of the barrel. The position of that support is ad-

justable and the shooter fires groups to find the tightest while moving the support block in 1/64" increments.

Because all their testing was done on a bench with sandbags, I wrote in concerning issues when using a tight shooting sling for support as this will pull on the stock and could alter the effect of the support device. Unfortunately, they never responded. It's doubtful this was taken into consideration. My Anschütz squirrel rifles have double pillar bedded fiberglass stocks by a major custom stock and floated barrels.

On the range, I found a tight hasty sling opened a visible gap between the bottom of the barrel and barrel channel in the stock, returning to normal when sling tension was lessened. Note, this applies to a specific shooter using the amount of sling tension comfortable for him. Stocks are made of different materials and different dimensions and different firearms may well react differently to sling tension. Every

AR-15 BARREL HARMONICS CONTINUED

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Above center: JP Enterprises Modular Hand Guard System with forward section removed allowing easy access to the barrel nut for adjustments. shooter using a sling for support will have individual sling tension to provide the amount of steadying affect needed. I haven't tested the Smart- Stock so don't misinterpret this as criticism, however, these are issues that can change accuracy and zero. Firearms have more similarities than differences.

I've made modifications to AR-15s based on what I've learned from bolt guns and pistols. The Smart Stock has potential and I gave the idea thought for some modifications on certain ARs. The first is float tubes on National Match Service Rifles. These have metal tubes with a barrel nut and delta assembly on one end and a sling swivel on the other. Using a tight sling on an as-issued setup causes a temporary bend in the barrel and the float tube removes that.

National Match tubes fit under modified handguards that appear stock and the bottom handguard has vent holes about 5/8" center to center. With a bottom handguard in place, I traced the vent holes with a white Sharpie onto the tube beneath it, then removed the handguard and centered drill holes on the traced patterns. I drilled seven holes corresponding to the most rearward vents to locate the barrel supports far back to minimize flex in the metal tube.

I consider this a design improvement over the Smart Stock with support near the front of the stock where flex will be greatest if a

sling is used. I tapped the holes at 8-32. This is the same thread normally used on windage-adjustable front sight housings and customers will already have the appropriate 5/64" Allen wrench. 8-32 Allen screws purchased or dressed to about 9/64" in length fit flush in a 1 1/4" float tube. A fatter 1 3/8" float tube needs set screws to measure about 13/64" to 1/4" long.

Longer set screws is OK unless the shooter uses a lead weight in the handguard, requiring clearance holes in the lead. For testing, the shooter locates the support screw in the rearmost hole and torques it tightly against the bottom of the barrel. It is important to use the exact same torque each time the under-barrel support screw is moved. I recommend 15 inch-pounds. Fire a group, then move the screw forward to the next position and retest for all seven support holes.

This initial range session makes bold 5/8" movements of the support set screws. Those support holes are centered on the bottom handguard vent holes and the handguards don't have to be removed to change the position of the support screws. As before, continue to test as groups improve and then go past the sweet spot. Fine tune as desired. Let's say groups shrink from the location furthest to the rear to hole 4 and then begin to get progressively bigger again with holes 5 through 7.

Secondary holes drilled between 4 and 3 at the rear and another between 4 and 5 at the front will help fine tune the performance. By firing additional test targets at these two sec-

ondary positions the shooter should be able to nail a sweet spot. From my experience, trying to fine tune beyond these secondary holes is a waste of time but you are free to experiment on your own. Getting set screws into the secondary holes will require removal of the bottom handguard.

Another good handguard is the JP Enterprises Modular Hand Guard System. I use these on Match Rifles, F-Class rifles, and tactical shooters can attach rails to all four sides. This unit allows ready access to the barrel nut for tuning. Each handguard has two long 3 3/4" slots milled in the bottom for adjustable hand stops via included dovetail inserts drilled and tapped to accept quick-detachable sling swivel studs.

For accuracy tuning, I do away with the sling swivel stud and substitute a 10-32 set screw with about 1/2" long to fit the thread of the original dovetail and move it forward and back in the rear slot in the hand guard to accomplish the tuning process. My substitute screw is long enough to reach and snug up on the bottom of the barrel, supplying the tuning support.

I take apiece of masking tape and attach it next to the slot and mark off the same 5/8" tuning intervals as described above, yielding five tuning increments. Testing is as previously described. Once a coarse sweet spot is found, move the dovetail any distance forward or

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Support holes are centered, drilled, and tapped (author recommends 8-32, the same as commonly used on windage-adjustable front sight housings.) Fine tuning holes can be located between the primary points, shown with Allen wrenches in place. On top, the underbarrel support is in the front half of the float tube. This results in no accuracy improvement over placing them rearward. The matching rear slot is marked for a normal 5/8" beginning spacing. back from that setting to further fine tune performance.

While the JP is user friendly for tuning, other hand guards may be less compatible to this tuning method but I'm sure you will apply your own ingenuity to make it work. Some handguard designs may be hopeless. In that event, employ other accuracy tuning methods. Before closing my research on the location of the barrel support, I had to perform one final test.

Both the Smart Stock and O'Connor bedding approaches located their respective barrel supports under the front where they would be most susceptible to sling tension. Most of my customers are National Match shooters using tight loop slings to steady their rifles, so I locate barrel supports near the back of the barrel. Even though the float tubes and metal handguards in my guns are more rigid

than wooden rifle stocks, I wanted supports to the rear where any flex caused by heavy sling tension would be minimal.

In the interest of being thorough, I tried an experiment with the support located in the front half of a float tube and shot test groups at 15 inchpounds of torque. I was able to locate a sweet spot in the front half of the float tube and I could get the groups as tight as the ones with rearward support, but no tighter. Using the existing holes in the lower handguard, I tapped a total of six screw holes at 5/8" increments as before and tested all six locations.

What was noteworthy was the impact on the downrange location of the six groups. The group shot with the under barrel support closest to the front versus the most rearward location six holes back moved the point of impact by 7.5" at 100 yards! As one would suspect, the zero shift which occurs by supporting the barrel at its front is much greater than providing support at the rear of the barrel. Given the groups were no better with front barrel support compared to rear support, the better choice is obvious.

Varying Barrel Support Torque Some bolt gunners vary torque on pillar bedded stock screws in bolt rifles to tighten groups.

Varying barrel nut torque on AR-15s also tunes performance. Next step is varying barrel support torque. You will need a quality torque wrench calibrated in inch-pounds. I like to use a wrench measuring down to 10 inch-pounds or less. Many inch-pound torque wrenches are set up for 1/4" drive.

If not, purchase appropriate conversions, then use a Brownells Magna-Tip on the end to match whatever set screw or screw head you choose for barrel support. I use 15 inch-pounds of torque when I am moving forward or aft with my support to establish the correct location for it so that groups already fired don't need to be repeated. Once you have located a sweet spot along the bottom of the handguard, perform the torque tests with the support in that sweet spot location.

I like to shoot groups with torque increased and decreased in five inch-pound increments (10 and 20) from the initial 15 inch-pound setting. Continue in the direction of the better group until it goes past the sweet spot and gets fatter. Feel free to fine tune in smaller than 5 inch-pound increments. I seldom go above 25 in-lbs to find the torque sweet spot. Usually, the torque sweet

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spot is with rather modest upward pressure. Remember, don't try bending the barrel and don't get hoggish with the torque. Besides accuracy penalties, there are other disadvantages to applying too much torque to the barrel support screw. Too much upward pressure on the support screw runs the danger of stripping the threads out of the metal handguard as some of these are only about 1/10" thick. There likely won't be more than three threads tapped depending barrel support size.

On top of that, the metal used is soft and strips out easily, though it's suitable for removing sling pressure from the barrel. Even modest torques can make substantial point of impact changes. For example, I located a sweet spot on a customer's Service Rifle about three inches forward of the delta ring. Varying torque from 15 to 25 in-lbs moved the POI by four inches at 100 yards! It's important to verify zeroes after any tuning effort.

With the sweet spot torque identified, coat the set screws with red Loctite and torque against the bottom of the barrel. If the set screws vibrate loose the sweet spot (and possibly zero) is lost. Flush-fitting set screws can be staked like the bolt carrier keys screws, however, this will make removal more difficult when rebarreling is needed. The Other End Long before varying the torque on the barrel nut was understood, gunsmiths were experimenting with flash suppressors to accomplish the same thing.

Early attempts involved the A1 flash suppressor because it is not directional. The back section of the suppressor was sawed off and The set screw on the right is substituted for the sling swivel stud on the left. Above center: Use a quality torque wrench calibrated in inch-pounds, such as the adjustable unit on bottom (Brownells #080-000-515). Fixed torque drivers on top in 15, 20, and 25 inch-pounds can also be used. Size-appropriate Magna-Tip ends will fit both types.

If you are still worried about them unscrewing, stake them as well. used as a jam nut. Most of us would make a white paint dot on the forward section of the suppressor for tracking purposes. Moving that front section about one clock face hour at a time sometimes produced noticeable accuracy improvement. Beginning at 12 o'clock, the sweet spot would be found before a complete revolution was made regardless of the direction turned.

Once the sweet sport was identified, the front section was held in place while the back section was jammed tightly against it to lock the setting in. While this technique is faster than varying torque on the barrel nut, the torque method results in greater gains. Many gave up on the jam nut method and started using peel washers as each washer moves the suppressor about one hour on the clock face.

An often used, non-directional suppressor is the Vortex from Smith Enterprises for .22 calibers with standard pre-ban 1/2 x 28 threads as well as 6.8mm and .308 versions

with different threads. These work on any threaded barrel, such as my .22 Magnum Anschutz. As with A1 suppressors, Vortex units hit a sweet spot within one revolution and thin sections of standard peel washers make one hour changes. For competition rifles, make sure visible modifications comply with the rules.

Vortex units are not legal on NRA/CMP Service Rifles. With 20" pre-ban Service Rifles, I combine suppressor and barrel nut tuning. I initially set the solid part of the A2 suppressor at 6 o'clock as originally designed, then tune the barrel nut. With that complete, I remove one peel washer and retest with the suppressor at 5 o'clock and again at 7. This differing suppressor setting is barely noticeable. If I nailed the barrel nut torque sweet spot, there is no improvement at either 5 or 7 o'clock.

I have gotten good enough at fine tuning barrel nut torque settings that most rifles leave my shop with flash suppressors at 6 o'clock. I call this suppressor tuning the "Poor Man's BOSS" and is based on Browning's Ballistic Optimizing Shooting System. Both work by effectively lengthening or shortening the barrel. This is different from a taper bore. For decades, barrel makers felt the best barrels had a subtle taper to the bore and were a bit fatter in front

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Peel washers were later used to position the suppressors. of the chamber with a uniform taper at the muzzle. In practice, achieving this is easier said than done. Makers of quality AR barrels believe flash suppressors put on with too much torque crush the bore at the muzzle, a constriction thought to deform bullets as they pass through.

I tested this theory when I first started working on ARs by pretesting factory barrels with suppressors mounted with a hard torque, then removing and reassembling with modest torque. There was usually an improvement in accuracy! It appears there is some "elasticity" in stainless and chrome-moly steel. Once the crushing torque is removed, the metal rebounds somewhat, with non-chrome lined barrels responding best. I posit that chrome is not as elastic and likely holds more of the constriction.

I wasn't the only AR researcher to discover this. Others tried to use this "Poor Man's Taper Bore" by carefully controlling the amount of flash suppressor torque applied and slightly constrict the muzzle without being excessive. In reality, the whole length of the bore was not tapered. The hope was to slightly constrict the muzzle and harvest some additional accuracy but I haven't found this to work as well. Perhaps I am not in the right torque range.

Regardless, I haven't heard of others having much success with this either. After discovering accuracy loss from flash suppressors mounted with too much torque, it was common for AR gun plumbers to overreact and put suppressors on just hand with lots of red Loctite. I guarantee this will let the suppressor eventually work loose due to heat. A loose suppressor will remove any tuning efforts and likely change the point of impact.

After a couple of embarrassing incidents, I compromised with three foot-pounds of torque combined with Loctite and haven't had a single suppressor come loose. Some gunsmiths and barrel makers apply hand tightening with red Loctite to the other end of the barrel. Big mistake! The barrel extension is heated by the hot chamber and applications quickly loosen. I 22 Magnum squirrel rifle. had it personally happen and the rifle tracked horizontally across the target as the barrel unscrewed from the extension!

The correct torque on the barrel extension is 150 ft-lbs and I encourage that whenever possible. If a situation prevents proper timing and requires dropping torque, use plenty of red Loctite. Never go below 75 ft-lbs. BOSS Look-A-Likes There are accuracy tuner devices based on the BOSS. Units such as the Harrell's Tuner Brake (Harrells Prec. com, incorporate ports to reduce felt recoil. Others, like the Hoehn Tuner (Hoehn Sales. com, just provide accuracy tuning.

The Hoehn clamps on and fits any barrel with a 0.750" outside diameter, exactly that of a Service Rifle. The Hoehn can clamp on to pre-or post-ban barrels and Match Rifle barrels stepped down to 0.750" at the front. The Harrell's Tuner Brake threads on but initially didn't offer a unit fitting standard 1/2 x 28 threads. I approached them about this and they made a unit to this size for .22 caliber. For larger calibers, consult the company. The Harrell's unit is more streamlined than the Hoehn.

The only design change I would make in the Harrell's would be no drilled vent holes at the bottom between 5-7 o'clock. As is, there's a significant dust signature when firing from prone. The Harrell's costs less. Given that it tunes accuracy and reduces recoil, it's probably a bargain. The Hoehn comes without instructions. My experience with tuning ARs helped reduce the learning curve. Since this was not a permanent rifle, I didn't spend much time fine tuning.

A few hours on the machine rest convinced me there's much potential. The tuner cut groups by 30% and a little additional experience could have likely yielded more. Mr. Hoehn says this unit is popular with .22 rim-fire shooters. I was sufficiently impressed with my initial

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introduction that I plan to include one with each dedicated .22 LR Service Rifle trainer I build from now on. This is more user friendly than the barrel nut tuning method and I think combining both could result in stellar performance. The unit is a bit bulbous, isn't legal for some competition guns, and not for everyone. I have heard F- Class shooters are using these tuners.

Although I had no problems with it moving or coming loose, for a permanent mount, use green Loctite on the bearing surfaces and blue Loctite on the clamp threads. I tested the Harrell's device in the same manner, using ten round machine-rested groups with known ammo lots and a standard A2 flash suppressor in the 6 o'clock normal position, and then substituting the Harrell's. I have experimented with various screw-on recoil reducers over the years.

Many of them are quite effective in lowering muzzle rise but they're usually loud. The Harrell's was no exception, however, unlike other recoil reducers that often reduce accuracy, this unit has adjustments to minimize this problem. Average group size with the Harrell's unit ran about 23% larger than targets fired with the standard A2 flash suppressor. If you do everything else right and start with an accurate, premium barrel one MOA groups are possible with good ammo.

Some kinds of shooting requires a balance of accuracy and speed. For customers needing improved recoil recovery and speed while

maintaining one MOA group potential, the Harrell's unit might be a good investment. For maximum precision, a normal suppressor or flash hider might be a better choice. Tungsten Before leaving the front end of the barrel, it's a good time to cover an experiment I tried that didn't work. For years, hopphobes and other fools have viewed flash suppressors as evil.

Shooters in areas stricken with laws influenced by this silliness need something to cover up the threads of muzzles stripped of their suppressors. I made simple thread protectors in stainless or black for this. While making them, I thought of M9/Beretta 92 accurizing. These pistols normally lack a bushing and the slide doesn't support the barrel's front.

Gunsmiths initially cured this Groups on the left fired with the tuner on the same barrel show a 30% average reduction in group size. by threading the front of the barrel and screwing on a bushing fatter than the barrel to lock up with the slide. Early designs used regular steel as the bushing material before someone tried heavier and stiffer tungsten instead. While difficult to machine, tungsten is available in several grades and only the "softest" grade works in the pistol applications.

Pistolsmiths using the tungsten bushings claim enhanced accuracy by improved harmonics. There is no doubt that stiffening the front inch of the barrel in addition to hanging more weight out there does influence barrel

harmonics. As Armorer for the Army Reserve Shooting Team I outsourced some work to various specialty shops. Most of my earlier armorer and gunsmith education was in revolver work for local police. As cops migrated to semi-auto pistols I worked on 1911s and Beretta 92s.

I had so much AR-15 work with the Reserve Team I outsourced M9 accurizing to Dr. Nick at Mountain Competition (Mountain-CompetitionPistols.com, The tungsten M9 barrel bushings were an option and some USAR Service Pistol Team liked his guns, so I contacted Dr. Nick about tungsten thread protectors. Pistols use a different thread than the AR-15 but it was close enough to allow a judicious "re-tap" to fit.

Mike Harpster (Dead-CenterSports.com, a local gunsmith here in Pennsylvania that I outsource some of my work to, performed the machine shop modification. The tungsten thread protector was notably heavier than the regular steel. I pretest all the AR barrels I sell on a machine rest for accuracy. The ones that shoot tighter groups retail higher than those shooting average.

I make these test groups available to my customers so they can select a barrel that is the best compromise of price and accuracy to meet their needs. I had just received a shipment of Bartlein gain twist barrels and was finishing up their ten shot

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Pistolsmiths are using heavier tungsten bushings on M9/92FS pistols to enhance accuracy. break in when the thread protector project was coming to fruition. I ran three tests with known lots of ammo in the pre-ban configuration barrels using a normal A2 flash suppressor, a regular steel thread protector, and the special tungsten unit. A third of the barrels liked the A2 flash suppressor, a third shot best with regular steel thread protectors, and the final third favored the heavy stiff tungsten units.

My study of the tungsten thread protectors found firearms to be individuals with some liking the heavy protectors and others not. Since only a third of the barrels favored the heavy protectors I don't offer them for sale. Outside of a full machine rest test, a customer has no idea if his barrel would be one of those favoring the heavier protector and I won't sell an expensive piece of kit that my own study pointed to having two chances in three of making the firearm perform worse.

Why didn't the tungsten thread protectors have the desired outcome of improved accuracy? An M9 barrel is five inches long and the tungsten bushing occupies the front inch, or 20% of the total length. Contrast that to a 20" AR-15 barrel and a 1/2-5/8" long thread protector covering about 2.5% of the total length. Perhaps part of the answer is the longer barrel is too long for the tungsten to have a positive dampening effect on barrel harmonics.

Other Considerations The DPMS Lo-Pro receiver has thicker walls than standard uppers. That increased thickness runs all the

way up to the back of the barrel nut threads at the front of the receiver. The threaded portion at the front of any AR receiver is very skinny and this area provides extremely poor support to the third of the barrel extension that lives inside this area.

The DPMS Lo-Pro and Sun Devil (SunDevilMfg.com, receivers are fatter just behind the barrel nut threads where the other two-thirds of the barrel extension resides. It is posited by some that the added thickness of these receivers provides better support for the barrel extension and helps tame barrel whip—or at least make it more consistent—adding to accuracy. Folks are using the AR-15 with heavy 90 grain bullets out to 1,000 yards and barrels have been getting longer to harvest as much velocity as possible.

Some long range shooters feel that barrels between 26" and 32" are so heavy that the skinny receivers just don't provide enough support. I have been experimenting with both company's heavy wall receivers and have seen accuracy improvements even in the wimpy .22 LR rifles with standard 20" barrels as well as centerfire rifles. I want to look at a little larger sample size before stating that as fact, however.

The DPMS unit lacks a forward assist or dust cover and Sun Devil offers their receivers with or without either or both. The DPMS is made to mount on a conventional dimension lower receiver and looks fine. Sun Devil offers lower receivers that area little fatter than normal and their receiver looks best on their lower. That said, Sun

Devil uppers are compatible with normal lowers. Consult the rules of competition before using anything that isn't stock.

Heavy upper receivers would not be legal for NRA/CMP Service Rifle matches. Conclusions In the decade I served as the Army Reserve Shooting Team Armorer I was successful in cutting the average group sizes of the Team's Service Rifles fully in half. When I left, every one of them shot sub-MOA with good ammo. Some improvements required new parts, such as using premium match barrels and substituting match bolt carriers.

Budgets are always fixed, so in addition to buying new parts, I also had to find less expensive alternatives to improving accuracy. Most of the tips in this article fall into that category. They are cheap on the wallet but labor intensive and work on all Stoner platform firearms. Your application of these tips will depend on how much accuracy your customers demand, your individual skills, and how much time you have. No gun has left my shop without application of a combination of these tips.

I am sure they will significantly enhance the accuracy of the rifles you build as well. I began this article with a quote by a Nobel laureate. Even though I've never been nominated for a Nobel Prize, I'll end with a quote by me. "Shooters, handloaders, and gunsmiths tend to blame almost everything they don't understand or can't explain on barrel harmonics." AG

SAFETY & COMPLIANCE

Reader Forum

BY AMERICAN GUNSMITH EDITORS OCTOBER 2016

ORIGINAL PP. 23-24

ITAR Confusion The Department of Defense Trade Control Office (DDTC) has issued contradictory and confusing guidance regarding if/when a gunsmith or gunmaker needs to register for International Traffic in Arms Regulations (ITAR) compliance. Rather than rely on interpretations that may be incorrect, read the DDTC's guidance first (goo.gl/W73-gow). Contact the DDTC response team [DDTCRefor](mailto:DDTCRefor@ddtc.gov) clarification should you find the published guidance contradictory.

Adam Kraut, Esq., a pro-gun attorney and regular contributor to The Gun Collective has an entertaining video explaining this at goo.gl/nxr3t0. Further, he maintains a blog about legal issues concerning gun owners, dealers, and gunsmiths at goo.gl/bKNBFv. The NSSF is supporting legislation to remove the new ITAR interpretation for gunsmiths at goo.gl/1lqCl5. In the meantime, call your U. S. Representative and Senators and email them (house.gov/representatives/find) urging them to support Rep.

Collin Peterson's Resolution (H. Res. 829) demanding completion and publication of the proposed rules to transfer the licensing of commercial and sporting firearms and ammunition products to the Department of Commerce which doesn't require registration or payment of a fee. Herbal Root, London Guns, And Hue Shawn Mc Williams points out that gunsmiths, painters, furniture makers all have used the same techniques. You got that right.

No one has stated this before, unless it was in the Stains and Finishes book The Mad Monk and I wrote over ten years ago. Yep, it's now out of print. I used Pilkington's stain, which I think was called English Red. I stained a stock with it and it came out a nice reddish color, but faded over time, even in my safe. I doubt it was

alkanet. Reds are fugitive. Over twenty-five years ago, I stained paper with alkanet and let it sit in the window and it turned to gray within two weeks.

I did stain a plaingrained walnut stock with a ETOHbased leather stain a few years ago. While I can't remember the name of the stain, but it has not only failed to fade, it may be a bit too reddish or oxblood in color. Venice turpentine is not something I have played with but I have made a true lead-based linseed oil which is not available today. I don't know which dryer metals are used now but it certainly isn't red lead oxide. I may be manganese dioxide.

Linspeed sucks, as do most "boiled" oils, which never really dry and definitely do not dry hard. And, you are right, the oil doesn't boil. If you look at original PA rifles, the finish is black, unless it has been skinned. The black is a reaction between the lead and sulfur in the air to produce lead sulfide, which is black. That is the reason most flintlock rifles that have been skinned show black curl, which is the porous wood. I made a horn in 1990 and put a geometric design on the butt plug.

Having used a lead-based oil, you now can't see the design as the plug has turned black. Sounds like you have somewhat of a chemical background when you wrote about solvents. English Best Guns were sent back every so often to be reconditioned, which means the stock was finished again so, you might not see that black color on the stock. My guess is that the makers didn't use a lead-based oil, probably Venice turpentine instead. I don't know how hard that dries, but a good lead-based linseed oil dries very hard.

If interested, I have a "quick and dirty" method of making a true leadbased linseed oil. However, it really isn't all that quick.

With the knowledge that I think you have, you will understand how I made it. Bill Mende Author Shawn Mc Williams responds. Thanks for the interesting info. I will definitely read more on lead-based materials. Venice doesn't dry hard and the key with it is to use incredibly small amounts. Although it may improve gloss and flow, it too is soft.

The most challenging thing for all this is getting the ratios right because there is so very little information about the topic. The varnish blend I have is hard and really made for the alkanet. As aside note, I mention in the article about alkanet being ared oil The reason is because alkanet in its pure state is red but if it's mixed with linseed oil it is actually purple. Joe Carlos Articles MSG Carlos, it is good to know you are still around and making contributions to shooting issues.

I really enjoy American Gunsmith and think your articles alone are worth the price of the subscription. The days we worked together training, retraining, and deploying Reserve and Guard soldiers were really good times. CW4 Roy W. Plumlee (ret.) Author Joe Carlos responds. Thanks a million! Comments like yours are worth way more than the pay for the very long hours spent writing.

Although I have been associated with Stoner Platform rifles for nearly 50 years now a lot of my research was conducted in the decade plus when I was the Armorer for the All Army Reserve Shooting Team. Taxpayers funded many of my studies and my articles area way of paying some of that back. If we gunsmiths continue to build these rifles the same way we did 50 years ago in Stoner's day, they will shoot little better than ARs did back

READER FORUM CONTINUED

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then. So much of my research has been centered on ways to make the guns shoot better at an affordable cost. Accuracy problems I have a Browning A-Bolt chambered in .300 Winchester Magnum. I handload various 165 to 180 grain bullets from Hornady, Sierra, and Nosler with several propellants as recommended in load data published by these companies. The rifle was bought used and I found it had screws loose with a bore badly fouled with copper but these problems have been fixed.

Using a Lead Sled on a bench, the best accuracy I've obtained is 3.5 inches at 100 yards. I checked my overall cartridge length is 3.433 and it fits in the chamber. Some manuals list this as a maximum length of 3.340 and this particular magazine fits a maximum length of 3.390. What do you recommend as the next step? First, contact S. A. A. M.

I. for a double check on specifications for the .300 Winchester Magnum chamber and overall cartridge 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 length. Secondly, you mention loose screws. Were/are they closely related to the action? We have two suggestions. One possible fix is pillar bedding.

The other, and perhaps the best when it comes to firming things up, is bedding the action after reading up on the pros and cons of floating barrels. We know that in some installations the barrel only floats for a few inches in front of the receiver. In others the tube floats to within 8 or 10 inches of the muzzle. In both cases a means, usually a nylon screw, is installed on each side of or below the muzzle itself for making final and fine adjustments. Brake Cleaner?

What's your opinion on using brake cleaner to clean out a barrel to get the heavy stuff out? Don Waldron Author Joe Carlos responds. I have used aerosol brake cleaner with an AR chamber brush to clean my chambers at the

end of my cleaning session. I have never heard of anyone using brake cleaner to remove fouling from the bore. For the bore I recommend standard Hoppe's No. 9 first on a brush to remove the carbon. Then I John Klee follow that with Hoppe's Bench Rest to get the copper.

Of course, always use a quality bore guide when using a cleaning rod. Note, using brake cleaner on the chamber before getting all the copper out with Bench Rest will often "kill" the copper solvent and prevent removal of all the copper. Only use brake cleaner at the very end of the cleaning session. Also, never mix bore solvents by different manufacturers. Doing so may cause an unwanted chemical reaction which can ruin gun barrels. In the example above, I followed one Hoppe's product with another.

That is fine, but don't follow a Hoppe's solvent with another by a different company. You can generally use an abrasive such as J-B Bore Cleaning Compound with most any solvent as they don't clean with chemicals. I go into further detail in "AR-15 Bore Cleaning" in the January 2015 issue. Walther P38 A customer brought in a Walther P38 (9mm P1 stamped 4/64) with an issue concerning the hammer not falling when the hammer is cocked and the safety put on.

Obviously, the hammer should fall and I ordered anew uncocking piece (part number 11037 from Jack First Gunshop) that is called the Safety Hammer Lowering Lever on some military models. If I pull the hammer back I can put the safety on but I'm having trouble with fitting and getting full function. Walther was no help. Any advice? Henry Penedo Gretna Gun Works Postwar Walther P-series pistols had slight design differences from earlier models. As a result, not all parts are interchangeable.

Be certain the part you purchased is intended for later Walther P-series pistols. You can find very detailed take down/ reassembly instructions in The Gun Digest Book of Automatic Pistols Assembly/Disassembly. AG

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