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PRECISION ARMS WORKSHOP

AND THE AMERICAN GUNSMITH ARCHIVE

A TECHNICAL JOURNAL OF CRAFT, REPAIR & RESTORATION

07

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INSIDE THE ARCHIVE

BARRELS FOR CUSTOM AR- 15S, PART 1

SPECIAL OPS • REFINISHING FINE STOCKS • 1871 VETTERLI CONVERSION • H&R 922 TRIGGER ADJUSTMENT

ORIGINAL METHODS. MODERN ACCESS.

ARCHIVE EDITION 163

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HISTORY

Special Ops

BY AMERICAN GUNSMITH EDITORS JULY 2017

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US Special Ops by Fred Pushies covers the history, weapons, and missions of elite military forces. It's an broad overview of military special operations in the United States, from weapons, gear, missions, and the troops. It's a topic that's often of interest among firearm enthusiasts.

Due to their clandestine nature, these elite forces are cloaked in an aura of intrigue that has only ratcheted upward with the expanded roles they have assumed in today's world, not to mention their recent and frequent appearances in film, books, and other mass media. Special Ops This book covers the scope of America's elite fighting forces.

Profiles of hundreds of weapons, gear, vehicles, missions, and commandos, from eighteenth-century fighters like Francis Marion right up through the most advanced capabilities of today's Green Berets, Rangers, SEALs, Marine Force Recon, US Air Force combat controllers, CIA Special Activities Division, and more. Over 350 entries in all, from the tomahawks used by Rogers's Rangers to Col.

Aaron Bank to Operation Neptune Spear and beyond, US Special Ops is a comprehensive and informative survey of US special operations, past and present. Despite the mystique, there is no magic inherent in special operations. It's a collection of studied and evolved tactics and training procedures of very human personnel willing to undergo the rigors. Given the amount of attention and interest among so many gun owners, it's likely a topic that will arise in your shop.

Having a knowledgeable overview may be helpful in lieu of fanciful tales. The Suomi Submachine Gun by Leroy Thompson is more focused, covering primary weapons development in Finland in the World War Two era. As the title suggests, the Suomi is featured but this is more than a book about subgun. Other designs by the Finns in this period are covered, such as the Lahti-Saloranta m/26, was well as history of the Winter War, Continuation War, and Lapland War with notes on Finnish tactics of the time.

Featuring first hand accounts and specially commissioned color artwork, this is the story of one of WWII's most distinctive and respected infantry weapons. Initially used by the Finns as a light machine gun, it eventually became a dedicated submachine gun, and even pressed into the role of a sniping weapon.

ORIGINAL SOURCE PAGE

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RIFLES

Refinishing Fine Stocks

Refinishing Fine Stocks A detailed approach to handling and refurbishing vintage gun stocks to their original luster.

BY RAY ORDORICA JULY 2017

ORIGINAL PP. 3-8

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Many an old rifle or shotgun has splendid wood hidden under a collection of vast amounts of crud accumulated over the years. If you can recognize a jewel within the stock wood under all those signs of age, you might want to consider refinishing it. So you grab your paint remover, your belt sander or maybe an orbital, chuck the stock in a vise and have at it. Most likely the result of such treatment will be clean wood with absolutely none of the original quality of the stock's shape or nicer attributes remaining.

I'm sure you, like I, have seen plenty of examples of this sort of thing over the years. Let's say your great uncle left you a fine old shotgun with sound metal but with a thick coating of varnish on top of layers of lacquer with some questionable oil, wax, and what-have-you sprayed, brushed, or slathered onto the wood along the way. If you could make the wood look great the whole gun would then look great. How do you do it?

I've refinished many dozens of gunstocks over many years, and these include extremely costly double rifles, fine British shotguns, excellent-quality bolt-action rifles, and quite a few The biggest change is in the much-increased contrast to the wood grain. relatively common firearms. Many times I've tried to write up how I do a stock

finish but have always been stymied, because on each different stock I end up doing whatever it takes to get the right result. That seems to change with every stock.

However, I'm finally going to try to explain here at least some of my basic procedure so others might benefit from my long experience. If you have doubts as to my abilities, there's a photo of me refinishing my \$40,000 Churchill double .470 in my book, *The Alaskan Retreater's Notebook*. There's also a photo of me in that book refinishing a low-cost .22 target rifle with a birch stock. Been there, done that. First, some advice: Don't use ANY power tools to refinish a fine gunstock!

In fact, don't use power tools on any gunstock, not ever! Hand work is all that's needed and it's not hard work. More advice is to picture the gun with a glossy, like-new stock wrapped around ancient, rusty, pitted metal with little or no bluing remaining. Is it time to redo the metal? Or maybe you could just tone down the gloss of your new stock-finish job to make the gun look somewhat more harmonious.

Or maybe just leave the whole thing alone and cherish the patina of age the old gun has honestly acquired over time. The Gun I recently sent a bunch of fine old guns to a major auction house to raise money for a big personal project. I nearly sent along a

fine old Westley Richards 10-bore double gun with Damascus barrels. However, I'm very fond of the old Westley, so at the last minute I decided to hold it back. Westley Richards' records informed me this gun was made in 1880.

I've owned this bundook for more than 20 years. It fits me like it was made for me and I've shot it extensively at clay birds. I've never missed a clay bird with its right barrel. One day I took it to a Cowboy Action match and the grand old lady stole the show. Every shooter there gave her a good, close look and cheered when she mowed down three iron targets with one shot.

I had the old brown barrels refinished by Keith Kearcher, who did a superb job, as he did on several other Damascus barrels on British firearms of mine. The bores are clean and nice and the gun throws exceptional patterns. I'm all set up to reload for it so, except that I currently have no use for it, there was no good reason to let it go. The only flaw in the gun is that its stock was refinished long ago by someone who didn't really know what he was doing and I've never been happy about that.

The flats on the stock behind the action should have had sharp edges but have rounded into something ugly. The grain was hidden by what looked to be heavy varnish but which was probably

REFINISHING FINE STOCKS CONTINUED

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Top He's used it for over 40 years to refinish gun stocks. The two on the right are cabinet scrapers that might be better if you learn how to use them. Bottom This throws up burrs that do the actual work. some sort of old, yellowed, quicktype "oil finish." It came off more easily than varnish. The butt stock should have had straight lines and been sleek. Instead, it bulged.

The odd-shaped silver oval inletted into the stock stood proud of the wood by a sixteenth of an inch or more, just one more thing that wasn't right. Old British guns require extensive knowledge about their woodwork—how small details, Lots to go. lines, flats, etc. should look—in order to be able to do a proper job of refinishing. I happen to have some of that knowledge, hard won, and decided to put it to use on my Westley. It turned out to be necessary to remove the stock from the action.

Most refinish jobs are going to require that as some areas can't be accessed unless you remove the metal from the wood. The incredibly simple Anson & Deeley action came easily out of the wood with the careful removal of a few screws. Note that British gun screws generally require thin blades on the screw-

drivers. The Tools The next thing to do was to attack the old finish with a suitable scraper. I used the same scraper I started with over 40 years ago.

It's basically a thick putty knife with metal 0.040inch thick and a straight edge some three inches long at the bottom. I put cutting edges on the putty knife by securing it in a vise and pulling a file flat along the bottom edge, which throws up a burr on each side of the blade. This burr is what does the work. I have used this tool to remove a great many finishes.

More than 40 years ago I used this tool to remove the epoxy finish from a German Weatherby and more recently did the same thing to the epoxy on my CZ 375. Both rifles had fabulous wood beneath the epoxy finishes that hid much of their beauty. With the epoxy off, some linseed oil could soak into these stocks and emphasize the grain. The result in both cases was glowing wood. So yes, this simple scraper, or something similar, is where to start.

You might want to try curved cabinet scrapers, available on e Bay from many sources. I have a pair that I use to improve vi-

olins by scraping their inner wood but prefer the straight, flat edge of my old putty knife over the odd curves of the cabinet tools when doing a gun stock. I know exactly what that straight, flat scraper will do but am unsure about the curved ones. It's your choice. If I had as much time in on the cabinet scrapers I think I'd prefer them to the flat cutting edge of my old favorite tool.

Grab the scraper, press it gently against the stock and have at it, removing the old finish a line at a time. Avoid digging into the wood. I pull the scraper toward me, always going with the wood grain. A gunstock is curved almost everywhere, so as you scrape you'll be making tiny flats with a straight-edged scraper. To some extent you can pull the scraper at an angle across the stock, somewhat across the grain, and get rid of most of the stripes you've made.

If your stock has flutes next to the pistol grip you'll use just a tiny part of the scraper and pull it only about an eighth of an inch with each stroke. Convex surfaces require lots of small scrapes. You'll end up sanding the wood anyway, so don't fret.

REFINISHING FINE STOCKS CONTINUED

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You'll still have to clean up the checkering but don't make work for yourself. I have found the use of a scraper to be the fastest, most controllable way of removing old stock finish. You'll quickly learn to control it. I used my old putty knife on one of my violins that had a horrid pebbly finish all over and just that scraper got it down to nearly bare wood with no damage to the thin surfaces.

The Technique I got all the old finish off my Westley in a day's scraping, just having fun with it and not slaving over the job. The scraper can also remove wood. With it I was able to remove the worst of the bulge from the right side of the butt stock and was able to once again give the flats behind the action the sharp edges that should have been there. Try not to dig into the checkering with the scraper. Scrape up to the checkering but not over it.

You'll probably have to sharpen up the diamonds to get rid of the old finish, but you really don't want to cut all new checkering. Cleaning up old checkering is one heck of a lot easier than doing it all brand new, I promise you. With all the old finish off, the next

task is to sand it. Some caution is advisable here. One of the quickest ways to destroy a gunstock is to round edges that are supposed to be sharp. The front of the stock mates with the back of the action.

If I round off the edge at the very front of the stock the effect is a huge gouge, or "hog wallow" as Elmer Keith used to call it, where the wood dips in behind the metal instead of flowing into it. The use of hard-wood backers to the sandpaper and some careful thought how to proceed will help keep things sharp where they need to be. The butt plate on my old Westley is horn, not hard rubber. As such it's subject to cracking. This butt plate is at least 137 years old, so I treated it with caution.

If your gun has old horn like this, be careful! When I took the butt plate off to redo the bugged screws that held it, the plate relaxed slightly into an arch that no longer matched the wood. My solution was to recut the curvature of the wood to match the That's not right. Unfortunately that job also took the wood slightly below the surface of the matching metal. One has to live with

that. Don't make it worse. horn, not try to straighten the horn. This was easily done with a sanding wheel on my Dremel.

Yes, I have a variable-speed Dremel that qualifies me to call myself a master gunsmith. Humor aside, I turned the speed down to avoid overdoing the job. Most of the wood came off the outer edge of the butt wood because the original setup had the central portion of the wood carved out so the plate touched primarily at the edges, not in the middle. The plate was originally held on, or patched sometime later, with what appeared to be gobs of ancient hide glue.

This was a mess and highly toxic as airborne dust, as I found out. It cost me a day in bed. I reinstalled the butt plate before I did my final scraping and sanding so I could match the new clean wood surface to the butt-plate edge. Again my The Westley Anson & Deeley action comes out with the removal of a few screws. Here the top lever is removed. That small screw halfway out lets the locking plate come out. The trigger plate needs to be dropped and then out comes everything.

REFINISHING FINE STOCKS CONTINUED

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scraper did most of the dirty work of blending the two surfaces, and the sandpaper finished it up. I use 220- and then 320- and 400-grit wet-dry type with oak backing or sometimes a felt pad a quarter-inch thick that I got from Brownells many decades ago. Here and there my thumb was the ideal backing. You might want to go to 600-grit paper and I have no argument with that. Careful and thorough sanding is good insurance against seeing sanding marks after you make the stock really shiny.

Just be sure the wood is as smooth as you want it before you apply any finish. I have left off the task of whiskering. In my experience ancient gunstocks don't require it. But if you must do this, understand it'll open up the grain considerably and require lots more work to fill the pores. The whiskering process is simple: Dampen the stock wood with a wet paper towel and dry it quickly over heat, such as a red-hot stove burner.

This raises the grain, which you then have to cut off with either fine steel wool or fresh fine sandpaper. Do it several times until the grain no longer raises. Use the wet-dry paper dry. The Finish With the wood scraped, smoothed, sanded and, if desired, whiskered,

be sure to wipe everything off with clean, dry paper towels or a soft cloth. The first thing I put onto the wood is something called alkanet root oil. You can The checkering will have to be cleaned up later, after finishing.

The butt plate was replaced before the scraping was done. Here a file is laid on top showing the gaps at front and back. More work with the scraper removed most of this, giving a better-looking stock. make your own and several sources online tell you how. Basically it's alkanet root powder in something like linseed oil with a bit of turpentine. I had some remaining from a Purdey Warthog Kit I bought some time back. This alkanet oil darkens and slightly reddens the wood.

To me that's what was needed on this old Westley. Wipe on a good coat, rub it in somewhat, let it sit a few hours, and if needed, do it again until it looks right to you. Be sure to wipe off any excess oil. Your stock will undoubtedly have some slight bits of open grain, though the original finish will still be filling some of the pores to some extent. If you were gentle and didn't dig into the wood, a lot of that "filler" will remain. But you'll really want to fill all the pores.

There are several ways to deal with that. The easiest is to "... fergit filling the pores and jes' rub oil on it" and no one will ever complain about it. At least not to your face. A better way, sometimes used by master The post protruding from the wood is an ancient patch when the lower retaining screw was moved even lower. This was a clever way to patch a hole in the horn plate.

Author found it necessary to recontour the wood slightly to match the stress-relieved plate. stock maker Al Linden, is to fill the pores with varnish. Top-quality spar varnish, specifically. But if you're going to do that I recommend holding off until you get the alkanet oil and some linseed oil into the wood first. What kind of linseed oil? I've used the stuff you can buy by the gallon at your hardware store sold as Boiled Linseed Oil. I've also used "artist's quality" linseed oil and it's lovely.

Dries a lot faster than normal oil. I've also heated common "boiled" linseed oil for extended periods of time when I used to heat the oil instead of the stock to apply it and it turned into something better than what came out of the gallon can. Author used 220 through 400 grit paper.

REFINISHING FINE STOCKS CONTINUED

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This can be removed to some extent with careful application of heat and paper towels to soak out the oil. It's a good idea to then put on a coat of shellac to the inside wood surfaces to help avoid later soaking-in of oil.

It brings out the grain and imparts a rich slightly reddish stain to the wood. To get linseed oil into the stock is to get some oil on a wad of paper towel, turn on the electric stove's biggest burner to full strength, heat the stock wood carefully above the burner, and then wipe the oil onto the hot wood. Repeat this carefully so as not to set the oil or wood on fire. Don't drip the oil onto the hot burner. Don't scorch the sharp edges of the stock because the burn marks won't come off.

Wipe more oil onto the hot wood, repeating until the stock doesn't seem to want any more oil. Thoroughly wipe off all remaining oil with clean, dry paper towels, rubbing hard. You don't want the oil. It's time to put oil into the wood. In years past he heated the oil too, but that's somewhat risky. Give the stock all it'll take, wipe it dry, and repeat after giving it time to soak in. It's possible to fill the grain with this technique.

Rottenstone works too, as does good spar varnish. On the wood, you want it IN the wood. By the way, this is how wood golf-club

drivers were treated long ago, or so I'm told. I have a Jack Nicklaus driver that I did this to and it improved the club in looks, hardness and avoidance of cracking. Do the linseed oil treatment several days in a row, or you could let it dry for several days to a week between sessions, and then do it again.

After awhile you may want to cut the residual oil down to the bare wood and you'll find the pores are largely filled with linseed oil. If you have a gas stove the same technique can be used but you'll probably burn the wood or set the linseed oil on fire before your job is done. I've done this task on gas stoves but you have to be careful to never get the oily rag near the flame nor let the oil drip onto the flame. I recommend only the use of an electric range or some similar source of dry, safe heat.

Getting back to Al Linden, if you want to fill the pores with varnish, then as soon as the wood looks nearly as dark as you want it from hot linseed oil and/or alkanet root oil, apply a coat of best-quality spar varnish. Linden recommended many thin coats, but I've found one unthinned coat does the job nicely. This will blend to some extent with the linseed oil, so you don't have to wait months for the oil to dry before using varnish.

When the varnish is thoroughly dry, sand it down to the bare wood and the pores will be essentially fully filled. I've used varnish just one time, on my .338 OKH, and that was over 40 years ago. The rifle spent lots of time in extreme cold in Alaska and I took it to Africa in 1995. That stock still looks wonderful. The finish has stood up, the pores are filled, and I think that finish is a bit harder and more durable than just plain oil.

If you use varnish to fill the pores, once they are filled to your satisfaction go back to the linseed oil applied hot. I'll bet you won't need many coats to get a fine finish. The ancient time-tried method of keeping an oil-finished stock in good shape was to occasionally put a little linseed oil onto the stock and rub it into the wood with your (well washed) bare hand until the stock gets hot from friction.

Long ago, I watched Alaskan master guide Andy Runyan rub linseed oil by hand all one evening onto one of his favorite rifle stocks. I used to do that too. That's still an accepted way to do annual maintenance on an oil finish, but my hands can't take it any more, having been mistreated with linseed oil, various thinners, gasoline, motor oil and grease, photo-dark-room chemi-

REFINISHING FINE STOCKS CONTINUED

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338 OKH (.338-06) Mauser over 40 years ago. It still looks fabulous and has no open grain, despite years of extreme cold and intense heat. The checkering had been stained dark and that made a hard job harder. A simple tool is all that's needed along with a toothbrush to remove the dust. Forty years of practice and the patience of Job help. cals, extreme cold, and other nasty crap for many long years. Today I use nitrile gloves and a paper towel.

I applied two coats of Purdey's alkanet root oil and four of linseed oil to the Westley. The wood is darker now, a pleasant change from the awful finish it sported when I got it. The grain shows more contrast, thanks to the alkanet oil. With that done, I needed to fill the pores. There are several ways to do that and I already mentioned varnish. Do not use commercial wood filler on a fine gunstock. One old method of stock finishing and pore filling is still commonly used. It involves what's called slackum oil.

This is a compound that consists largely Here's how the top lever looks after the author's rust-bluing, the only type of bluing proper for such a classic old shotgun. of linseed oil with various driers and some wax added. Formerly available in the discontinued

Purdey's Warthog stock-finish package, today you'll have to make your own. Find recipes for it online. Basically this stuff is wiped on, allowed to get tacky, then rubbed off with linseed or other rubbing oil and wiped dry.

This leaves some of the sticky slackum in the unfilled pores. The next step is to anoint the wood with rottenstone. Wipe a small amount on evenly with your hand and then rub or polish the stock with a soft cloth. The rottenstone sticks in the pores and eventually fills them as you repeat the process of applying slackum oil, rubbing it off, applying rottenstone, and final polishing. The result is lovely, and gives you a shine James Purdey would be proud of.

If you don't have, or don't want to make, slackum oil, you can let the stock with its hot-applied linseed oil sit for while, up to a day (be sure to wipe it completely dry before you let it sit.) Apply rottenstone sparingly, wipe it onto the stock evenly with your hand, and then polish the stock with a soft cloth. As with slackum oil this has the effect of filling the pores and imparting a shine. You might experiment with rottenstone and linseed oil together, which I've tried but can't say I loved the result.

It did seem to fill the pores quickly. The stock is done when you say it is. You can make it shine so as to knock your eyes out from glare, if you so choose. If you want to leave some pores not quite filled, no one will notice. If the finish gets too shiny, try rubbing it with Bon Ami cleaning powder. That'll cut it down to a dull finish. If you don't like that result, make it shine again with linseed oil and rottenstone as detailed above.

When I decided the finish was done to my satisfaction on my old Westley, three tasks remained. They were to recut the checkering, which I did, and that was agony because some dolt stained the old checkering and I had to dig it all out. Then I rust-blued the top lever, bottom plate, and trigger guard. The third task remains, which is to engrave my monogram into the silver shield on the stock. Then the grand old girl will be ready for several more centuries of reliable and good-looking use. How to recut checkering?

It takes a couple simple tools. If you want to checker your gun when it never had any, you'll need one more tool, and you do it after the finish is all done. How do you do it? I'll tell you in a future article. And how do I do rust bluing? We'll think about that. AG

FROM THE ARCHIVE

Barrels For Custom AR-15s, Part 1

Barrels are the foundation rifles are built upon. Due to no fault of the barrel maker, AR-15s often don't deliver their accuracy potential.

BY JOE CARLOS JULY 2017

ORIGINAL PP. 9-14

As a former military armorer and current custom AR-15 gunsmith, the questions I'm most often asked are: How many rounds is my barrel good for before it shoots out? How far should I jump my long range 80 or 90 grain boat tail bullets? What barrel should I buy? I've written dedicated articles for the first two questions. This article answers the last one. Military shooting team armorers and gunsmiths should be able to answer these questions and have data to back it up.

Even if that answer is, "Barrel wear is extremely variable and no one can accurately predict wear out," which is the only correct answer to Question #1. Most team armorers have machine rests and other equipment available to test barrels without the influence of human error that is inevitably involved with shooting from bench rests and other methods, so they should have answers with data. Shooting teams go through barrels and ammunition in great volumes with captive, skilled marksmen disciplined in recording data.

If armorers are doing their jobs, they darn well better be asking often! Active duty teams can be more regimented, with leadership able to check things daily. Reserve teams lack this daily contact but still able to glean much more data and experience than civilian gunsmiths. Most civilian gunsmiths are "general purpose" and work on a variety of firearms. My hat is off to you guys as your range of knowledge is amazing!

However, this can't create the depth of knowledge that a team armorer can acquire on a specific platform, monitoring hundreds of guns shot by dozens of highly skilled shooters over the course of many years. The "general purpose" gunsmith will likely have a more limited, part-time exposure to any particular gun.

Having written exclusively on AR-15 topics in this magazine for several years now, I get a fair number of questions and it seems many gunsmiths only see a customer's AR-15 rifle anywhere from once a month to once every year or so. As a rule, general gunsmiths only see "sick" ARs so their opinions can be skewed accordingly.

There are a handful of us specializing in the Stoner platform and those that do may rival the full-time military gunsmiths in volume of output but our customer bases are scattered so we usually have limited feedback. Once the gun is put on the truck we may never hear from that customer again until his barrel shoots out or a problem crops up. Email helps, but feedback is still limited compared to team armorers. There are two general types of custom AR shops.

One caters to the growing "tactical" clientele and the other to National Match Course competitors. The tactical shops are more into fancy handguards with rails, flat tops with all sorts of electronic sights and fold down iron sight backups, muzzle compensators, bipods, fluted barrels, etc. I believe "cool factor" cosmetics are stressed

more on those builds. Despite sometimes lavish claims from tactical builders, NMC builders probably stress accuracy more.

It is not uncommon for NMC custom shops to offer two general barrel grades with a low cost (usually button rifled) and a higher priced (frequently single point cut rifled) option. I don't know of any shop stocking all of the many brands of custom barrels on the market. Of the dedicated NMC custom shops, it's common to offer either Douglas or Wilson for low cost barrel choices. Although the Wilson usually runs less money, my tests show the Douglas normally shoots tighter groups and last a bit longer.

Those custom shops offering a premium barrel option typically choose Krieger. Few custom shops, tactical or NMC, have machine rests to objectively test and compare barrels for accuracy. Testing guns takes time away from filling orders and building guns. Gun writers occasionally have useful information on the Black Rifle. Most fall into two camps, much like gunsmiths.

There are more guys that are general purpose, writing about concealed carry handguns one month, African elephant rifles the next, and shotguns for grouse in the next issue. Since those authors don't specialize they know a little about a wide variety of guns but don't have in-depth knowledge. "General gunwriters" tend to rely a lot on literature searches and sometimes their articles read like parrots rehashing what other writers said before them. Unfortunately, most folks don't have the time, resources,

BARRELS FOR CUSTOM AR-15S, PART 1 CONTINUED

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Top to bottom, Les Baer, JP Enterprises, and Young Manufacturing. and money necessary to do real field research. This often results in “Encyclopedic Error” where something never proven by any valid research is just repeated so many times that it becomes accepted as true. If a guy is routinely writing about various firearms, how many AR rifle barrels could he possibly test at length?

Most of these scribes must be awfully good shots, given the photographed test groups, yet seem absent from formal competition where this skill can be measured. General gun Doing so ruins accuracy and can dangerously increase pressure, resulting in blown primers. writers are forced to accept anecdotal stories and the item featured in the next issue becomes the “flavor of the month” even though the writer could never test enough to make statistically valid assumptions or conclusions.

Of writers dedicated to the AR-15, Derrick Martin’s *The Complete Guide To AR-15 Accuracy* is excellent, as is Glen Zediker’s

The Competitive AR15 and *The Competitive AR15 Builders Guide*. Both discussed barrel choices in their books. You will find the three of us in general agreement on most topics most of the time. This is not because we re-hash what the others have written. Derrick and I were military team armorers and competitors in addition to serving in combat.

All three of us have conducted valid research with many test rifles over along period. The conclusions are right regardless the researcher that reached it. Finally, the barrel makers are obviously an ideal source of information on this. These guys do this every day for a living. Of course, all of them will insist their particular barrels are best, however, you can harvest a great deal of useful information from them. Just remember that making barrels is very different from testing them.

Mystery Barrel Saga As I’ve discussed before, the first steps I took as armorer for the Army Reserve Marksmanship Program was machine rest testing all of the team’s NMC uppers. It was obvious they had a hodgepodge

of barrels from different makers, many of them unmarked. The uppers had been built and serviced by armorers from a different, competing team. I inherited no spare parts or barrels, initially had no purchase budget, and knew we needed new barrels when we did.

Test data was kept on serial numbered uppers so as to identify barrel brands shooting the best. I figured I had the makings of a pretty good start on a barrel study if I could simply link the barrel manufacturers to the groups. I asked the original builders which barrel brands were used and was told they kept no such records. I named them “mystery barrels.” This lack of record keeping was the beginning of a huge wake up call for me.

As I asked around, I found other team armorers would often use whatever was available. Most of them were experimenting around with about four different brands with little overlap with one exception. Krieger was the one brand used by almost every team.

BARRELS FOR CUSTOM AR-15S, PART 1 CONTINUED

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Initially, I was flabbergasted that teams could have been in business so long and not know what barrels shot best. Poor record keeping was obviously part of the problem. Then I thought about my own military education. While the military does a good job with simple instructions ("Front Toward Enemy" on a M18 Claymore mine, for example) troops rarely learn statistics or how to set up scientific studies, the sort of approach needed to evaluate barrel accuracy. My degree from Penn State is in Wildlife Management.

I never took a college course on how to evaluate barrel accuracy, but did take courses in statistics, biometrics, and how to set up a study. The math, research, and science skills needed to manage a deer herd are similar to those needed to evaluate rifle barrel accuracy. As Abby Sciuto famously said, "Science is poetry; it's about making order from chaos." Paradigm Shift Risk Is Our Business, the title of Star Trek's James T. Kirk's autobiography, sums it up.

I knew that deciding the Army Reserve Marksmanship Program should begin from Square One and be the lead on unraveling the

barrel accuracy mystery which others with more resources had failed to discover had us embarking on a paradigm shift. The USAR Team, the "Damn Dumb Reserves," had always been followers. Our defeatist attitude had always been, "Let the big active duty teams figure it out and we will copy them." While a "wait and see" attitude is safe, it created a huge lag.

Not only was there the expected delay in waiting on others to conduct research, there was deliberate lag in that information trickling down to competing teams. If you were in charge of a competing team, would you be anxious to release information to other teams that would put them on a level playing field with you? Or would you tend to hold that information closer to keep any equipment advantage in your corner? It was obvious to me that other members of reserve component teams were also dissatisfied.

In "AR- 15 Sub-Caliber Training" (October 2015) I mentioned that reserve training centers used to have basement ranges for rimfire shooting, such as the M261 .22LR conversion for the M16. While a great idea, this was of-

ten under utilized. A group of Army Reserve marksmen assigned to the Small Arms Readiness Group at Fort Gillem, Georgia updated this idea through the 1990s with the Laser Marksmanship Training System, replacing the M261 with a laser simulator.

These same SARG folks stepped forward to train troops for deployments in Bosnia and Kosovo and then again to Iraq and Afghanistan. In addition to developing an inexpensive simulator suitable for reservists and conducting training for issue small arms and accessories at Power Projection Platforms for all deploying personnel, team shooters reinvigorated use of the M14 when it was identified as useful for longer range engagements.

These deployments revealed that most military personnel are not as proficient in marksmanship as needed. An idea labeled Squad Designated Marksmen was implemented as a partial solution by having at least one member of a squad trained to a greater degree of marksmanship proficiency. Especially with an optically-sighted M16A4 or similar, this person could

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Ultra sonic gun cleaners help clean the carrier assembly and chamber brushes. shoot well past typical qualification distance and cover a previously requiring a school-trained sniper or support weapons. My reason for digressing is that knowledgeable taxpayers should have some say in how government spends your money. Atop-notch marksmanship program, along with all its members, competitions, and the classes they teach, can be well funded for the price of one cruise missile.

SARG was disbanded shortly after the mass mobilizations greatly slowed, so the handwriting is clearly on the wall. Our leadership is already forgetting lessons learned in the Gulf and deemphasizing marksmanship in our military again. Sadly, if the bean counters ever end up abolishing shooting teams there will be no one with the needed skills to get your sons and daughters up to the necessary marksmanship level needed to save their lives in combat.

However, continued effort by shooting teams—especially between deployments—helps keep this knowledge alive and growing. Conduct Of Testing When I finally had budget money to start buying gun barrels to test, I recalled a urban legend that was sometimes repeated during that time.

Supposedly, some successful shooter (I don't remember if his discipline was ever identified in the story) would purchase ten gun barrels for his rifle from an inexpensive

barrel maker, test all of them, keep the best two, and sell off the other eight at a slight loss. As reported, his theory was this would more likely find a great barrel instead of paying double for a premium barrel and taking his chances.

I can't confirm if there is any truth to this, but it's plausible due to the relative ease of installing and removing AR barrels. In testing I also stuck with the ten barrel minimum, not because of the urban legend but because statisticians say a sample size of ten is about minimum to have any validity. In purchasing from companies offering both stainless and chromemoly I bought half in each. At the time, stainless was being hyped up in the shooting press but I wanted to leave no stone unturned.

This ended up being a good thing. Upon receipt, I broke the barrels in as described in "Gas Gun Barrel Break-In" (October 2014), then built a temporary gun using the same A2 upper, match bolt carrier, and front sight housing and gas tube. The barrels were threaded for a flash suppressor and timed to 6 o'clock with three footpounds of torque. Torque on the barrel nut was set at 47 ft-lbs. and all the guns were tested in a machine rest with ten-shot groups with the same three lots of ammo.

In addition to keeping the targets, I entered the data in an Excel spread sheet that automatically summed and averaged the group sizes for each ammo lot. That made it ef-

fortless to see if a given barrel was shooting average, tighter, or larger compared to other barrel brands. The same lower receiver was used with a fresh, tight-fitting Accu-Wedge in place. No test firing was conducted if there was wind. All barrels had Wylde chambers.

In trying to test all of the custom barrels on the market, it took about a decade to complete this study. This wasn't due to the testing time (although there was no small amount of work as you can easily imagine) but due to budget. Compared to the big active duty shooting teams, the Army Reserve is always the poor kid on the block. If I had the budget, I could have purchased hundreds of gun barrels and completed the entire study in a year or two.

Instead, I bought barrels in the appropriate numbers to replace shot out ones as they cycled into my shop. There wasn't one added penny to the cost of the study as I used the tested barrels to replace shot out ones that would have to be replaced regardless. I simply kept meticulous records during the entire period and analyzed at the end. I still use this same basic technique to break in and pre-test the barrels I offer for sale today.

I run a shop at Camp Perry each year (Building 910-A on Commercial Row) during the CMP National Service Rifle Championships and have a table full of barrels with a test data

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and targets fired on the machine rest for every one. My customers can go through my book and pick their barrel. The price includes installation and load work up. I test my complete uppers the same way and includes a box of long range ammunition with 80 or 90 grain bullets tuned to the barrel. This takes the guess work out of the purchasing equation that others in the business don't offer.

Some barrel companies also attempt to "grade" their barrels but they do so based on techniques such as air gauging, not actual test firing in a machine rest. I am not saying that gauging won't help predict a good barrel but, like peering in a bore scope until you're bleary eyed, there is no substitute for actual range fire testing. I believe I am the only custom builder in the country offering this service.

I read advertisements of "guaranteed" grandiose accuracy claims but test targets backing this up are nowhere to be found.

When impartial testers shoot many of these guns, they often report disappointment—unless it's a gunwriter that never seems to shoot a group bigger than one Mo A. I have machine rest tested many hundreds of barrels and uppers and know those shooting the one Mo A and above far outnumber those that are under—at least when kept honest and using more statistically-valid ten-round groups.

I completely discount three-round groups and hold five-round groups as highly suspect. A tester discounting fliers from the test forget these will also happen during real shooting. A tight, 1/2 Mo A eight-round with two fliers that take it out to well over a minute is not an honest sub-minute group! "Good Enough" Accuracy In National Match Course competition, the Army Marksmanship Unit is the force to be reckoned with.

They have a record of consistent wins like no other military or civilian shooting team on the circuit. When I was with the Reserve Team, the AMU had a contractor whose job was to conduct machine rest testing. I got to know him as he was a fellow Viet Nam vet. I asked him what their acceptance criteria for NMC AR-15 accuracy was and he said a gun shooting one Mo A was passed. Given the bold accuracy claims of some civilian builders, the AMU's requirement seems modest.

However, as discussed, consider how such testing is conducted. NMC competition targets have ten rings a full 2 Mo A in size. An accomplished marksman with an honest one Mo A rifle leaves a full minute of shooting error for perfect scores. The AMU trains five days a week leading up to competitions and their philosophy is to provide good guns and rely on superior application of marksmanship skills in order to win. It is certainly working

BARRELS FOR CUSTOM AR-15S, PART 1 CONTINUED

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for them. It is fair to guess many of their ARs are capable of sub-minute groups. As a civilian gunsmith, your customers likely don't have five days a week to shoot, so it behooves us to build the most accurate guns we can. Analyzing The Results In The Complete Guide To AR-15 Accuracy, Derrick Martin emphasizes there are many good barrel makers in the U. S., but only if properly installed.

After analyzing the voluminous data from my barrel study, I found there are barrels out there not delivering accuracy performance that the factory built into them because of three culprits. The first is the gunsmith. One barrel installation problem is failing to stabilize the barrel extension in the upper receiver, as I discuss in "The Relationship Of Barrel Extension Diameter To Accuracy In The AR-15" (March and April 2013.) Properly done, this can reduce group sizes by about a third.

I also recommend using true match bolt carriers. As reported in "AR-15 Upper Quick Fixes: Match Bolt Carriers" (May 2014) this shows an average improvement in group size of 8.8% from the match carriers with an additional 14% group shrinkage when anti-tilt pads are incorporated. A second gunsmith failure is not properly aligning the gas tube with the bolt carrier key, discussed in "Gas Tube Alignment" (March 2014.) Selecting a chamber that jumps magazine length ammo excessively is another.

Drilling the gas port through a land is unavoidable in six-groove barrels and quite likely with five. Three or four grooves provide wideenough grooves to accommodate the width of a gas port. The person drilling the gas port has to properly locate it and not all gunsmiths can. When buying an AR-15 barrel, choose appropriately and get a guarantee that the gas port will be located in a groove. While it may not degrade long term accuracy, it makes break in very difficult. The second primary culprit is inferior ammo.

Very few lots of 62 grain military ammo (M855, SS-109, etc.) shoot worth a darn. It has been said what's found on the commercial market consists of rejected lots that failed to pass loose military standards. No maker can deliver barrels that will compensate for such inherent poor accuracy. The bullets in most factory and hand-loaded ammo don't line up straight with the center axis of the casing, causing them to enter the back of the barrel crooked and be deformed.

This can be exacerbated if the gunsmith selects a chamber reamer that has along leade and throat, jumping the bullets before contacting the lands. To realize accuracy potential, the shooter must either cull ammo with excessive run out or straighten it using a proper cartridge straightening tool. Likewise, don't "soft seat" ammunition with boat tails (seating the bullets a bit long) as it results in a "hard seat" and leads to pressure problems.

Details are in "Precision AR-15 Ammunition" (April 2016.) The final culprit in barrels not shooting to their potential is the shooter. The first, likely problem is a failure to consistently apply proper marksmanship fundamentals. Members of my team were some of the finest marksmen in the country and included many High Master classifications along with a number of national champions and a few national record holders.

Despite this very high, proven skill, I found they often shot groups about double that of my machine rest. So, if actual champions aren't perfect, guess where that puts the rest of us mere mortals who are even more fallible in our skills? Learning how to properly apply marksmanship skills takes years. Easier fixes include implementing simple solutions like the Accu-Wedge and guiding long range single shot cartridges into a uniform position in the chamber each time.

Of course, the shooter has to learn and bother to use such fixes. The final operator failure is in cleaning. This includes not cleaning the bore often enough or getting all the fouling out. The chamber is an important part of the barrel. Failure to consistently position the cartridge in the chamber will rob an otherwise accurate barrel of its potential. Clean every time you shoot and use a chamber brush. Damaging the bore during rough cleaning is another problem.

Tight metal bore guides are helpful but not foolproof. Rifling is about the thickness of a sheet of paper and are easily damaged. I have a Bartlein gain twist demo barrel split lengthwise that will make a believer out of you in a hurry. Likewise, a failure to properly break in the barrel may result in significant damage to the barrel.

Keep the bolt carrier assembly cleaned and lubed or it creates nonuniform lock ups, different positionings of the cartridge in the chamber, and unequal pressures on the cartridge case head by the bolt face, ejector, and extractor. Shooter should lube the carrier assembly after cleaning and during firing. Store the firearm properly between range sessions.

Regardless of barrel steel, burnish corrosion preventative like WD-40 or Boeshield T-9 into the pores of the bore, with heavy shots in the chamber and muzzle crown to prevent accuracydestroying rust. I cut average group sizes of Team uppers in half by using simple techniques like this. With exceptions like electropolishing and fire lapping, everything I did simply harvested the accuracy potential inherent in the barrel.

I believe about half the potential accuracy of most AR barrels is masked by haphazard assembly, bad ammo, and shooter errors. Unfortunately, barrel makers often get the bad rap. AG

HISTORY

1871 Vetterli Conversion

Converting an old Swiss Vetterli 1871 .41 Swiss to centerfire. Here's a modern way to conduct the conversion with the help of a 3D printer.

BY KEVIN BAXTER JULY 2017

ORIGINAL PP. 15-18



Below: Baxter's converted 1871 Swiss Vetterli sitting atop his equally ancient 12" machine lathe.

ORIGINAL ARCHIVE IMAGE - PERMISSION CONFIRMED

The 10.4x38 (.41 Swiss) Vetterli is a fascinating firearm of the late 19th century—an early bolt action with a cam actuated loading mechanism that lifts cartridges fed from a tube magazine and a rimfire cartridge that spanned the evolution from black to smokeless powder. It is a not uncommon rifle and even nice specimens are not expensive. Largely, it is probable, because the rifle is a rimfire the ammunition is difficult-to-impossible to find.

According to *Cartridges of the World*, the rounds were produced into the 1940s but evidently not since. In the due course of events, I inherited a Swiss Vetterli 1871. From my earliest memories seeing it leaning against a wall in my grandfather's attic the rifle had fascinated me.

A good bit of family apocrypha surrounded the rifle, not the least of which being that my grandfather's friend, from whom he had inherited the rifle, had begun boring out the barrel in preparation to convert it to an available rimfire caliber. This I took at face value for years. The omniscience of the Internet ultimately gave the old rifle new life.

Upon doing a little research I discovered there is a small community of shooters who have converted by a variety of methods the various models of the .41 Swiss Vetterli to

shoot centerfire ammunition and that reloading dies were available. This inspired me to consider how to convert my rifle, if it was sound. The first task was to take down the rifle and give it a thorough cleaning. The dust of well over into the inner workings and the oil inside had turned to varnish.

On scrubbing out the barrel, I was delighted to find that it looked nearly like new, with sharp rifling and no discernible wear or corrosion or, contrary to rumor, tool marks. The next task was to slug the chamber and the bore. A couple of quick sessions with Cerrosafe confirmed the rifle was chambered for .41 Swiss, the rifling remained sharp, and the grooves measured 0.429" as per specification.

This resulted in an order to Buffalo Arms (Buffalo Arms. com, for 25 rounds of .41 Swiss brass (converted from 8mm Lebel cases) and to Midway for reloading dies, a bullet sizing die, and 330 grain .430 RN bullets. My goal in converting my Vetterli was to minimize irreversible changes to the bolt, keeping it as nearly original as possible, and permitting return to its original condition if desired in the future.

The only permanent change that my method entails is a hole bored in the bolt face to accommodate the center fire pin.

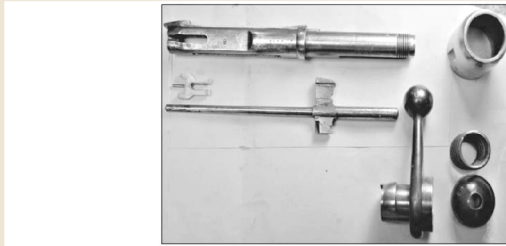
Otherwise, my approach simply replaces the original wishbone-shaped firing pin with a modified replica with shorter arms that don't extend beyond the bolt face and includes a centerfire firing pin. The Vetterli Bolt The first task in the bolt conversion is to remove the bolt from the receiver. This is a little more involved than with a modern bolt action.

It requires drifting a split wedge retainer in the top of the rear of the receiver out to the left with a screwdriver—the wedge is designed to remain in the receiver when it is clear of the bolt—and removing the loading tray out the bottom of the receiver by backing out the retaining bolt from the left side of the receiver. When this bolt is removed, the entire loading mechanism—the cam and the tray—will drop out the bottom of the receiver.

With the retainer wedge pulled out to the left, the bolt will slide effortlessly out the back of the receiver. The bolt comprises eight pieces: Bolt body, extractor, handle, rear shroud, back retaining nut, spring, striker rod, firing pin. There is no safety. Further, the bolt body does not rotate. Rather, the bolt handle rotates and locks the bolt in place at the rear of the receiver.

1871 VETTERLI CONVERSION CONTINUED

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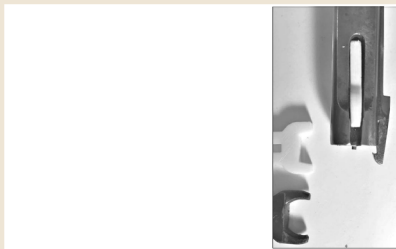
Left: The original rimfire cartridge on the left, and the new centerfire cartridge on the right, with a supply of 310 grain .429 round nose bullets ready to load. Above: The Vetterli bolt assembly in pieces. In practice, the firing pin has to be inserted into the wishbone through the hole in the bolt face. The assembled firing pin won't fit into the slot.

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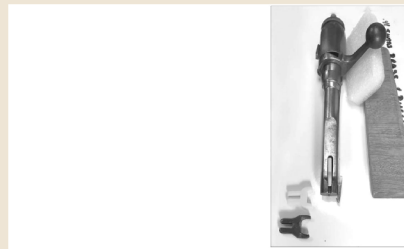
Left: The original rimfire cartridge on the left, and the new centerfire cartridge on the right, with a supply of 310 grain .429 round nose bullets ready to load. Above: The Vetterli bolt assembly in pieces. In practice, the firing pin has to be inserted into the wishbone through the hole in the bolt face. The assembled firing pin won't fit into the slot.

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Left: The original rimfire cartridge on the left, and the new centerfire cartridge on the right, with a supply of 310 grain .429 round nose bullets ready to load. Above: The Vetterli bolt assembly in pieces. In practice, the firing pin has to be inserted into the wishbone through the hole in the bolt face. The assembled firing pin won't fit into the slot.

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Far left: Detail of the converted bolt with the new firing pin. The original is at the bottom. Left: The complete modified and reassembled bolt. Original firing pin is at the bottom. Note that the locking lugs are at the back of the bolt assembly.

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429 round nose bullets ready to load. In practice, the firing pin has to be inserted into the wishbone through the hole in the bolt face. The assembled firing pin won't fit into the slot. To disassemble the bolt, take a firm grasp of the body around the shroud at the rear and unscrew the retaining nut from the back of the bolt. The nut compresses the firing spring, so care needs to be taken when backing it out, lest you inadvertently distribute parts all over the shop.

Once the nut is free, the shroud, striker, and bolt handle will all come off the rear of the bolt body. The firing pin rides in a slot machined through the bolt body at the forward end. It is a wishbone-shaped piece of metal, with the base of the wishbone fitting over the

end of the striker rod and the wide ends of the wishbone riding in slots machined at 3 and 9 o'clock in the sides of the bolt head. The extractor is on the top.

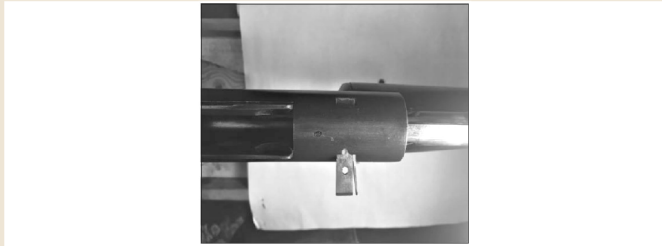
When the trigger is pulled, the striker rod is released to be propelled forward by the spring, pushing the wishbone-shaped firing pin forward. The ends of the wide (forward) part of the wishbone then strike the rim of the cartridge 180° apart. With the striker rod removed, the firing pin can be taken out through the side of the bolt body. I decided to first bore a hole in the bolt face. I chose to use a (notionally) 0.061" de-capping pin for a firing pin, so I bored the hole with a number 50 drill.

Rather than trying to set up the bolt body in the drill press, I chucked it up in my lathe and put a chuck in the tail stock to bore the hole. The bolt face is 0.280" thick, but it's not especially hard, and it's perfectly flat except for a numeral "8" stamped in the center.

My first attempt at recreating the original firing pin on my milling machine involved using a piece of thin bar stock and milling a replica of the rimfire firing pin, shortening the arms of the wishbone such that in Far The original is at the bottom. Original firing pin is at the bottom. Note that the locking lugs are at the back of the bolt assembly.

1871 VETTERLI CONVERSION CONTINUED

ORIGINAL PAGE 17



Above: Detail of the bolt retaining wedge. It is designed to remain in the receiver.

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Below: Detail of the Vetterli action with the new bright yellow firing pin assembly. Note how the bolt locks at the rear by rotating the handle as the body stays still.

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It is designed to remain in the receiver. its forward most position they would not extend past the bolt face. This I accomplished without incident, including boring the hole for the striker rod. However, when drilling the hole in the center of the crotch of the wishbone to accommodate the firing pin, my drill broke in the hole, ending that effort. Following some color commentary that had a sad effect on the paint on my milling machine, I stopped to reconsider.

The wishbone, in the centerfire configuration, is simply a mechanism to hold and guide the firing pin. Of itself, it doesn't really require a lot of strength and what strength it does require is in compression. So a piece of plastic should do. With this in mind, I mailed my failed sample to my brother, an engineering professor in the SUNY (State University of New York) school system and who, more importantly, has a 3D printer and Computer-Aided Design (CAD) expertise and software.

A couple of weeks later he had scanned the sample into his CAD software, cleaned it up, added a pilot hole for the firing pin, and printed five bright yellow ABS plastic wishbones and sent them back to me. All that was required was to finish fit the wishbone to the bolt—the hole for the striker rod in the base of the wishbone needed to be re-

lieved a bit and the hole for the firing pin needed to be opened a bit with a number 53 drill.

With this accomplished, all that remained was to reassemble the bolt and test the function. The wishbone with the firing pin inserted will not fit into the slot in the bolt body. I put a very small dollop of quick-curing epoxy in the hole for the firing pin, then inserted the wishbone into the bolt body and slid the striker rod in to hold the wishbone firmly against the inside of the bolt face. I then inserted the firing pin through the hole in the bolt face and into the wishbone and let the epoxy set.

If I need to remove the assembly, I can grab the firing pin with a pair of pliers and pull it out, but in normal operation the epoxy should keep it in place even if dry fired. I confirmed that the wishbone had free travel in the bolt face, then reassembled the bolt. This is simply a reversal of the disassembly. If you try to do anything out of order, the bolt will let you know. The only tricky part is getting the retaining nut started against the spring, but it's just a little fussy, not difficult.

I loaded primers into five cases and loaded one into the rifle. With appropriate eye and ear protection, and the muzzle pointed into

a box of rags, I pulled the trigger and was rewarded with a sharp snap and the pleasant smell (as far as I was concerned—the distaff side of the family had a different take) of a fired primer. I also had a primer with a hole all the way through it. So a little dressing with a fine grinder on a Dremel tool and a couple of additional test shots got the firing pin length adjusted.

The final length was 0.568". Firing The .41 Swiss There is not much load data for the .41 Swiss. I was leery of using smokeless powder, although various user forum entries suggested using Unique, 5744, 4198, Blue Dot, and other smokeless powders in small quantities. This seemed to me to be inviting problems. The .41 Swiss case, while not large, is still big enough to make a small charge of powder a challenge to ignite.

Plus, even though the original ammunition transitioned to early smokeless powder, it was designed for black powder and the smokeless was most likely pretty low pressure, low density stuff. With this in mind, I decided to test fire the rifle using FFg. I found that the maximum uncompressed volume of FFg that the cartridge would take was about 38 grains, so

1871 VETTERLI CONVERSION CONTINUED

ORIGINAL PAGE 18



Above: Author test firing the .41 Swiss Vetterli on a steel plate and hitting at 200 meters on the Fairfax Rod and Gun Club Lea Valley Range.
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41 Swiss Vetterli on a steel plate and hitting at 200 meters on the Fairfax Rod and Gun Club Lea Valley Range. I loaded five rounds with 35 grains of FFg behind a 330 grain round nose bullet sized to 0.429" with an overall length of 2.2". This seems to be critical to proper feeding if you want to use the side-loaded tubular magazine. It also seems to be a pretty close replica of the original.

My brother the professor was in town with his family for Thanksgiving and we test fired the rifle on a steel plate on the 200 meter range at the Fairfax Rod and Gun Club on Friday after Thanksgiving. For the first round out of the muzzle in the better part of a century, I braced the rifle carefully with the muzzle pointed at the berm and pulled the trigger from a discrete distance.

The rifle stayed in one piece, the bullet hit the berm and neither the bolt nor the empty showed any signs of distress. We proceeded to see what we could hit. With nephew Matt spotting, I aimed about a foot above the top of the steel plate target at 200 meters, figuring that the trajectory would be like a mortar. When I squeezed off the round, there was a light recoil, a large volume of delicious black powder smoke, and Matt announced that the dirt kicked up directly above the target.

After spending some considerable time cleaning the rifle, I decided to revise my thinking on smokeless powder and looked for one that was bulky enough to mostly fill up the case without creating dangerous chamber pressures. I found the answer in

IMR's Trail Boss. Another shooter had tried 13 grains of Trail Boss behind a 310 grain lead bullet with good results.

I compared that load to one listed at Ammo Guide (AmmoGuide.com) for the similar Italian Vetterli 10.4x47R and to the .45-70 Trail Boss loads, finding that 13 grains seemed reasonable. Further research on Ammo Guide revealed a similar load. Upon testing, I found that the maximum uncompressed load of Trail Boss was about 13.5 grains, so I loaded five rounds with 12 grains of Trail Boss behind the same 330 grain lead RN bullet. I tested this on a paper target at 40 yards.

The rifle shot about nine inches high with the sight bottomed, so the first round was off the paper. The second round, aimed about halfway down the target was about 4" high and the subsequent rounds aimed at the bottom edge of the target were dead center, with about an inch of displacement left and right total. Subsequent experimentation confirms that the rifle is zeroed at 200 meters and even with the ancient sights offers sub-minute-of-plate accuracy.

For the second round I aimed at the middle of the plate and squeezed again. There was a bang, a pregnant pause, then a clang as 330 grains of Midway's best lead hitting the target. The subsequent two shots had the same result. While not especially powerful, the .41 Swiss Vetterli is pleasant to shoot with these loads and clearly quite accurate with 140 year old military iron sights. Other shooters report using 240 grain .44 Magnum bullets with essentially the same powder loads with similar success.

This rifle is not uncommon and not particularly expensive. The conversion process is straightforward, reloading dies are available from RCBS, and brass is available or can be converted from .348 Winchester or 8mm Lebel with a few evening's effort. As a fun project and an even more fun shooter, the .41 Swiss Vetterli has a lot to recommend it. Conclusion While not the simplest Vetterli conversion procedure, I am convinced this is a fairly simple, easily executed, and technically sound approach.

Marrying the 21st century technology of CAD and 3D printing to a 19th century firearm results in a minimally-disruptive modification that uses all of the original parts in their designed roles and configuration. The only exception is the firing pin replaced with a shorter replica and a small hole in the bolt face to accommodate the new center fire firing pin. The 3D printed part is inexpensive and can be produced in quantity, allowing for spares and mistakes.

Further, 3D printers of adequate precision can be had for under \$1000 and there are several good, free CAD programs available, including one from Google called Sketch Up (SketchUp.com). In applications like this conversion where the properties of steel aren't necessarily required for the function, 3D printing could have a regular place in the resurrection of old firearms and even in the repair and modification of more modern arms. All without the hysteria generated by the printing of an entire firearm. AG

PISTOLS

H&R 922 Trigger Adjustment

Conventional methods of repair won't always get the job done in a safe and satisfactory manner. Here's how to adjust and increase the trigger pull weight of an H&R 922 revolver.

BY NORMAN E. JOHNSON JULY 2017

ORIGINAL PP. 19-20

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An older Harrington & Richardson Model 922 .22 revolver was presented to me that had a very light trigger pull. Though it functioned quite well as a double action, the owner felt the trigger was too light when cocking the hammer and shooting it in single action. He had purchased the gun at a reasonable price and wanted to know if I could do anything to correct the problem. The Model 922 is a double action, nine-shot .22 LR revolver made by H&R from 1950-1982.

It appears to be a very well-made, solid frame revolver with 2.5 inch barrel threaded solidly into the frame. The gun has plastic As overall hammer release is measured as combined trigger pull force, the three springs that come into play are the trigger spring, sear spring, and hammer spring, which is felt as load let-off friction resistance. This clearance must be maintained for safe pre-release of the trigger. grips which feel good to the hand.

I gave the gun a thorough examination to try to determine why the trigger pull was so light. I removed the cylinder and grips to get a closer look, using Gun Scrubber and compressed air to remove excess crud, but it was of no help. Take up slack of the uncocked trigger showed a pull weight of 21 ounces, which is trigger spring tension taken up before the back surface of the trigger even makes contact with the forward tip of the sear which actually releases the hammer on firing.

Take up slack of the sear spring tension for the first few thousandths of an inch showed only 2.8 ounces pull weight. Mating surfaces on the lifter and sear looked quite sharp and clean, which work together as the gun is fired single or double action. Based on these findings and the nature of its function, I decided to add spring pressure to the sear to supplement the existing coil spring pressure.

This could easily be accomplished by placing a leaf spring between the lower sear tang and rear aspect of the trigger loupe. By

design, the lower part of the sear tang fits into a milled out race at the inside rear of the trigger guard. This channel is of adequate depth, 0.8 inch in length x 0.15 inch wide—just right for placement of an added leaf spring.

As a means of pre-testing the function of such an auxiliary sear spring, I placed a temporary piece of flat, curved spring steel between the lower sear tang and the inner race of the trigger loupe. It was a good test of what I could expect from an added spring. Even with this lighter piece of spring in place, overall trigger pull was increased from an erratically lighter pull weight to a consistent four pound pull.

We are reminded here that the overall combined trigger pull weight is a function of the trigger pull itself along with the sear spring pull weight and searto-hammer load friction. The double action function still worked perfectly with the tem-

H&R 922 TRIGGER ADJUSTMENT CONTINUED

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Above center: Apiece of spring taken from an old alarm clock was used in making the auxiliary sear spring for the Model 922 H&R revolver. porary auxiliary sear spring in place. I then set out to make the perfect spring that would establish about a six pound pull while still maintaining smooth double action function. Making An Auxiliary Spring It required a bit of searching for the ideal spring material.

I finally found just what I needed by robbing the spring from a key-wind style alarm clock, an old "Big Ben." I cut the spring material to size with a sharp tin shears and removed the tem- The tab is shown on the added spring as used to install and remove the spring. Below center: The trigger scale shows the total trigger pull weight which is the force required to release the hammer.

Four springs now come into play, being the trigger spring, sear spring, auxiliary sear spring, and hammer spring pressure, causing friction resistance. Trigger function was much improved with the use of an auxiliary spring beneath the sear. Very adequate accuracy is shown for a short barrel .22 LR revolver. per from one end to shape a small, square corner as a means of holding the spring while installing and removing it.

This enabled me to slide the curved spring into place beneath the sear by grasping the tang with a forceps. With just the proper bow to the spring it could be slid into the race (groove) seat firmly in place just like it belonged there. I couldn't wait to try it. The little revolver felt good in my hand. I held it with the muzzle pointed to the dirt and cocked the trigger. I had planned to shave the spring down, if needed, for an ideal pull weight but this wasn't required.

The trigger released at exactly 6.5 pounds and worked smoothly with double action function as well. Repeatedly bumping the cocked hammer with the heel of my gloved hand did not cause the hammer to move forward to the "fire" position. Function Testing I cocked and dry fired the revolver several dozen times and worked it as a double action several times. All went smoothly. Test firing the revolver was next. I shot 18 rounds of CCI .22 Long Rifle Pistol Match ammo at 20 yards.

I really didn't expect too much from a 1 1/4 pound pistol with a 2.5-inch barrel when shooting offhand, but it did quite well. This isn't the first time, nor may it be the last, that I have been able to safely improve on the function of a gun. If things don't work out I never blame the tools. Perhaps the measure of a gunsmith is how some of those tricky tasks are dealt with. AG

PEOPLE & COMPANIES

Upgrading A Henry Lever Action

Few items of equipment add more usefulness to a rifle than a good sling. Here's how to add one to a rimfire Henry lever action rifle.

BY NORMAN E. JOHNSON JULY 2017

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A look through the Brownells Number 67 catalog lists over 92,000 products for one's shooting needs, including pages of gun slings and attaching swivels and studs. Even with such a vast array, gunsmiths will still challenge their ability to complete customer jobs. Recently, a hunter/shooter brought me his Henry lever action .22 repeater for installation of a sling. This seemingly easy task was attempted by him on a similar rifle and the job nearly ruined his rifle.

But this sling would be different; it was for his son on his birthday—just the ticket for the new .22 lever action Henry rifle. My customer brought in the rifle with a Brute padded sling made by Outdoor Connection, along with a set of sling swivels by Uncle Mikes. Mounting sling swivels on a rifle equipped with tubular magazine and metal forend band presents a unique task for the less skilled gun This tubular magazine, exposed hammer, lever action rifle is a very popular hunting and plinking rifle.

A good sling makes the rifle even more versatile. owner, so we gunsmiths end up with the job. Mounting The Sling Swivels Drilling and tapping the front screw hole into the forend band must be performed with utmost care at exact center of band. I used a center drill to start the hole with the stock in a padded Left and Screw hole is positioned at exact midline. Hole depth should only extend through the forend band metal. It is not necessary to remove the barrel band.

UPGRADING A HENRY LEVER ACTION CONTINUED

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Sometimes a nylon spacer is used between sling swivel body and stock to enhance its appearance. mill/drill vise. A number 21 drill is used for the 10-32 tap. Be sure not to drill into the magazine tube or force the tap into it. Some use a form of thread cement to lock the swivel in place, however, this is usually not necessary as when the swivel is screwed in place as it likely tightens well enough to the nearest right angle position.

Below and The rear swivel base is mounted about two inches ahead of the recoil pad or butt plate. A number 7/32 hole is drilled at exact center at right angles to the stock, about 7/8 inches deep. A nail or small punch is used to screw swivel base into stock for a flush fit. Slings are used in different ways to aid the shooter. In carrying the rifle it is slung over one shoulder, Swivel must be securely tightened to nearest right angle hole position. providing freedom for the arms.

A slung rifle can be quickly removed for shooting or while resting. A sling can aid the shooter while shooting from position, including offhand, sitting, kneeling, as well as in the prone position. When buying a sling, be sure you buy the right kind (there are several kinds to choose from) and get full instructions on how to use it. AG These groups shot at 25 yards with the help of a sling readily prove this point.

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FROM THE ARCHIVE

Gun Shows

Gunsmith marketing at your local gun show done right.

BY ARTHUR J. HUNT JULY 2017

ORIGINAL PP. 23

Other than two days of sweating and being bored, gun shows can be fun.

With luck, you can eat lunch at the snack bar, paying three times more than it's worth, and only get a mild case of diarrhea. With so many collectors, dealers, and individual gun owners, where else can you go and lie and be lied to so much, trade a junker for a worse junker, and just enjoy yourself? There are too many shows to hit them all.

It's not unusual for any show to share dates with another in a city within 50 miles, which doesn't help insofar as sales are concerned and can be a promoter's nightmare. Making It Work Still, gun shows can be useful for promoting business, particularly the local shows. You have to look at shows in a light of public relations and getting new customers. The fellow who bought a gun (junker, probably) at the last show is having trouble with it so he will be asking you to hold his hand.

Additionally, most gunsmiths have some guns to sell and hopefully buyers will but keep in mind that we live on gunsmithing, not gun sales. I sell gunsmithing first and last, though if someone manages to pass up the other 300 tables of guns he might buy one of mine. Given hundreds and thousands of guns offered at these shows it is getting harder to sell what I call standard guns so I don't try. I exhibit differently.

First, I have a display of custom rifles and restocked shotguns that I've built, repaired, or worked on. Years ago, I cut a military Mauser in half so I could show just how the gun was built. In addition, I have a couple of displays with firearms completely stripped and all the parts fas-

tened to the boards with identification of each part. I also have before/after examples of some of my work. I take a rusty barrel and polish and blue half of it to highlight the difference and what I can do.

Likewise, I have an old stock with one side finished and the other rough. This has been good for me. What is needed to make these gun shows work is to have a "stopper" that attracts. After all, there are rows of tables with tons of the same guns, so you have to be different. People that are intrigued and looking at your varied and different display can bring you some customers. In displaying your work you have an opportunity to answer a ton of gunsmithing questions and, most important, pick up new customers.

Hand Outs I go a step further. I have a one-sheet handout I give to everyone with a short history of who we are and what we offer. I don't quote prices but do list a 15% "gunshow discount" for any job over \$50.00 if the person presents this paper at my shop within 60 days of the date of the show. This approach has worked for me so I still use it. I find that with four shows in my town each year it only pays me to attend the one in or around May. Why you ask?

This gets the customer interested before he thinks about a summer vacation and spends all his money there. A fall show often competes with hunting seasons and is a time a customer doesn't want to tie his gun up. A show too early in the year has the income tax specter hanging over them. You can't help but talk to at least 100 people over two days. Out of those hundred it's possible to get 25 new customers over the following year. Don't expect more than that and you won't be disappointed.

If you consider an expenditure of \$100.00 for your table and don't count your time, this is a very small amount for each new customer. Also consider that your displays have been seen by hundreds more. While these potential customers likely won't show up directly, they may remember you during some discussion with a gun owning friend and mention having seen you answering questions and your displays at the show. I can't think of a better public relations effort.

On top of all that, there aren't many gunsmiths displaying at gun shows. Parting Thoughts Take the same table each year and keep thinking up ways to come up with better displays. While cleaning up my shop (would you believe me if I said it didn't need it?) I painted all the benches white, put a clean shirt on, and took a bunch of pictures of different operations and guns being worked on.

I took the best photos showing me at work and had them printed in 8x10 frames, mounting four in two separate columns to fasten at the back of the table. You would be surprised at the people who stop to look at them. I'm now working on a video of the same idea that I can run on a loop. Gun shows can be a hassle but there is plenty of solid potential for promoting your gunsmithing business. Consider yourself an educator demonstrating your craft and showing off your work.

This puts the "show" back into a gun show and gives attendees (and new customers) something to learn and talk about, especially among the many rows of identical guns for sale. AG

PEOPLE & COMPANIES

Reader Forum

BY AMERICAN GUNSMITH EDITORS JULY 2017

ORIGINAL PP. 24

Modifying Model 41s I am working on a Remington Model 41 Targetmaster. The barrel and receiver are one unit on the M41 and were so advertised by Remington. They are serial numbered on the bottom of the barrel at the front end of the stock. The Stevens Westpoint Model 121 also has the single unit of barrel and receiver. How would you advise me to proceed with this? Call Brownells for a free copy of their parts source when working with outof-production guns.

It also contains sources for barrel relining and we've concluded that is the route for you to pursue. The alternate would likely require along search for a used barreled action. Winchester Model 100 I have in my shop an Winchester Model 100 chambered in .308, serial number #62XX. It was brought in for the firing pin recall and the owner states it does not cycle. While disassembled it I examined all parts for wear or breakage and bore scoped it to verify the gas port opening.

Everything looked clean and in good order with no noticeable wear. The gas port is clear. When I called Winchester I was told by the technician that when Winchester became licensed by the Herstal Group; Fabrique Nationale (FN) of Belgium and the Browning Arms Company that they do not work on or have anything to do with the older guns previously made by the Winchester Repeating Arms Company. Do you or anyone know where I can send this rifle for repairs or technical assistance?

Jeff Mike Dill Pickle's Pistol There is a still active organization that can help you out. Nu-Line Guns Inc. bought all of the parts from Winchester for the Model 100, among many others and used to be an official au-

thorized or by mail a Big Sandy, TX 75755. service center for the Winchester Repeating Arms Company. They also have parts.

Contact is Nu Line Guns. com and Colt Army Special While I am not a professional gunsmith, I read American Gunsmith because I have an interest in gunsmith work and I pick up some interesting information. Last year I purchased a Colt Army Special in .41 Colt. My Letter of Authenticity from Colt says the gun was made in 1916. I have several questions about this gun. It shoots fine in single action but in double action the hammer barely dents the primer and the gun does not fire. I'm am not sure why that is.

Possibly a bad mainspring? If so, where can I get apart like that? The gun's current finish is nickel but Colt told be the original finish leaving the factory was blued. I would like to have the gun refinished just like it left the factory. I have asked Turnbull Restoration & Manufacturing Co. (Turnbull Mfg. com, but they do not work on double action firearms. Any suggestions? I know this gun is not worth a lot but I enjoy researching and working on this sort of odd project.

Any help you can give would be greatly appreciated. Michael Lyons, USAF (Ret.) Mountain Home, 1916 you say? That's a real old timer. Hammer might be very worn along with a weakened spring. Try Numrich Gun Parts Corporation (Gun Parts Corp. com, and Jack First (jack-first-gun-parts.myshopify.com, for parts. We've found that using Dura Blue from Lauer Custom Weaponry does a great job and can recommend it to readers seeking an original "Colt Blue" look. Very simple to use. No heat. No dangerous chemicals.

CONTACT LAUER AT LAUER-WEAPONRY.COM. AG

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