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DIGITAL ARCHIVE EDITION

PRECISION ARMS WORKSHOP

AND THE AMERICAN GUNSMITH ARCHIVE

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INSIDE THE ARCHIVE

RENOVATING SPORTERIZED M98 MAUSERS

OLD TECHNOLOGY, STALE DESIGNS, PART TWO • PRECISION BARREL FITTING, PART FOUR • PREDICTING BARREL WEAR…

DIGITAL ARCHIVE EDITION

Preserved for the bench.

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A complete guide to the searchable editorial work preserved from July 2014.

PEOPLE & COMPANIES

Old Technology, Stale Designs, Part Two

BY AMERICAN GUNSMITH EDITORS JULY 2014 ORIGINAL PP. 2

An editorial by Paul Mazan. During a SHOT Show long ago, a rep from an American shotgun maker asked me what they were missing in the marketplace. I suggested a good double shotgun for Cowboy Action. His response, "What is 'Cowboy Action'?" To a different company rep, I suggested they look into a lever gun that aped the 1892 Winchester on the outside but was updated internally.

His response, "I think we'll just let our friends at Marlin keep that market segment." Back in 1986, an engineer for an after market trigger manufacturer asked for ideas and I told him the market was crying for triggers for the AR-15 and Japanese Arasaka. His response, "How would we do that?" I told him I wasn't an engineer, just a guy listening to customer requests. Fifteen years later, under new ownership, the company finally introduced AR-15 and Arasaka triggers.

I was the lead on the development of baking lacquers and the aerosol epoxy finished for alloys that couldn't be blued, and worked for many years trying to find someone that could make a spray-on, bake-on finish that looked like color case hardening and a cold parkerizing for touch up like the cold blues.

For nearly two decades I worked as a New Product Manager for two companies and looked, begged and pleaded for an immersion bluing system that did not require heat and caustic salts to replace traditional hot salts bluing. I once again told them that I was an idea guy organizing requests from real customers, not a chemical engineer. I never did find anyone willing to take on the projects. One of my favorite incidents was the Phantom scope and mount, proprietary units that wouldn't work with other optics or mounts.

At SHOT that year I visited their booth and a salesman mentioned dropping the mount. Naturally, I commented they must have dropped the scope, too. He scanned his computer print out and said, "No, we still offer the scope." I asked why they would discontinue the necessary mount and the answer was a classic case of a company not knowing its own product line. The scope was profitable and the mount wasn't, according to the P&L statement. Despite explaining this problem, I was told they still supplied other mounts.

To nobody's surprise the scope was discontinued the next year. Seems it was no longer profitable. These product ideas were dreamed up by a low level guy with no formal education, namely me. You would think corporate guys with MBAs would fill the market with cutting edge products but they simply aren't gun guys and have no understanding of their customer's needs. One company I worked for did away with my position because they switched to a corporate strategy of acquisition rather than R&D.

Instead of developing products customers were asking for, they simply bought young companies developing a good idea. Even corporations with people passionate about firearms find it more economical to let someone else develop ideas and buy them. The bottom line trumps innovation.

RIFLES

Precision Barrel Fitting, Part Four

Part Three ended with a mention of the barrel. It deserves much more than that.

BY CHICK BLOOD JULY 2014 ORIGINAL PP. 3-6

What follows here can only be considered a beginning to barrel prep and installation, and gives me an additional opportunity to recommend the purchase of the third edition of John Hinnant's book, The Complete Illustrated Guide to Precision Rifle Barrel Fitting. How to and where are listed at the end of this article. It may surprise you to see Dave Manson being identified as a source. Well, it shouldn't.

Dave plays an important role in Hinnant's content as most of it involves chambering, rechambering and crowning a barrel. How to do all three are described by John Hinnant inclusive of a lathe, however, and further includes how those vital steps can be accomplished equally well with hand tooling manufactured and supplied by Dave Manson. I never claimed this series to be a substitute for the book's total content. An encouragement to own it? For sure.

Couple that with a polite plea to somehow, some way, rack up enough hours working with a lathe. There is no substitute for eliminating any concerns about your ability with machine tools other than getting to know them. I'll only offer a single, very large warning: Never be wearing a necktie when you turn on a lathe. Way, way back in my high school shop days one classmate of mine had tucked his tie into his shirt.

It fell out and began wrapping around the workpiece, fortunately being turned at moderate speed, between centers. Mr. Dudley, the shop teacher, was standing next to the kid, saw what had happened, whipped out the very sharp hunting knife he habitually wore on his belt, slashed the tie cleanly in half and my friend straightened up with his nose still attached to his face. Nobody ever wore a tie in shop class after that. I'm also betting nobody challenged Mr. Dudley to a knife fight, either.

A three-jaw chuck with repeatable centering capability is permissible. A four-jaw is preferred. Perhaps the necktie warning comes as unwarranted where you are concerned but precision barrel fitting is a process not to be casually plunged into. There's simply too much to learn beforehand. Besides the oft-mentioned Hinnant book, there is Gunsmithing by Roy Dunlap and How to Run a Lathe published by South Bend Lathe Company. Through your own research you're likely to discover other pertinent reading. Don't avoid it.

If there's anything I've learned about this business it's you can't afford to stop learning, you'll never learn enough and no one person will ever know all there is to know about every kind of firearm. Regardless of your knowledge, you will certainly hear your share of "I heard that…" or "I read somewhere that…" expressed in opposition to almost any resolution you offer on the repair or improve-

In the process avoid taking off excessive material. A too-thin barrel can become crushed under lathe jaw pressure. It is rarely, if ever, required with an OEM barreled action. ment of a gun. Possibly they will be spoken of the rifle just handed you. Ask questions up front. Leave no question unanswered or in doubt before starting a rebarreling job. A first question to ask, is your customer OK with a barreled action from the original manufacturer or is a custom barrel demanded?

If the latter, it will mean you will be accumulating more billable man and machine hours and a higher end cost to prep such a barrel for fitting up. You can reduce the hours by choosing a maker well known for providing perfectly straight barrels with rifling well defined inside a dead center bore, precisely chambered and in the desired configuration, such as tapered, fluted or target. Ask around if you have doubts. The Brownells Techs will have suggestions. So will widely experienced gunsmiths.

To get you started, I'll mention three makers you should consider: Shilen, Shaw and Mac Millan. There are others to be considered of course. A couple are mention in the Hinnant book. The importance of choosing a barrel provider cannot be overstated. Choose wisely and don't rush into the choice uninformed. While I avoid making that choice for you, I insist on making one regarding a dial indicator. Buy one.

It will be indispensable in assuring the precision of all your turning operations and you can apply it in checking how straight the barrel appears to be. A Mitutoyo or Starrett indicator with +/-0.0005 capability is recommended. You can either mount it on the tail stock of a lathe as shown in the Hinnant book or, as I prefer, mount it on a magnetic base that can be moved easily along the length of the barrel before it firmly grabs on to any magnet-receptive point in the working area.

That includes the metal table on which the lathe is mounted. These magnetic bases can be found on the web. Search for "Starrett Machine Tool Indicators." When a lathe with along bed still lived in my shop I used to check barrels for straightness by placing the indicator in contact with the barrel exterior just short of the muzzle and turning on the lathe. If the indicator showed any wobble more than +/- 0.01 the barrel was returned to its maker for replacement and/or

straightening. You may elect to be more or less demanding. With either one of the indicators mentioned you have the flexibility, and the luxury, of setting your own standards. Making Barrel Relief Cuts In case you missed or misplaced the previous issue describing them, there are two basic lathe setups for turning a relief cut. The first is done using along bed lathe. Here the muzzle end of the barrel is held in the lathe chuck. The shoulder of the cut avoids slippage of the barrel through the chuck jaws.

The OAL of the cut should match the jaw length. Avoid making cuts shorter than this. Short cuts can cause longitudinal springing of the jaws, possible jaw damage and a resulting loss of centering accuracy. The diameter of the cut doesn't present that particular problem. It presents another. Turn off too much material and you may end up with thin barrel walls. If ex-

Any departure from perfection can result in lessened accuracy and reliability. The cutting tool should be given a left hand turn to form an angle of five to ten degrees. The indicator above is mounted on its magnetic base and can easily be moved to any magnet-receptive work area. cessively thin, these can be crushed under lathe jaw pressure. When no long bed lathe is involved omit the long bed lathe setup and use a set up for a short bed lathe instead.

A three-jaw chuck is permissible as long as it centers accurately but a four-jaw is recommended. Another three-jaw alternative is the use of a collet in which case the cut diameter must match that of the collet. Turning The Breech O. D. These instructions will apply if the decision is to fit up a barrel blank rather than an OEM barreled action. Unless your operation has machinery capable of drilling bores and rifling accurate bores, I doubt you will be working with a total blank.

You could, however, be faced with a bored, rifled, but otherwise untouched one. If that be the case turn the breech to the correct diameter plus 0.025-0.030 inches. In the turning, position the steady rest as close as possible to the work area of the barrel. Avoid positioning the rest so close it interferes with movement of the carrier and cross feed movement of the compound rest. Tenon Length When marking the thread tenon length, the end of the breech point should match the shoulder length of the cartridge case.

This can be determined using an outside caliper or micrometer as a gauge. Open either measuring tool to the finished, major breech outside diameter. Safe sporter barrel standards for this diameter in many of the more popular calibers appear in Gunsmithing by Roy Dunlap and are included in the Hinnant book. Slide the gauge you have fabricated up the barrel until it stops. That's point "X," the place where the downward configuration of the chamber ends and the taper toward the muzzle begins.

The length of the tenon should match the depth to which the threads reach within the receiver. Turning Tenon Diameter Make no change in lathe set up from its breech turning operation. The tenon should be turned 0.025-0.030 larger than its finished diameter. Note that a cutting tool should be given a left hand turn to form an angle of five to ten degrees. A corresponding angle will be cut on the breech/tenon shoulder.

Since the tenon must match perfectly with the receiver, and the receiver has previously been precision faced, the angle just cut on the tenon must now be faced to a matching 90 degrees. In this facing operation, do not allow any left or right longitudinal movement of the cutting tool. On page 65 of his book, Hinnant describes two means of preventing any movement. The importance of achieving a square tenon shoulder can't be overemphasized.

After threading, a properly-fit barrel must be tightly butted against the receiver. Any deviation in a perfect relationship between the tenon shoulder and receiver face prior to uniting the barrel and receiver will prevent the union from being 100%. In Part Five, muzzle crowning, making the extractor cut and assembly of the barrel and receiver will become the focus. Chambering will get most of the attention in Part Six and include the .22 LR cartridge.

Part Seven will address blue printing a rifle, including an update on the same subject. Contacts John Hinnant, johnsharonhinnant@ sbcglobal.net Dave Manson, Manson Precision, AG

MAINTENANCE & REPAIR

Predicting Barrel Wear, Part Two

BY JOE CARLOS JULY 2014 ORIGINAL PP. 7-10

We'll start with pitting and cleaning rod damage. In the decade plus that I was the armorer for the Army Reserve Shooting Team I replaced about as many barrels that were damaged by rough or improper cleaning or pitted due to neglect on the part of the shooter as barrels that were genuinely worn out. I replaced a lot of pitted barrels. Some folks are under the impression that they can "bullet proof" themselves from pitting by substituting stainless barrels in place of chrome molly barrels.

Granted, stainless is more corrosion resistant than carbon steel but stainless is not corrosion proof. I have seen many stainless barrels ruined by pitting. Pitting results when corroded barrels are not attended to for a prolonged period. Corrosion often results when the owner fails to clean his bore after a shooting session and the problem will be exacerbated if such a firearm is stored in a moist environment even for a short period of time.

If you store your firearms in a gun safe make sure it has a good dehumidifying rod. Small amounts of pitting are sometimes not fatal in most sections of the bore. The exception is the muzzle and crown area where even minimal pitting will usually ruin the barrel. Avoiding Pitting The first step to avoid pitting is to thoroughly clean your firearm every time you shoot it and never get complacent and put away a dirty gun.

After I have removed every last trace of bore fouling I clean the chamber with the appropriate chamber brush and a high pressure aerosol gun scrubber spray. Follow up with a patch wet with Windex without ammonia. Most common Windex contains ammonia but they also make it without ammonia and that is the one to use. The container of non-ammonia Windex I have is marked "Crystal Rain" and this flushes out the ammonia from cleaning solvents. I mentioned that a lot of bore pitting occurs at the muzzle.

I believe that may happen due to not getting all the gunk and excess solvent removed. Pre-ban guns with flash suppressors may exacerbate the problem as they tend to hold these substances. On guns with flash suppressors use the aerosol Gun Scrubber or its equivalent to spray the front of the muzzle clean as well as the inside of the suppressor and the flutes. You can use a clean shop rag or cotton swab to remove the excess moisture at the muzzle and insides of the flash suppressor.

Dry out the bore with about four clean patches. If you are going to shoot the next day you're all done at this point, with the exception of cleaning and lubing the bolt carrier assembly and cleaning the upper receiver where the carrier lives. On the other hand, if you are going to store the gun for more than a handful of days, especially in a moist environment, you need to use some kind of rust preventative.

Brownells did a super comparison of various common rust preventatives a few years back, Gun Cleaning Clinic: Knowing the Limits of Rust Preventatives by Steve Schmidt (goo.gl/a4j VAx) In the center is Windex WITHOUT ammonia. A couple of products gave really stellar results. They were Boeshield T-9 Waterproof Lube made by Boeing and good old WD-40. Apply these to the bore using a loop tip, very saturated with the product of your choice.

I work the patch back and forth several times to burnish the preventative into the pores of the bore. Then I allow the patch to exit at the muzzle and I pull it back gently into contact with the crown and muzzle. Holding the rod at the back by the shaft, not the handle, I rotate the patch in several 360 degree turns while applying rearward pressure so the muzzle and crown get a good coating.

Some of you are probably jumping up and down right about now saying that a patch should never be pulled back through the bore after exiting the muzzle. That applies to dirty patches. We just finished cleaning the bore so this patch won't be dirty. Additionally, we are not pulling it back through, just applying rearward pressure. Some sprays of either rust preventative up through the flash suppressor impacting the muzzle and crown won't hurt.

Likewise, a shot in the chamber is good as I see a lot of rust form there and that can cause feeding and extraction issues if it gets bad enough.

Because we are applying these preservatives liberally, store the gun muzzle down for at least a few days to avoid having preventative pool in the action and on down into the buffer area, trigger, or lower receiver. We need to remove these substances before shooting to avoid pressure spikes and first shot fliers. To do so, just hit the chamber with a little shot of Gun Scrubber, patch the bore out with nonammonia Windex, and follow with dry patches.

If needed, hit the flash suppressor and muzzle with a splash of aerosol Gun Scrubber to remove any excess in these areas. Salt Bath Nitriding Another very effective method I employ to avoid pitting is having my barrels salt bath nitrided. The trade names for this are Isonite or Melonite and there are several locations around the country performing the service. The nitriding compounds are applied both to the inside and the outside of gun barrels.

This is different than bluing which only goes on the outside and provides no protection to the important and rust-prone bore. The nitriding procedure can be performed to either barrel steel but you will have to identify which you are sending as the processing is a little different. Because of the near 1,000 degree heat involved in the nitriding, barrel extensions will want to come off. This ain't cool!

If you build a gun for a customer only for him to return it a few weeks later because the barrel is unscrewing plumb out of the extension, you lose credibility and the customer loses the service of the rifle while you fix it. I covered several ways to deal with this in the September 2013 issue called "Retention Of AR-15 Barrel Extensions." I suggest you follow the advice in that write up. Nitriding is not an end all, do all.

It is just added insurance and isn't meant to take the place of proper and prompt cleaning after each range session and the use of a rust preventative if you are going to store the gun for more than a few days before your next range session. Likewise, you need to continue to store all firearms in dry conditions (use a dehumidifying rod in a safe) whether nitrided or not. In addition to helping curb rust there is one more benefit of nitriding that I really like.

It makes the gun very easy to clean which lessens the probability of cleaning rod damage. I hear a lot of claims right now that nitrided barrels wear longer. Maybe they do but currently I don't have near enough data to substantiate or refute those claims. You saw that laundry list of barrel characteristics that can lengthen or shorten barrel life earlier in the article.

Until such time as someone (or myself) sets up a scientific study where 20 barrels are purchased all from the same maker and all with the same internal specifications and half are coated and half are not and then compared for wear I don't think anybody can make any statistically valid claims one way or the other. Damage During Cleaning I have mentioned before that the lands only stick up above the grooves by about the thickness of a sheet of paper. They are very easily damaged.

You can avoid damage and increase the life of your valuable barrel by following these suggestions. First, always use a quality, straight, one-piece cleaning rod with a freely rotating handle and wipe it off frequently to keep it clean. Use a rod of the proper length for the barrel you are cleaning. I have a longer rod for cleaning 26" match rifle barrels than the one I use for 20" barrels.

Using the longer rod inappropriately in the shorter barrel results in too much rod flex which is one of the big damaging culprits. Use a rod of the correct diameter. Don't try cleaning a M1A .30 caliber rifle with a .22 rod. Skinnier rods flex more! Second, I like to have two rods for each type of gun. I have one rod with a female thread on the end that I use exclusively with screw-in bore brushes and a second, dedicated rod for use with bore patches.

Before I screw the tip for that rod on for the first time I bevel the 90 degree shoulders that usually exist just forward of where they attach to the rod. Then I use blue Loctite on the threads of the tip where it screws into the rod and I tighten it on to prevent the tip from unscrewing during cleaning. I have seen so many guys push a patch down through the bore and then remove it from the tip at the muzzle as they should. Then they get in a great big hurry and yank the rod back up.

If the tip has come loose, as they will if you don't Loctite them in place, gravity will cause that loose tip to slope down after it exits the muzzle. A hard fast rearward yank on the rod can ram the back of that tip right into the bottom of the crown and booger it big time. Ensuring that the shoulder of the tip is beveled combined with keeping the tip in alignment with the rod via Loctite holding it in place and not jerking the rod so much should help eliminate the problem. Third, don't mix bore solvents!

You can end up creating a third compound that can damage your bore. I'm not using the term "mix solvents" like one might imagine a kid with a chemistry set pouring one bottle into another. I am thinking of using regular Shooter's Choice in your brush to get the carbon fouling out and then following that with Sweet's 7.62 on a patch to get the copper. Bad idea!

It's perfectly fine to use regular Hoppe's No. 9 on the bore brush to get the carbon and then follow with Hoppe's Bench Rest to attack the copper because they are both from the same company and compatible. Same, using regular Shooter's Choice on the brush and following with Shooter's Choice Copper Remover on the patch. Follow solvent manufacturer's instructions.

Hoppe's says it is OK to leave Bench Rest in over night whereas the maker of Montana X-Treme 50 BMG says 15 minutes is the time limit to soak a bore with their product. Big difference! Don't use high ammonia solvents like Sweet's and the Montana X-Treme with bronze bore brushes as bronze

contains copper. The harsh solvents will eat your brush for lunch and can easily deposit copper in the bore from the brush, making your cleaning job more difficult. Forth, use quality bore brushes with windings that never terminate on the front of the brush, unlike the cheap ones. The slightest flex or bend in the cheap ones will jam those sharp open windings right into the barrel, causing damage. Always use a clean brush.

I throw my dirty ones in the solvent tank of my ultrasonic unit when I am cleaning regular gun parts. Other people spray them clean with an aerosol gun scrubber, or use lighter fluid to hose out the crud. Just allow them to dry before their next use and replace them when they get worn down or bent to the point where they can't be straightened. I don't have much faith in nylon bore brushes because I don't think they are abrasive enough to attack the hard, baked-on carbon fouling.

You can use them with high ammonia solvents, however, unlike bronze brushes which shouldn't be used with such solvents. Never try to reverse the direction of a brush when it is inside the bore. This can cause a lot of dangerous rod flex. Fifth, a word about abrasive cleaners. I don't worry about abrasives, such as J-B Bore Cleaning Compound. They actually do a great job of removing stubborn fouling that solvents alone may not get. I do worry about how they are used.

Normally they are applied to a patch and then worked back and forth in a scrubbing action in the bore. A lot of guys push the patch forward and stop it just before it exits at the muzzle and then pull it back down to the chamber and repeat a bunch of times. On the forward stroke, if you mess up and push too far and the patch exits the muzzle, remove it and don't pull that filthy thing back through the crown. J-B can also be "short stroked" in problem areas where fouling tends to be heavy and persistent.

For example, if the gas port isn't properly broken in when the gun is new, the port and about two or three inches forward of it may be such an area. The throat is another such area. Use of abrasives there gets the fouling out but the short stroking action may cause damaging rod flex. Let's take the gas port area as an example of using short strokes of about three inches each.

The patch is initially pushed a couple inches forward of the port, then the direction of travel is reversed and the patch is pulled back to about one inch behind the gas port. Even though you are reversing the direction of the patch you are not going to get much rod flex when pulling it, however, the next patch reversal will be at that stopping point one inch behind the port when you go from pulling back to pushing. That is where you will get the rod flex.

J-B has a creamy texture and you probably won't feel much flex at all but it will occur. A lot of that flex will happen at the back of the barrel just forward of the chamber and it can easily damage the lands, but you won't feel a thing! So, slow down your stroke and be particularly careful scrubbing with abrasives and changing direction from pulling to pushing inside the bore. Last, but certainly not least, is a quality metal bore guide.

I've seen incidents where a worn plastic bore guide ruined a brand new barrel. The bore guide in question began life as a .22 caliber AR bore guide and no doubt performed its job just fine when new. Unfortunately, the hole that the rod goes through wore fatter with age. When I inspected the offending unit for a customer at Camp Perry, the guide had grown clear to .35 caliber!

That bore guide my customer was relying on to keep the rod going straight and with minimal flex was doing the exact opposite and a perfectly good, very expensive barrel was destroyed as a consequence, yet the shooter never felt anything untoward. So my advice is to use nothing but quality metal bore guides made by the likes of JP Enterprises or Wheeler Engineering.

Diagnostics How do you know when a barrel is shot out? "An early indication from the USAMU was that they had gotten in the vicinity of 7,000 rounds from a barrel before a rifle wouldn't clean at 600. … Well known builder Derrick Martin doesn't even recommend checking an AR barrel until it's had 5,000 through it." That's the advice given in The Competitive AR15 by Glen Zediker. Barrels normally decline gradually and not all at once.

Most bad scores or bad shots are caused by shooter error or inferior ammo, not worn out barrels. You know when a barrel is shot out by its shooting performance and no other way. Yes, you can take throat gauge readings and a reading of five or more tick marks may tell you that it is time to test the gun for group. You can also take Stoney Point readings and any bullet jump exceeding ¼" might also suggest test firing.

You can bore scope for heavy and deep fire cracking, roughness in the back three inches or more of barrel, and/or pitting anywhere, especially up around the muzzle. If one land is wearing down back at the throat that certainly points to problems. If you are seeing much fouling of either kind I suggest the shooter do a better job cleaning, or I just properly clean it myself, and that he then try shooting it again.

A lot of folks are fixated on the copper portion of fouling and tend to discount the black carbon fouling. Carbon fouling is debilitating to accuracy too and requires abrasives, such as a bore brush, to get out. Knowing the right questions to ask the shooter is very important in diagnosis. The first thing to find out is what classification is he? Marksman through Expert-class shooters tend to blame all bad shots on either the gun or the ammo, rarely on themselves.

Masters and High Masters normally shoulder the blame on themselves for not applying the fundamentals rigor-

PREDICTING BARREL WEAR, PART TWO CONTINUED ORIGINAL PAGE 10

The black plastic one at the right is worn out and close to .35 caliber. The owner ruined anew barrel because of it! ously enough. I have seen a bunch of them miss some rather obvious gun problems because they just don't think to look there. Does the shooter think the gun is shooting fatter groups or is it still shooting good groups but with occasional unexplained fliers? A lot of fliers are not barrel related. Ammo (especially concentricity issues) is mostly to blame.

Gas tube alignment is another prime culprit in AR-15s. Has he changed something recently? Changing ammo lots or loads can cause a lot of problems that might be misdiagnosed as barrel related. If he is a person who normally spun his ammo for concentricity, but just didn't have the time to do so about the same time as fliers and fat groups started? Swapping in anew magazine (even if it feeds well) can cause significant shifts in point of impact.

Pistol shooters were first to notice the relationship of point of impact to magazines used and sometimes machine rest test with their magazines to be sure none of them caused zero shifts. Also, look for copper build up on the feed ramps of the barrel, which might indicate that a magazine is not feeding straight. If the gun is used in National Match competition, is it performing poorly at only the 300 yard line, just the 600, or both?

Too many shooters (and gun plumbers) base a gun's performance only on 600 yard performance. Typically, long range ammo has bullets seated out further to be single loaded and not fed from a magazine. Therefore, those bullets jump less distance than magazine-fed ammo like we use at 200 and 300 yards. Because of the longer bullet jump from ammo that is seated to magazine length, a barrel may be shot out with regard to 300 yard performance but still shooting strong at 600 yards.

If the shooter keeps an accurate round count log, how many rounds is he showing through the barrel? Anything in excess of 5,000 should probably merit a range test. Right before I test fire a customer's rifle I check for obvious mechanical problems. Gas tubes out of alignment are notorious for causing fliers and fat groups. When I was armorer for the Army Reserve I used to find many loose butt stocks and sometimes loose buffer tubes causing the same problems.

It is like putting the stock in a different position in the shoulder for each shot and the best barrel in the world won't shoot well under those circumstances. And for crying out loud, always check sight track- Shooters and gunsmiths can misinterpret this as barrel accuracy issues. ing. Dead spots and jumps can open up groups (especially at 600 yards where you are doing a lot of clicking) something awful. I also make sure that the bolt carrier is clean and properly lubed.

Otherwise, you will not get consistent lockups and optimal performance out of any barrel. When I test fire the gun I like for the customer to provide samples of his ammo. I gauge his ammo for concentricity to get an idea of the overall quality. I also like to run a chronograph on his ammo to see what velocity spread it clocks at. In addition, I like to fire with known-good ammo of my own which you can bet I have spun for concentricity.

When the smoke from the test firing clears, if his gun is shooting 10 shot groups exceeding MOA with his ammo and subminute with mine I show him the test targets and try to steer a conversation to how he loads his ammo. If both his ammo and mine shoot 10 shot groups over minute of angle I suggest rebarreling. My company motto is, "My goal is to help you achieve your goals." At the end of the day the customer is always right and if he wants anew barrel that is what he gets. AG

TURNING

Renovating Sporterized M98 Mausers

Don't automatically pass on old sporterized military rifles. You may be surprised in the value and accuracy they can deliver.

BY PAUL MAZAN JULY 2014 ORIGINAL PP. 11-15

The venerable M98 Mauser has never really gone away in its military dress and there is tremendous interest in collecting prime examples. What I am addressing in this article are those 98s that came home from the wars with returning GIs and were turned into "sporters" in the 50s and 60s. With the upcoming centennial of World War One I've seen interest—and prices—of vintage military firearms of that conflict spiraling upward.

I've also noticed more of the "economy sporters" appearing at gun shows and they have really captured my interest. Originally I was looking for uncut examples of WWI guns that could be returned to their military configuration as I expect they will be going up in The gun below has been restocked, the military sights removed and replaced with a front ramp and receiver rear sight installed. price during the centennial much as Civil War firearms did in the 1960s.

I thought that if I could put a few aside before then I'd be able to make a little money on them in a couple of years. Still a good thought but, as usual, I have been sidetracked by some of the work I've seen that was put into those "Barracks Bag Specials." The first question I expect you're asking is with so many great hunting rifles available, why would anyone want to bother with one of these old warhorses? My answer to is economics! Have you priced one of those great hunting rifles lately?

Used prices on Gunbroker are running $500-$600 for Savage 110/111 series rifles, $600-$700 for Remington 700s and even more for Winchester 70s. Most of the hunters I know never hunt out of their home state and earn between $12 and $15 per hour. With mortgages, car payments and kids in school, $500 rifles are something to dream about and wish for. The Mausers that were sporterized in the 50s and 60s are still out there languishing on dealer's shelves and looking for new homes.

The prices are usually around the $200 mark but vary widely based on what has been done to them. We aren't talking about full blown custom rifles here but cut down military service rifles. One more reason to take them seri-

Recoil has moved the receiver rearward in the stock, chipping out the wood where the sight was bearing against it. ously for a hunting rifle is that they can be surprisingly accurate even with pretty rough bores. I picked up two rifles for this article representing both an economy sporter and one that has had a bit more work done to it that I will refer to as a midline sporter.

The economy sporter started life as a Danzig 1917 GEW that still has its original number matching barrel that was, unfortunately, cut to 23 inches. The rifle sports WWII military sights and a turned down bolt handle in a cut down military stock. Since it has not been buffed and reblued, this one may well be a candidate for restoration to its WWII configuration as a 98k, but that will be a project for another time. The second rifle is a Spandau 1917 GEW that has been turned into an attractive sporter.

Unfortunately, along with cutting the numbermatching barrel, a previous owner removed the sights, polished the metal, reblued the gun and drilled it for a Redfield receiver sight. This means the gun is not really a candidate for restoration but it may well shine as a very interesting hunting rifle. Along with the receiver sight it has been fitted with a ramp style front sight and placed in a nice after market sporter stock.

The gentleman that owned it thought he had a really valuable rifle when he came to the gun show but was walking The crack extends forward all the way to the trigger and to the rear as far as the front of the comb. out discouraged when I met him. It seems nobody at the show had the least interest in his gun although nobody would tell him why. I told him I might be interested and he allowed me to examine the rifle.

My first impression was that it was a really nice job of converting a military rifle into a hunting gun. The stock is plain walnut with a nicely executed cheek piece, decent checkering and a delicately shaped schnoble forend tip. The style is classic and very pleasing overall. Upon closer inspection my admiration for the gunsmith that carried

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The old commercial stock needs the same kind of help from proper bedding and reinforcement. The action coated in release agent is then put in place for a perfect fit between stock and receiver. this off fell sharply when I noticed chips of wood missing behind the receiver sight and a crack running through the wrist. There were also repaired cracks at the forend tip and the pistol grip but those were probably from damage in the field or when the gun was dropped.

I can forgive that but whoever stocked the gun committed some serious sins. The commercial stock has no reinforcement behind the recoil lug and an oversized and unreinforced tang screw hole. As the gun was used, each shot drove the top tang into the stock like a splitting wedge. The result was, naturally, a split piece of wood. I pointed these out to the owner and explained that the action needed to be properly bedded and the stock repaired and reinforced.

I asked him how much he had been trying to sell the gun for and he said $100. I told him I thought that was more than fair and came home the proud owner of another sporterized Mauser. I keep telling people that since I am a lefty I have no interest whatsoever in right handed guns, especially bolt guns. However in looking at my accumulation of guns I think I've been lying to them. At last count I had 18 right handed bolt rifles ranging from .22 to 8mm and only 3 left handed bolt guns. How the heck did that happen?

Well part of the answer is that I collect military guns and that accounts for 15 of them. The easiest and least expensive thing would have been to simply glue up the cracks in the stock, bed the rifle and go shooting. Being an idiot, I decided to take the gun to the next level and make a few improvements.

I broke out the Brownells catalog and ordered a Glasbed kit, a Timney Sportsman trigger and a Timney low safety to replace the military trigger and safety on the gun. $126 later I had more than doubled what I had invested in this project. Still, $226 is a bargain price for any centerfire rifle today. While waiting the two days it took for the package with the goodies to arrive from Brownells I disassembled the rifle and stripped the stock.

The stock had an oil finish and plenty of gun oil had been absorbed into the wood over the years. I used Far With full contact and the recoil area reinforced, our stock repairs will hold for thousands of rounds. The sporter is not only prettier, it's a lot lighter with all that wood removed.

You could make this conversion easier and free of any worry over splitting or breakage with a synthetic replacement stock. To my eye, wood is prettier and plastic stocks, for all their positive attributes, have neither soul nor personality. Birchwood Casey Gun Scrubber to flush out all the oil from inside the cracks and repaired them with Hot Stuff Instant Glue (Brownells # 862- 100-002AD), a strong, water-thin glue that easily wicks its way into the cracks and instantly bonds the wood back together.

The Timney trigger (# 883-100-398AD) dropped right in with no fitting or fuss. If you can drive out a pin and turn a screwdriver, you can install an aftermarket trigger on a Mauser. The Brownells Glasbed Kit (#081-050-101AD) is a dream to use. The epoxy is pre-colored in brown or black and comes packed in a two part plastic bag. There is no measuring, no mess and no concern about getting the mixture right.

You simply remove the heavyduty plastic bag from the clamshell package, place it on your bench and press down on one side of the bag, forcing the contents into the barrier that separates it from the other The job takes little more than removing and reinstalling a pin. Here it is shown on the rifle with the removed military trigger. component. A bit of pressure and the barrier that keeps the two parts separate pops and the two components mix.

Kneed the bag for four minutes until the brown and the white parts are all one shade of brown, cut off

Today, we can buy replacement bottom metal with hinged floorplates but what I wanted was a gun that looked like the work had all been done in the golden age of military sporters. Sure, it's pretty, but will it shoot? There's only one way to find out. a corner of the bag and squeeze the epoxy into the stock recesses. The whole process is so much neater than the old method of measuring both components into a cup, adding dye and mixing them. Anyone can do it successfully.

With the stock repaired and refinished, the action rebedded and the barrel free floated, I also recrowned the barrel just to be sure it was absolutely square with the bore. The gun is still wearing its number matching 8X57mm barrel from WWII and the That's about as well as these 65-year-old eyes can shoot with iron sights at 100 yards. Wonder what we could do with a scope? bore is best described as dark with strong rifling and certainly not one to build a lot of confidence in its accuracy potential.

Bore scopes aside, I'm a believer in the adage that every barrel is an enigma and the only way to predict how it will shoot is to shoot it. I hoped for 3-4" groups at 100 yards. That would be adequate for hunting in Missouri's heavy cover but wasn't sure my 65-year-old eyes and iron sights could still pull that trick off. Much to my surprise and delight, the first five shot group showed four shots within an inch with the fifth shot opening the group to two. "Wow," was all I could say.

I have to wonder what the gun would do with a scope? The economy sporter was left just as I got it. Cut military stock, two stage military trigger, stock hardware and military sights. As I mentioned earlier, I hope to return it to its WWII configuration even though it is a WWI era gun. If the original barrel hadn't been cut I would have returned it to the GEW configuration. Once again, the bore was rough with strong rifling and I was absolutely shocked when it put five shots into three inches at 100 yards.

Both these Mausers would be excellent choices as deer rifles for the budget-minded hunter. The GIs that brought them home and the gunsmiths that converted them knew what they were doing. They created an industry around surplus Mausers in the 50s and their work is still doing what it was converted to do: Provide an inexpensive hunting rifle that packs an accurate punch to the hunter on a budget. AG

RESTORATION

Refinishing Or Restoration?

Figuring out how best to improve a customer's firearm will help you serve their needs best.

BY WENDELL DEANER JULY 2014 ORIGINAL PP. 16-19

When a customer comes in your door toting Pap's old smokepole and tells you he wants to have it restored, does he really? Maybe he just wants to get the stock touched up or the piece reblued. Maybe he just wants to be able to shoot it. Or, maybe he isn't sure what he wants. A few questions are in order. Does he know the difference between refinishing and restoration? Refinishing means just that, stripping the old finish off and applying new.

There is nothing wrong with this and it has been bread and butter for a lot of us. I personally take a lot of pride in transforming an old clunker into a handsome, functional piece. Recutting checkering, polishing and rebluing the metal and applying a pleasing finish to an old chunk of walnut are all jobs I enjoy, but that is not restoration. Restoration is returning a firearm to its original condition, that is, new from the factory condition. Not an easy task when your gun may be 100 years old.

Refinishing can be accomplished in most of our shops, and prices are reasonable and in the reach of almost anyone. Restoration is a specialized process that requires expertise, applied knowledge and the wherewithal to do this kind of work. It also takes years of study and more than a good deal of dedication to the craft. We have to determine what the customer wants and what we can do. There are very few actual restoration experts in the country. One of the finest and most established is Doug Turnbull.

The guns coming out of his shop are truly works of art and fully functional as well. He works his magic on about any type of firearm, but his shotguns and lever actions are truly a sight to be seen. I am the first to say that I can't do what he does. Many different factors go into restoration. Color case hardening is an art form not practiced by Without proper tools, you will only be messing things up, be it restoration or refinishing.

Have good padding and make sure you don't crush any delicate parts like shotgun barrels. With a big vise like this one it's easy to do. many nowadays, but there is more than one way to do it. This process was used by the old firearm's makers more than it is today, and often had subtle differences from one run of manufacturing to another, even on the same gun from the same manufacturer. Turnbull has studied these types of things and will make sure your gun is historically accurate.

Another area is wood finishing, also a challenge because of the many techniques and different grades of stocks that could be fitted on the same gun. Subtle color differences between parts of fine guns, how screw heads look and fit, engraving, are all challenges for the restorer. If you think you can do it and want to save some money, Turnbull has a video on how to prepare your gun to send to him for the final restoration process. Some questions need to be answered. Can your gun be restored?

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There are other brands but these work as advertised. Study old examples. Are parts missing? Is the wood so damaged that it can't be brought back to life? Parts can sometimes be found. Wood can be replaced, but neither will be original, though (if done properly) it would take an expert to tell the difference. Also, a heavily engraved or otherwise unique firearm is best left to the professionals from the get go.

If you want to try your hand at doing some of the metal polishing—this can be a time consuming (expensive) process when actually doing it by hand—go for it. Be aware that not all guns were polished the same and can vary considerably from year to year. Study original condition firearms like yours before starting the polishing project. Some guns were polished mirror bright and some to as little as 120 grit. The lines of polishing can also differ.

When you are ready, some of the tools you will need are safety mask and glasses, assembly/disassembly books and schematics, vise with padded jaws, pin vise, ball peen hammer, files with safe edges, needle files, screwdrivers and punches, abrasive cloth in 80-600 grit, 0000 steel wool, oil, Happich Simichrome Metal Polish, Acraglas gel and release agent, wooden dowels and sanding blocks, bench grinder holding a 0.0025" wire brush wheel, degreaser, and bluing solvent.

A rock-solid vise is mandatory to hold parts when polishing. Be careful because many parts, including shotgun barrels, are easily crushed by a powerful vise. Always use pads to protect your work. The barrel is 400 grit. The action was left in the white and I blued the barrel. I like the way it looks and it was mine, so I suited myself. Never again. You'll only do more harm than good. Engraving complicates the polishing process. You don't want to sand these areas.

Cover the pretty stuff with masking tape to protect it. Before you do, make what is known as a "pull." Coat the engraving with inletting black using a cotton swab. Take apiece of clear tape and press over the engraving. Transfer that tape to a sheet of good white paper and you will have a clear picture for the engraver who may have to recut or otherwise touch up the engraving. The pull will be a map for the professional showing how to proceed on your particular firearm.

REFINISHING OR RESTORATION? CONTINUED

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If you can, make jig to hold the parts for polishing; the steadier the better for this process. Using Acraglas to make holders for unusual shapes can be a big help. Screws are another matter. Some old screws aren't available new and must be handled with care. Others are highly engraved and should be left alone for the restorers. Some can be restored even if damaged.

See my article in the August 2010 issue of this magazine, "Repairing Damaged Screw Heads." Don't do anything if it will be different from factory screws and distract from true restoration. If you're not sure, leave it to the professionals. It goes almost without saying to use the proper fitting screwdrivers, but, there, I said it anyway. I guess I'm getting tired of having guns brought into my shop with boogered up screw heads. To recap and enhance a few points: 1. 2. Clean all screw slots.

Take pulls of any engraving and stamped areas. Protect all engraved or stamped areas with tape. Have safe storage for parts. Watch out for captive springs in magazine tubes and holding firing pins, etc. Some of these are darn near irreplaceable. Do not remove barrels without proper tools. If you're not sure or haven't done it before, leave it to the restorer. After disassembly, degrease and clean all parts. 3. 4. 5. 6. 7. Finish removal 1.

Before doing any metal polishing determine the final direction of the original finish. Use a padded vise and make sure 2. Co. Co. you do not crush fragile barrels as on shotguns. Rotate your sanding blocks around the barrel frequently to prevent flat spots. Use degreaser and bluing remover, such as from Birchwood Casey, to remove bluing and rub off with steel wool. Rinse with hot water. Usually you can start the polishing process with 120 grit paper, however, each gun is a law unto itself.

Some are final polished to 120 grit and some on up to 600 grit. Lever actions are usually polished about 240-320 on parts and sometimes up to 600 grit on the actions. Take care and do not polish bearing parts as this could be detrimental to critical function of the firearm. Stay away from the sear area of the trigger. 3. 4. 5. Some parts are fitted together. If so, polish them together to keep the lines properly in sync and aesthetic.

REFINISHING OR RESTORATION? CONTINUED ORIGINAL PAGE 19

Co. Turnbull recommends polishing the curved surfaces before the flats and to polish towards the flat. I have done it differently in the past, but I won't go against the experts. When polishing screw holes make sure you polish the entire area, not just to one side. Nothing looks worse than messing this up. These are just common sense guidelines, and all of us should understand these techniques. On a highly polished area use a final polish of Simichrome on a 0000 steel wool pad.

It will really touch up the work and make it shine. Using a wire wheel of the six-inch diameter 0.0025" variety is another option (Brownells # 360.164.581WB for the two rows size and 360.164.631WB for the four rows.) This wheel is very fine. If a matte finish is called for, a light coat of oil should be applied to the part before final polishing. Finally, there is no sense in polishing brass parts of a gun if you want to preserve its color. After all this is done, wrap all parts so they can't touch each other.

Include in your package your name, daytime phone number, type of firearm, what you want done, and a list of parts enclosed as well as the insurance value of your piece to Turnbull Manufacturing Company turnbullmfg.com). You may want to ask yourself if you want to do this. If you feel competent and have the resources and time, why not? I have done some metal polishing in my day. It is a good skill to possess and you will learn something as well.

I'm not sure how much money you will save by doing this work yourself but it is probably substantial since this is a labor intensive job. If you have a customer with a firearm that's worth trying to restore I would go for it. AG Co.

REFINISHING OR RESTORATION? CONTINUED ORIGINAL PAGE 19

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PEOPLE & COMPANIES

AR-15 Chamber Selection, Part One

BY JOE CARLOS JULY 2014 ORIGINAL PP. 20-22

If you want to start a good fight, get a barrel maker using button rifling in the same room as another manufacturer employing cut rifling. Perhaps the second bloodiest brew-ha would be to ask two armorers which is the best AR-15 chamber. If one of those gunsmiths happens to be a military builder and the other caters to civilians, the cuts and bruises will likely be worse.

Since I have about a decade working for a big military shooting team and an equal amount of time catering to civilians, I figure I'll be more than capable of ruffling a bunch of feathers in both camps. This discussion will be limited to chambering for the original .223 Remington/5.56mm cartridge that most shooters are still using. The number of possible AR-15 chambers is nearly infinite.

There are reamer companies out there that will custom build a chamber reamer to your specs leaving the possibilities almost as endless as the human imagination. Therefore, we will try to confine our discussion to the more common chambers in general use today. The first questions to ask yourself or your customer are, "What is the finished gun going to be used for? What bullets will be fired in it?" Most folks will be using ammo set to magazine length which makes the chamber selection process much more limited.

I cater to National Match Course Service Rifle competitors—the Camp Perry crowd. Most of them actually shoot two different bullets. Their match starts at 200 and 300 yards shooting magazine-length 75 or 77 grain bullets in standing and rapid fire strings and they finish all the way back to 600 yards where most switch to more wind resistant and heavier 80s or 90s. Since 600 yard shooting is a slow fire stage, shooters usually single feed their ammo and seat the bullets out well beyond fitting in a magazine.

Chambers for these competitors are normally a compromise between what works best for the shorter ammo verses the long stuff and there is a fair amount of disagreement between gun builders on the specifics of those compromises. VLD bullets, bullets with thin jackets, military ammo, and brass and propellant preferences can also come into play in selecting a optimal chamber for any AR project. Specifics of the rifling will also need to be considered in some cases.

Before proceeding we need to include a few user friendly definitions. First is Overall Length, the distance from the rim of the cartridge to the tip of the bullet with the bullet seated to where it is just contacting the lands. This is measured with an Overall Length Gauge, such as the Stoney Point unit now owned by Hornady, consisting of a hollow rod with an insert and a dummy cartridge casing screwing onto the front.

Some gunsmiths and reloaders make their own chamber-specific dummy casing using fire-formed brass. The convention is to take this measurement with an 80 grain Sierra Matchking bullet, even if shooting another bullet, to get a common reference when communicating with other shooters. If one person takes his reading with a Berger 90 grain boat tail and someone else measures with a 55 grain FMJ there is no common reference because the bullets differ so much in shape, specifically, differing ogive profiles.

Outside of talking to others, there are many applications where you will be using the actual bullet you are firing. Looking at a typical Wylde chamber schematic you'll note there is no overall length annotated, largely because every time the rifle is fired this gets longer as the throat erodes forward (and gets rougher) due to the hot gasses eating away at the metal in that part of the barrel. It is mostly this throat erosion that wears out a gun barrel with the rest of the rifling changing very little.

The part of the chamber the body of the case occupies doesn't vary much between common reamers with the exception of the NATO chamber spec, which is just plain fat almost everywhere to keep functioning in dirty battlefield conditions. The front parts of reamers vary quite a bit, however, so we will spend most of our time studying those dimensions. We will start at the neck and work forward. The diameter of the neck is important for two reasons. The first is function.

Get the neck too tight and you will likely induce jams. The second is accuracy. Get the neck too loose and group sizes can get fat and fliers can be more common. There are variables that you and your reamer maker need to take into consideration. What is the rifle going to be used for? If you are magazine feeding some or all of the time you don't want a tight neck.

However, if you are building a gun just for long range belly shooting from 600 to 1000 yards and single feeding long ammo with heavy bullets, there is benefit by shrinking the neck diameter 0.003" or so. Some advanced handloaders outside neck turn their casings. This shaves brass off about

25") ammo, such as the Black Hills 77 on the bottom. Using the same gun, they shoot 600 and 1000 yard lines with long-seated, heavier bullets like the behemoth Berger 90 grain on top. 50% of the surface of the outside of the case necks. With regard to chambers and reamers, outside neck turning makes the case necks skinnier and a tighter neck dimension in the chamber is helpful. However, if the shooter is mixing ammo for Across The Course shooting the chamber neck needs to match the fattest ammo used.

Magazine fed, magazine length ammo for rapid fire without turned necks require room in the chamber or risk the possibility of feeding malfunctions. Brand of brass is another consideration as it varies in thickness between brands. And brass thickness isn't entirely consistent from lot to lot even from a single manufacturer. I tried— and soundly rejected—some Lapua .223 brass a couple of years ago, having used their cases in other cartridges successfully.

That particular lot was significantly heavier than Lake City and Winchester military brass and the measured case walls were thicker. To no surprise, the thicker walls shrunk internal case capacity and pressures jumped noticeably. I ended up adjusting powder charges down a half grain to keep primers from blowing out. The neck diameters were fatter with seated bullets as well.

While I achieved reliable feeding in my Wylde chambers, some reamer makers might have recommended going a little fatter in neck diameter as insurance for 100% reliable function. Referring to the reamer drawing, note the area just in front of the case mouth labeled "lead," often spelled "leade" or called freebore. Confused yet? With so many spellings and labeling it's no wonder people scratch their heads. Leade is an area with no rifling or lands.

It is normally the same as the bullet diameter, with 0.2240" being the most common groove diameter in AR-15 barrels. The leade is sized to help keep the bullet from tipping to the side on its way forward but without offering resistance. Much like headspace, we don't normally mess with making any changes to this dimension and the reamer manufacturers will just usually use the 0.2240" size automatically unless specifying a reamer for NATO chambers.

Tightening this diameter up too much creates function and pressure issues, and accuracy can suffer. While the diameter of the leade is normally just set at 0.2240", the length of it varies between chambers and the reamers that create them. The length of the leade conspires with the throat angle to arrive at the overall cartridge length. Moving forward in the chamber, at some point the bullet needs to contact the lands and that area on the drawing is the throat.

The throat is important, creating plenty of press and worry, and rightfully so. A bullet abruptly slamming into the lands would be damaged, so the throat is tapered in a funnel or cone shape to allow a more gradual entry into the lands. The amount of this tapering varies between chambers in general and .223 is no exception. Tapering is expressed in degrees and minutes and you would think that it would be called "throat angle" but often isn't.

It is frequently called "leade angle." In the Wylde chamber schematic, Pacific Tool & Die expresses it as 1 degree and 15 minutes, written 1°-15'. So that everybody can be confused, however, other writers and chamber manufacturers sometimes write that as a decimal, 1.25 degrees. There are 60 minutes in a degree, so 0.25 degrees is a quarter of 60, or 15 minutes. There is no difference between 1°-15' and 1.25 degrees.

I wish we could all agree to standardize how this is written but that isn't likely so you'll need to cipher the math in your head and to express what you want when custom ordering a reamer from various manufacturers. Reamer makers are used to this differing jargon so either method of stating the angle should be understood by them.

To be on the safe side, however, it is difficult for anyone to misunderstand when writing out in long hand, such as "1 degree and 15 minutes." Throat/leade angles vary in .223/5.56mm chambers. The popular Wylde chamber with a 1 degree and 15 minute angle has a very gradual taper. The more gradual the taper, the longer the throat will be. I have seen a few chamber reamers in this car-

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Middle, a Hornady Overall Length Gauge for measuring overall length with an 80 grain Sierra Matchking. On bottom is a headspace gauge to check shoulder bump. The "throater" is on the left and a tight neck Wylde is on the right. Note the pen pointing to the pilot bushing. The dummy cartridge was provided to the reamer manufacturer when the order was placed. tridge with a more gradual taper at 1 degree and 13 minutes but they aren't common.

There are a fair number of reamer designs out there, however, that go slightly steeper at 1 degree and 30 minutes and some much more abrupt in angle at a little beyond three degrees. A three degree throat will be shorter than a more gradual 1 degree and 15 minute one. How much difference do these various throat angles make in practical application?

When Bill Wylde settled on his gradual 1°-15' angle his considerations were to provide support to guide the bullet straight into the center of the barrel while offering a minimal amount of deformation to the bullet. When I first began developing loads for the 90 grain Sierra Match King in early 2006 I was using Wylde chambers exclusively because they had been so successful with the 80 grain SMK bullets.

The jackets on those 90 SMK bullet were, unfortunately, too thin and the bullet soon earned a reputation for blow ups. In fact, Sierra credited me with the first reliable report of this problem but they were soon deluged with complaints. As a military armorer I saw it as part of my job to work with manufacturers to make products better, more reliable and more accurate and was speaking with Sierra quite frequently about this.

It was always their belief that most problems with the 90 grain jacket failures had to do with rough obduration of the base. I agreed in part with Sierra on this but felt other areas of the bullet were also weak. Building on their rough obduration theory, the amount of the bullet buried in the casing below the neck was considerable. When VLD bullets were being made with thinner jackets than today there was a notion that having the bullets extend below the neck caused rough obduration among other possible problems.

When the hot expanding gasses "smack" the base of such a bullet with no neck support the idea was that the bullet began obdurating and the back of it swelled out in an egg shape. As that swelled out part entered the barrel it had to be swaged back down, stressing the bullet quite a bit.

Since the 90 grain SMK jacket was obviously quite thin and since the bullet extended down inside my casings when seated for Wylde chambers, I decided to try a longer chamber to see if moving the bullet up in the casing to match the longer chamber would result in less deformation caused by rough obduration and lack of neck support to the sides of the bullet. I was having some barrels chambered at the time by a company that had both a Wylde reamer and another with a longer leade similar to a NATO chamber.

Using the reamer with the longer leade, we expected to lengthen the 90 grain SMK seating length as much as 0.075" before the bullet came in contact with the throat. Doing so gave better case neck support to the bottom section of the bullet and we expected to lower bullet blow ups and maybe even cure them entirely. Not! The exact opposite happened which made no sense but did fit William Bell's prediction ("In any search for knowledge there are always unintended consequences".) Bullet blow ups went through the roof!

I talked with the folks that had done the chambering and they dug out their chamber schematic. We discovered that the throat angle was just a little steeper at 1°-30. You wouldn't think such a tiny departure from Wylde's would be so stressful to the bullets but there was no other explanation. The company had a "throater" reamer that only cuts at the throat and does not touch the body or the shoulder of the chamber at all.

Their throater was set up to cut a Wylde angle, so I returned the whole shipment of barrels and had them rethroat them to Wylde specs. When they came back the incidence of bullet blow ups dropped back to "normal" but some bullets still continued to blow up and that failed to completely cure that problem. The whole scenario convinced me that gradual throat angles stress bullets less. What benefit this is to more "healthy" bullets with thicker jackets, I can't say for sure.

To clarify, this example points to evidence that the front of bullets can be stressed by more abrupt throat angles. Although the test was designed to lessen stress to the back of the bullet during obduration, it was not possible to either prove or disprove whether or not longer chambers are beneficial and this theory remains open. Next time we will look at specific chambers and their applications, discuss ordering a custom chamber reamer, and ruffle some feathers with "Encyclopedic Error." AG

SHOTGUNS

Reader Forum

BY AMERICAN GUNSMITH EDITORS JULY 2014 ORIGINAL PP. 23-24

Mossberg 500 I recently purchased a Mossberg 500 .410 pump-action shotgun with 24 inch barrel. Soon after, I began experiencing some ejection problems. The shotgun will chamber and extract, however, the it does not always eject a shotshell or spent hull. Can you offer any suggestions, or direct me to a parts list and owner's manual? I have written to the folks at Eagle Pass, TX but have not yet received a response. Also, do you have a good, current address and phone number for contacting O. F. Mossberg?

Robert Lindamood Whitleyville, TN Some possible causes and cures: Loose ejector screw needs tightening; broken ejector needs replacement; damaged extractors, springs or pins need replacement; right and left extractors are reversed and must be reassembled/reinstalled correctly. The address you sent us in Eagle Pass, TX is for Maverick Arms. The address you want is O. F. Mossberg & Sons, North Haven, CT 06473, phone When contacting them, request an owner's manual for your .410 with schematic and parts list.

Ohaus Powder Measure I have been enjoying the two-part article "Requiem For A Gunsmith" by Wendell Deaner (American Gunsmith September and October 2013) and saw the picture of his Ohaus powder measure. It is much too good a machine to let lie idle due to a broken hopper. I suspect all of them have broken hoppers by now due to a design flaw in the hopper. My cure is both elegant, simple, and inexpensive.

Take a one liter plastic soft drink bottle and thoroughly rinse it out (like making sure a gun is empty before working on it.) Reduce the OD of the threads on the neck of the bottle until it is a snug fit in the body of the measure (I used a belt sander.) Cut the bottom off the bottle and turn it around to make a lid. Author Wendell Dwight Deaner responds: Thanks for reading our magazine and commenting on my article. I really like my Ohaus measure and powder scale, which is the same as the RCBS 10-10 scale.

While there are a lot of good products on the market for reloaders, some of the old ones can't be beat and deserve to stay in service. My measure "fixed" with the duct tape has been in use for a very long time. Your fix is simple and well thought out. I am going to try it. By the way, search eBay.com for some of this stuff. It's amazing what you can find. Charter Revolver Reassembly I ran across a "fix" that might help the readers along the way.

I recently had a Charter Bulldog Pup in the shop that had a very rough second stage of the ejector rod. Disassembly of the cylinder (ejector rod, extractor star, and accompanying parts) revealed some very rough surfaces that were quickly cleaned up. During reassembly, you need about four sets of hands to align the ejector rod pin hole, the extractor star pin hole, and the ejector rod bushing pin hole—all of them under spring pressure—to reinsert the small slave pin that holds the entire assembly in place.

The problem with four sets of hands is that you run out of space! I did solve the puzzle, though, with the use of an extra Dremel tool collet I had in the tool box. The collet is the perfect size for inside and outside diameter to depress the ejector rod busing into the extractor star area and keep it depressed while moving the ejector rod in perfect alignment with the slave pin holes. Once aligned, a small pin punch was inserted (with my third hand!) and then the slave pin was reinserted afterward.

I have put that collet in my "specialty parts" box and labeled it for Charter revolver cylinder reassembly. I am sure there are actual tools made to perform this task, but this might help the gunsmith that doesn't want to buy a specialty tool for every gun type and application. Rocky Giordano Mark R. Hollensen Bench Mark Performance Services benchmarkperformancesvcs@aol. com Thanks for this tip! Should prove helpful to some readers.

Walker Sight In Since the 1847 Walker Colt shoots about a foot high at 30 yards, would it be possible to file the hammer notch deeper or would it be more advisable to barrel mount a rear sight? Garry Moore Neither. Add material to the height of the front sight incrementally until you have established lower hits on the target. Then make the adjustment permanent whether it is composed of metal, rods of light-collecting plastic, such as a Fire Site, or highly illegal ivory.

Browning Buck Mark Do you have any info on field stripping a Browning Buck Mark pistol? I checked my back issues and the Browning web site. R. Presnall You didn't find a Buckmark reference because we covered its predecessor, The Challenger, in October 1995. There are plenty of differences between the two pistols but we don't believe field stripping to be among them. Call Browning/Winchester Customer Service, they should be able to come up with an owner's manual.

Union Arms Model 24 I have a Union Arms Company Model 24 pump shotgun in my shop and can not get it disassembled. John Harris Harris Gunsmithing

The shotgun was last produced in 1913. In 1917 Union Arms was taken over by the Ithaca Gun Company. In turn, Ithaca dissolved and was re-instituted as Ithaca Gun, USA We have our doubts they have much knowledge regarding a gun that old but they might be able to steer you to someone who does. S&W Model 1006 I'm looking for information on the old S&W 1006 in 10mm. I have tried Smith and Wesson, Brownells, Numrich Arms, and book dealers at the gun show but nobody seems to have any literature on the 1006.

I need data to repair and adjust the rough trigger pull. Can you direct me to where I can get detailed information? The owner's manual gives cleaning and other superficial information only. By George, we addressed the Third Generation pistols in our June 1993 issue. Being a member of that family the 1006 was included. Before discussing your request further, these S&W pistol's sear and hammer engagement angles should not be altered, merely refined.

In that respect they differ not from any other firearm, especially those primarily manufactured to serve as duty weapons. Therefore, your request for lessening a gritty trigger pull will not involve engagement angles. It will instead be dedicated to the reduction of friction.

At every Armorer's School this responder has attended, which includes most that are offered, the instructor has stressed to all present that the best way to respond to "trigger job" requests from members of their respective departments while assuring reliability was and will remain a matter of reducing/eliminating friction between the weapon's internal and external components. Friction causes drag. Drag causes gritty and/or weighty trigger pulls.

Smooth out the causes and, though a trigger pull of over 7 pounds may actually remain 7 pounds, it will feel much lighter to the operator. In extreme cases of generally poor production practices or the rare final assembly mishap, the reduction of friction has extended to a need for brightly polishing every pivot pin in a pistol and doing so without changing tolerances. We trust and believe your S&W will not have suffered either extreme.

We advise against George Ohara the use of any files and recommend using only the finest of emery cloth along with the reamers to be mentioned in the following text. One of the things that can cause drag in your pistol is the presence of burrs or roughness in the draw bar spring and plunger hole. It's located forward of the trigger guard and requires the first reamer you'll be using. Drag can also be caused by the draw bar rubbing against the frame.

Solution: Polish both flat sides of the draw bar and smooth up any frame surfaces it has been contacting. Another reamer is required to remove any roughness from the disconnector and magazine catch holes in the frame. A third reamer is required for the slide stop lever hole, a fourth to true the hammer/trigger insert pin hole and a fifth to do the same with the sear pin and magazine catch plunger spring holes. Do not attempt to substitute these reamers.

They've each been designed specifically for the jobs they do and they do them without any risk to tolerances necessary for safe, reliable function. Brownells should be able to provide each reamer mentioned. If they cannot, consult with S&Wand be certain any reamer purchased meets their specification for the intended task. Finally, the Third Generation disconnector is supposed to move freely when riding between the sear tangs.

Assure that it does by polishing both disconnector flats and the inner surfaces of the tangs. Two other things to consider are the hammer spring and the polishing of the hammer strut. A Third Generation factory spring is rated at 20 pounds. Wolff Precision Springs offers 16, 17 and 18 pounders. The lighter spring will lessen pull somewhat while the strut polishing reduces, you guessed it, friction. Remember, sissy triggers and full power loads do not always perform as required of a duty weapon.

TEST FIRE THE PISTOL AFTER ALL WORK HAS BEEN COMPLETED. AG

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