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PRECISION ARMS WORKSHOP

AND THE AMERICAN GUNSMITH ARCHIVE

A TECHNICAL JOURNAL OF CRAFT, REPAIR & RESTORATION

03

ARCHIVE ISSUE NUMBER

INSIDE THE ARCHIVE

AR-15 FLIERS, PART 2

NEW CNC EQUIPMENT • RUGER LCP II AND LCR HANDGUNS • NEW SIGHT TOOLS • STUCK CASE REPAIR

ORIGINAL METHODS. MODERN ACCESS.

ARCHIVE EDITION 207

DIGITAL ARCHIVE EDITION

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MACHINING

New CNC Equipment

BY AMERICAN GUNSMITH EDITORS MARCH 2021

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Tormach, Inc. (Tormach.com, has new shop items for both beginning and experienced Computer Numeric Control tool users. The xs TECH Router Mill with Path Pilot HUB is a ready-to-use tabletop unit ideal for students learning CNC fundamentals or for small jobs. Despite a small footprint that can fit on nearly any bench or similar workspace, the xs TECH features capabilities for cutting plastics, wood, and aluminum.

Intended as a starter CNC system for students learning CNC fundamentals, the xs TECH comes ready to run and is powered by a standard 120V outlet. The xs TECH comes with a wide variety of features including a 10.4" Touchscreen Path Pilot Controller, Keyboard, Mouse, and Jog Shuttle, Wi Fi Module, Electronic Tool Setter, 16-Piece Carbide Cutting Tool Set, and ER11 Collets for 1/8", 1/4", and 4mm. Aftermarket ER11 collets are available in 1/8-5/16" and 1mm-7mm sizes.

The Tormach xs TECH is now available for a \$500 discount with free shipping to the continental USA by going to Tormach's website and ordering the xs TECH using promotional code: xs TECH500. 8L Lathe For bigger jobs, Tormach recently released their 8L Lathe. Rigid enough to cut anything, from plastic to stainless steel and titanium, the 8L can be had in Entry, Deluxe, and Premium packages. The base model includes a tailstock, fully-assembled enclosure, and works with your tooling.

The Deluxe and Premium Packages include a stand with coolant tank, separate chip drawer, storage space, controller arm, LCD monitor, waterproof mouse and keyboard, a complete lathe tool kit, and OXA tool holder kit. The 8L lathe features a 5C spindle that accommodates parts up to 1" diameter. For larger pieces up to 8" in diameter, users can add a 3- or 4-jaw chuck. The 8L uses a OXA Quick Change Tool Post and the 1.5 HP (1.11 k W) spindle runs at 180-5,000 RPM.

Standard single-phase household power (115 Vac, 50/60 Hz, and a 15 A breaker) powers the unit. Stepper motors on the X and Z axes provide a feed rate of 150 IPM (3.8 m/min). The maximum workpiece length is 10" with the tailstock. The X-axis travel is 4.5", so users can accommodate apart that fully utilizes the 8" swing. Like all Tormach CNC machines, the 8L lathe is controlled by the Path Pilot software system.

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PEOPLE & COMPANIES

Ruger LCP II and LCR Handguns

Two small, lightweight handguns that are reliable, accurate, and easy to carry.

BY GLEN CALVERT MARCH 2021

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I own a Ruger Lightweight Compact Pistol II in 380 Automatic Colt Pistol and a Ruger Lightweight Compact Revolver in 38 Special. Both are small and lightweight and have proven to be reliable and accurate, making them ideal for concealed carry. I purchased them several years ago; the LCP II was initially offered in 380 ACP only, as was the original LCP. It is now available in 22 Long Rifle as well. The LCR was offered in 38 Special and 357 Magnum initially.

It is now available in 22 LR, 22 Winchester Magnum Rimfire, 38 Special, 357 Magnum, 9mm Luger, and 327 Federal Magnum. Lightweight Compact Pistol II The LCP is 5.17" long, 0.91" wide, and 3.94" tall weighing 12.70 ounces with 6 rounds in the magazine. It has a 2.75" long barrel with 6 grooves and 1:16" right hand twist. It is a simple blowback design with an internal hammer. The frame is made from glass-filled nylon and the slide and barrel are steel.

The only external safety is the blade in the center of the trigger that prevents the trigger from releasing the sear unless the safety blade is depressed. The sear incorporates a drop safety that prevents the hammer from falling if the gun is dropped with the hammer cocked. The top of the hammer is somewhat visible through the slots in the rear of the slide and frame. In good light

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I painted the sights for improved visibility. it can be used as a cocking indicator. Racking the slide partially cocks the hammer. Pulling the trigger retracts the hammer a slight additional amount and then releases it. There is no magazine disconnect safety and the gun can be fired without the mag in place. The LCP II offers several improvements over the original LCP. The biggest improvement is the trigger action.

The single action trigger pull is considerably lighter (5.6 pounds averaged over 10 pulls) and smoother. It has a short, positive reset and the effort doesn't "stack" like on the LCP. The LCP II has taller, easier-to-see front and rear sights. The slide locks open after the last round. LCP magazines will work in the LCP II but will not lock open the slide. Ruger added cocking serrations to the front of the slide.

The grips are molded on the frame, are slightly wider than the LCP, and are nicely stippled on the front, sides, and rear. The mag has an extension on the base but I can only get four fingers on the frame which is typical for this size handgun. The LCP II

ships with one magazine and a soft pocket holster. Field Strip The LCP II is a simple design with few parts. To disassemble, remove the magazine and make sure the chamber is empty. Rack the slide and let it go forward. Pry out the takedown pin on the left side.

Pull the slide assembly forward off the frame. The trigger does not need to be pulled to remove the slide. The recoil springs and rod are removed and the barrel is lifted out of the slide. Reassembly is the reverse. I find it easier to remove and install the takedown pin if the slide is retracted about 0.2". If the trigger is pulled with the slide removed, the hammer will go all the way forward and prevent the slide from being fully installed. If this happens, manually cock the hammer.

Lightweight Compact Revolver The LCR is Ruger's latest design of the snub nose revolver, which in one form or another has been around for along, long time. Ruger made some significant improvements to update the design for the twenty-first century. My LCR is chambered in 38 Special

+P and has an aluminum frame, as does the 22 LR and 22 WMR versions, while the 357 Magnum, 9mm, and 327 Mag have steel frames.

The LCR has a stainless steel barrel and cylinder with the frame, cylinder, crane, and ejector rod coated and the cylinder is fluted to save weight. The 1.87" barrel has 6 grooves and a 1:16" RH twist. The LCR is 6.50" long, 4.70" high, and the cylinder is 1.23" in diameter. It weighs 15.7 ounces loaded with 5 rounds. The LCR has an internal hammer and is double action only.

There is a transfer bar between the hammer and firing pin which prevents the hammer from striking the firing pin unless the trigger is completely pulled. There is no external safety as is typical for DA-only revolvers. The fire control group is contained in a polymer housing that comprises the rear part of the handgun. The trigger pull is the typical, long DA travel but it is smooth and doesn't stack. The pull averaged 9.5 pounds over 10 measurements and I've found the trigger pull can be "staged" to

RUGER LCP II AND LCR HANDGUNS CONTINUED

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improve accuracy. The initial 0.7" travel of the trigger indexes the cylinder and a slight amount of additional travel drops the hammer. The front sight is pinned to the frame and the rear sight is machined in the frame. The Hogue Tamer grip is comfortable when shooting and reduces the felt recoil. The advantage of the 357 Magnum version is Cleaning the LCR is easy, like most revolvers.

Open the cylinder, clean the chambers, clean the barrel bore, wipe down the frame and that's it.

Ruger offers the LCRx which has an external hammer and can be fired single action or double and it's available in all the same calibers as the LCR. At The Range I shot both handguns, standing with a two-handed grip, at 5, 7 and 10 yards using B-27 targets, firing 10 rounds at each distance. Both guns proved to be accurate, the results are in the table.

There wasn't a signifithat you can practice with 38 Special rounds and save the more powerful ammunition for serious business, if you don't mind the increased recoil. Personally, I prefer shooting 357 Magnum revolvers that have a bit more heft and barrel length. cant difference between the two handguns, both put all the rounds in the X, 10, or 9 ring with the exception of the LCR at 10 yards. In my opinion, the LCP II is easier to shoot accurately due to its lighter

RUGER LCP II AND LCR HANDGUNS CONTINUED

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Original caption: left top: LCR front sight is pinned to the frame. I painted the sights for improved visibility.

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and shorter trigger pull which is an advantage over the long DA trigger pull on the LCR. Each gun has its advantages. The LCP II is smaller, lighter, has a better trigger, a lower recoil, and 6 + 1 capacity. The LCR is slightly larger and heavier and only packs 5 rounds

but has significantly higher energy (stopping power) and, in general, would likely be more reliable. A semi- Bottom Far

Far left 380 ACP 95 grain FMJ-FN and 90 grain JHP, 38 Special 130 grain FMJ- FN and 110 grain FTX, 357 Magnum 158 grain JSP and 125 grain JHP. auto pistol can have an is-

sue will feeding or ejecting; typically ammo or magazine related. This means racking the slide, maybe ejecting the magazine, etc. With a DA revolver, if it doesn't go bang, just pull the trigger again. The LCP II and LCR have both proven to be 100% reliable for me with many hundreds of rounds downrange. AG

PISTOLS

AR-15 Fliers, Part 2

Ammunition-related causes of fliers.

BY JOE CARLOS MARCH 2021

ORIGINAL PP. 7-13

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Last month we said that two of the most common causes of fliers are gas tube misalignment and ammunition issues. We'll begin by jumping into imperfections in cartridge concentricity which is a major cause of fliers in any rifle or pistol. Our goal is to send bullets straight into the back of the barrel. If cartridge concentricity is compromised, bullets are set at a slight angle in the neck. When fired, they will enter the back of the barrel at an angle and deform.

It is possible to measure the runout using a gauge like the Hornady Concentricity Gauge (Hornady #050076). Runout is present in both factory and handloaded cartridges. Rifles vary in their tolerance to runout. Generally, guns jumping bullets further, either because they were chambered with long freebores or have eroded throats due to high round counts, will exhibit the lowest tolerance to runout.

As a general rule, I don't like to see competitors using ammo that has The Hornady gauge on the right can also straighten bullets that have been seated at an angle. anything over 0.003" of runout. The Hornady tool will also allow the user to actually straighten bullet alignment. Gauging ammunition, rounds with high runout that are straightened should be separated and tested to note any differences from those that started straight.

I am abbreviating this topic of concentricity by including some target scans that speak for themselves. A more thorough discussion is in my April 2016 and December 2018 articles. Pay attention to how the thickness of the brass in cartridge cases vary from side to side. This can cause bullets to seat at an angle in cartridge necks. It can also cause bullets to tip as they are leaving the cartridge and making their way into the back of the barrel.

Some remedies for this are offered in the articles and applying them can lessen fliers by a bunch. As you are gauging ammo for concentricity, take a few minutes to look at the rims of the cases for tears and deformations. The AR-15 as originally designed with a standard 20" barrel is not normally hard on case rims, although a rough chamber can exacerbate extraction. My September 2014 article on chambers described a simple and quick method to polish chambers.

Don't forget to use a chamber brush in your daily cleaning. If you area handloader, be sure to tumble your brass to remove surface crud that can make extraction more difficult. Soft brass is another factor that can result in torn casing rims. I blamed soft Nosler brand brass for rim deformation in an article on the 22 Nosler published March 2019. I remembered guys bad

mouthed Federal 223 Remington cases back in the day for poor primer retention and torn rims.

I have not used Federal brass in the 223 Remington in decades but I did find Federal and Starline brass to be too soft when testing the 224 Valkyrie. Dwell Time We saw a marked uptick in ripped casing rims when shorter barreled ARs started becoming increasingly more popular. The reason for this is the location of the gas port. For awhile, there was a tendency to move the gas port back toward the chamber in connection with shortening the overall length of carbine barrels.

Taking that approach influences the timing of extraction. The closer to the chamber we locate the gas port the sooner gas is going to reach the bolt and begin unlocking and extraction. The original timing of 20" barrels allowed chamber pressure to drop and cases to begin to "spring back" toward their original size, creating the clearance with the chamber enough to allow easy extraction.

With carbine gas ports located closer to the chamber there is a tendency to start extraction before casings have had time enough to begin to "spring back" to a smaller diameter that won't grip the side walls of the chamber, making extraction more difficult and causing torn rims. Gunsmiths have gotten smarter about this gas

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port business recently and we are seeing a lot of builds with the gas block well forward of where we saw them a couple of decades back. I discuss this with customers wanting a short barrel build. On all the barrels that I stock in 26" to 32" I move the gas port 2" forward than normal and get longer gas tubes to match from White Oak. That extra 2" delays extraction and rims remain pristine. We are trying to increase dwell time, which is the amount of time that the bolt remains locked up when around is fired.

In times past there used to be bolt carrier weights inserted in the back of the bolt carrier to delay opening. Unfortunately, I don't know of a current supplier but you may still find them. My study of these indicate they likely influence barrel harmonics and, therefore, can open groups or tighten them. For proper semi-auto function a slight modification to the buffer is called for in the instructions. The weights can also move point of impact so continue using them in order to hold zeroes.

So why do deformed case rims cause fliers? We want to send bullets straight into the back of the barrel every time the gun goes off. In order to accomplish that we need to seat bullets in line with the center axis of its cartridge casing. Then we must center the entire cartridge in the chamber, requiring the case head to rest flat on the bolt face. Tears in case rims normally go to the rear, creating high spots that will contact the bolt face and cause the entire round to cock in the chamber.

These gas gun chambers are not nearly as tight as some folks envision. I often find 0.003-0.007" of slop between a loaded round and the side walls of chambers. That much clearance allows rounds to cock at a significant angle away from the bore of the barrel. Far The top group, with two nasty fliers, was fired with ammo that was selected at random. The group on the bottom was fired with ammo from the same box selected for less runoff.

I prefer to buy quality brass, locate gas ports to lengthen dwell time, or use bolt carrier weights so I don't have to deal with

torn casing rims. That said, if you have some deformation to rims in spite of your efforts, handloading technique may help. Most folks loading for gas guns full length resize to enhance function. For hand-fed slow fire, this isn't necessary and creates slop. When a cartridge is fired in a chamber it expands outward until the walls of the chamber stop the expansion.

Then the casing walls spring back about 0.001" to easily extract and can be reloaded without being fully resized. The neck will obviously need to be sized back to have enough tension to hold anew bullet and the shoulder will need to be bumped back by about 0.003". A neck sizing bump die accomplishes this. Key here is to only use brass fired in your chamber. Accidentally using other cases will likely create a jam. Mark your cases and/or primers for easier identification.

My machine rest tests show that groups fired with neck sized brass will average 16% tighter than groups with fully resized brass. Obviously, magazinefed ammo needs full resizing.

AR-15 FLIERS, PART 2 CONTINUED

ORIGINAL PAGE 9

Soft Seating Bullets Some shooters competing in slow fire events who use bolt action rifles soft seat bullets. Cases are neck sized to result in low neck tension and bullets are seated a little longer than chamber length. The bolt is used to slowly push each round into the chamber. There will be no resistance to this forward movement until the long-seated bullet comes into contact with the back of the throat of the chamber. The shooter continues to push forward with the bolt.

While doing so the neck of the casing is riding up over the back of the bullet and the front of the bullet is simultaneously jamming tighter into the throat. Eventually a point will be reached where the bolt can be cammed down into its locked position. So far, so good, right? Perhaps, but if circumstances change the shooter may find himself in trouble. Let's say a cease fire is called.

Removing the chambered round extracts the case with the bullet remaining stuck in the throat, dumping propellant in the action and/or magazine. These same issues will take place if the firearm is a gas gun but a soft seat is more difficult as the AR bolt is held to the rear against heavy spring pressure by the bolt catch. When the shooter normally lays the cartridge on top of the magazine follower and trips the bolt catch, the released carrier slams the round into the chamber.

I call this hard seating and it ends up resulting in fat groups with a lot of bad fliers. See accompanying target scans. Seating Sweet Spot Every centerfire rifle I have ever tested had a specific bullet seating sweet spot where groups are tighter and fliers fewer. This is gun specific and has to be worked out on a test range by shooting groups. Before heading to the range, establish the "Length To Lands" for the specific chamber.

This requires a tool such as a Hornady Overall Length Gauge These groups were fired in the same gun. or Dead Center Sports Length To Lands Gauge. They both

need a caliber-specific dummy case that screws onto the front, a caliper, and a comparator made which fits to one leg of the caliper. A caliber-specific Bullet Insert fits in the top of the comparator. My June 2016 article "Bullet Seating Sweet Spot" details how to use these tools to arrive at the length-to-lands setting for your chamber.

Dead Center Sports has an online video (YouTube/BA3Sv0TB_1M) detailing how to use their gauge. Side note, if you experience a lot of variance in your length to lands measurements this may be a clue that cleaning rod flex has damaged the starting points of the lands just in front of the chamber. I discuss this next month along with what you will see in the bore scope.

With boat tail bullets your bullet seating sweet spot will end up being just short (0.000-0.010") of your length-to-lands with your ammo shorter than your chamber and bullets jumping a few thousandths before touching the lands. The bullet seating depth that you arrive at initially will remain sweet for the life of the gun and it doesn't require updating as the throat erodes forward. Very Low Drag (VLD) bullets normally want to be jammed a little into the throat, up to 0.010".

This means that you load the ammo just a little longer than your chamber. The challenge with VLD bullets is that as the throat erodes forward the shooter must take more length-to-lands readings and lengthen the ammo so the bullets jam into the throat by the same amount or suffer expanding groups. Most of us developing a bullet seating sweet spot end up with a bullet seating die setting where the sweet spot occurs. However, not all ammo seated at that die setting will measure the same in length.

Some folks question how this can happen if the die is not moved. The short answer is that variables other than

AR-15 FLIERS, PART 2 CONTINUED

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A. L (Over-All Length) Gauge on the bottom. the seating die can conspire to vary the final lengths. The thickness of the brass at the neck can vary by quite a bit. Necks that are thicker will resist bullet seating more, resulting in longer ammo. Outside neck turning may help this some and also may result in bullets seating straighter in line with the casing. This concentricity results in tighter groups and less fliers. Gunpowder is another culprit that can cause variations in final cartridge lengths.

Most shooters developing ammo for use in long range events use stick powder which normally fills the case more than ball powders. If the powder comes up close to the case neck it can resist bullet seating, resulting in longer ammo.

As stick powder is poured initially through a normal powder funnel into the case, there are variations between rounds in the way the powder packs, resulting in differences in the levels of powder making the seating resistance from Far Always use a match bullet seating die (right) to improve concentricity.

one round to the next vary. In the case of powders coming up close to the neck, seated bullets cause such charges to be compressed. A longer drop funnel is recommended to pack powder uniformly.

Packing powder can also influence the straightness with which bullets seat in the necks. If the top of the powder on one side of the case is taller, the bullet will meet more resistance to seating on that side and may end up cocking in the neck and creating runout. Brass brand also affects how powder packs. Some brands average thicker case walls and those hold less powder, making powder levels higher. In general, Western Cartridge Company and Lapua brass are thicker than Lake City and Winchester.

Chambers also have a big vote in bullet seating. A chamber with more free bore will result in bullets seating out further so the bases of such bullets meet less resistance from the powder to seating. Unfortunately, this chambering occurs at the "birth" of the gun and is not normally a repair option. So, we as gunsmiths need to spend a few mo-

ments with our customers before we supply a barrel so we know what disciplines the gun is intended to be used and what bullets the owner intends to fire.

There are minor variations in the shape of even the best match bullets that can also contribute to differences in seating. You can observe this very easily using the caliper with the comparator and proper bullet insert. Run the front of the bullet into the insert, then close up the other leg of the caliper on the bottom of the bullet and take a reading. Repeat this process with several bullets out of the same box and you will notice some variance. This all points to slight variances in the ogive.

Quality match bullet seating dies do not come in contact with the actual tip of the bullet. There is a hollow stem inside the die that makes contact with the bullet ogive. So, variances in ogive dimensions result in variances in seating depth. I have known of some very serious handloaders ac-

AR-15 FLIERS, PART 2 CONTINUED

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tually sorting their bullets by base to ogive dimension attempting to achieve greater uniformity and higher precision. Ammunition, handloads and factory, all varies in length. I employ all of the tips described with the exception of sorting bullets and outside neck turning. Out of a 10-shot group I will have typically have one or two rounds going 0.002" long and a couple going 0.002" short with the rest measuring closer. Occasionally, I'll measure one round in ten varying measuring up to 0.003" off.

How much this matters is gun and bullet specific. Most AR-15s will allow errors of +/- 0.001" from the actual bullet seating sweet spot. Other ARs may tolerate or be only minimally degraded by rounds 0.002" off. Many guns will show differences with ammo 0.003" or greater off sweet spot length. How do gun owners know if their gun/ammo combination is shooting fliers caused by ammo being seated I prefers using a Bob Sled single round loading device instead of a magazine when shooting single fed rounds.

AR-15 (second from left), AR-10, and 22 Long Rifle exert no pressures. longer or shorter than optimum? The answer involves leaving the confines of a nice air conditioned building and venturing to a hot, dusty range. Shudder to think! The range testing needs to be conducted on a wind free day so we can isolate variables. Begin by using the caliper with the comparator and bullet insert in place on one leg.

Place the bullet of each cartridge into the bullet insert and bring the other leg of the caliper into firm contact with the casing rim and take the reading to within a half thousandth of an inch (0.0005"). Compare your cartridge base to bullet ogive readings Then close the bolt and fire the round normally. to the sweet spot length that you established when you determined your bullet seating sweet spot during previous range sessions. Mark or segregate rounds that are off by 0.003" or greater.

Using whatever procedure you normally employ for ammo testing (likely a bench rest with sand bags) shoot a five round group with ammo measuring within 0.002" or better and include one round at 0.003". When selecting that +/- 0.003 round make sure you are also measuring the concentricity of the cartridges you are considering. Select a 0.003" excess-length round with low bullet runout (0.002" or less) to avoid an additional confounder. For the test to be valid extraneous variables must be kept to a minimum!

Note the impact of each of the five shots using a quality spotting scope and note where the 0.003" round falls in relation to the other four. If any doubts exist, shoot a second group for clarification. If the rounds that where off by 0.003" from your sweet spot cause no fliers, that is good news! On the other hand, if the 0.003"+ rounds caused fliers, that calls for another round of tests. Shoot 4 shots that are either spot on or +/- 0.001" and then the fifth shot at +/- from the

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sweet spot to see if there's a noticeable change. If your range tests indicate that your gun/ammo combination is sensitive to rounds either ± 0.002 - 0.003 " outside your optimal sweet spot length there are ways of dealing with this. One of the simplest solutions is to measure all your rounds as previously described and cull out ammo that measures too long or short. Why would you deliberately shoot around that you know before hand is going to cause a flier?

The obvious question then becomes what are you going to do with the culls? The second method takes a little more time but results in some stellar quality ammo with zero culls. Turn the micrometer dial on your match bullet seating die up 3 notches from your normal sweet spot setting. If you are using boat tail bullets that do not require chasing the throat, you can seat a box of ammo for the next day or seat a whole case for the season.

If you are using VLD (Very Low Drag) bullets that mandate chasing the throat, you can only seat enough ammo for use the very next day because your seating length for the following day gets longer due to the amount of throat erosion created each day you fire the gun. The following instructions pertain only to boat tail bullets. After your initial seating with the +3 tick mark die setting (each tick mark should move the bullet about 0.001") measure all the rounds you seated.

Any rounds that measure either $+0.0005$ " longer than your C.) when they are permitted to lie in a hot chamber before being fired. previously-established seating sweet spot or rounds measuring exactly dead on your sweet spot get a pass and are boxed for

future use. Now you will come down one tick mark on the die to +2 and seat a second time all of the rounds that failed the first measurement. Remeasure all cartridges and accept, as before, all that now are either $+0.0005$ " or spot on and box for later use.

Come down another tick mark to +1 and re-seat all rounds that failed previously, remeasure and cull as before. Continue these same steps until all ammo has passed and been boxed for future use. This may sound like a very time consuming process but it only takes me a couple of hours to seat and measure an entire case of perfectly-seated ammo. Some bullets are more demanding regarding the sweet spot length than others.

Heavy boat tail .224 caliber bullets commonly used by shooters from 600-1,000 yards such as the 80 and 90 grain Sierra Match Kings and the Berger 80.5 and 90 grain boat tails are usually more forgiving. VLD bullets, on the other hand, are normally much more demanding and will not tolerate ammo loaded either much short or long. The most demanding bullet I have found is the new 95 grain Sierra HPBT Match-King. If you miss your gun's sweet spot by even 0.002" you will likely see degraded performance.

If you fire around with these bullets that misses the sweet spot by either ± 0.003 " you can expect a nasty flier. Once you have established the sweet spot of your particular rifle for the 95 grainer I strongly recommend you follow the above seating plan or you will suffer many fliers and quite a few of them will be severe! The high ballistic coefficient (.600) of this bullet is attractive but it doesn't come cheap in terms of labor.

Regardless of how you seat your bullets when feeding cartridges into your AR in slow fire events I strongly recommend using a Bob Sled single load device which has no spring or follower, just a trough at the top to allow the shooter to lay in around. Once you have done that, don't release the bolt catch to slam the cartridge along distance into the chamber. Instead, insert your finger into the ejection port and push the round fully forward, then release the bolt.

This promotes more uniform positioning of the round in the chamber and my studies indicate it will shrink slow fire groups by a very substantial 13.8%. Bullet Tips The quality/precision of bullets varies by the factory in which they are produced. Berger and Sierra win most of the matches at Perry and they are also the choices of most military shooting teams whose pockets are deeper than most of ours.

I have found that bullets from other makers normally shoot bigger groups and more fliers when tested in my machine rest. The tip of the bullet seems to also be important to group size and fliers. Bullets with an open meplat (hollow point) seem to shoot tighter groups with less fliers than bullets with plastic or some sort of polymer tips on their front ends. The tipped bullets advertise a higher ballistic coefficient but in my mind that is a poor trade off when they also produce fatter groups and fliers.

A topic related to the above is "pointing" of bullets either by individuals or at the actual bullet factory. Bringing the front of the bullet to a nice, even, well-defined point does increase its ballistic coefficient by a significant amount.

AR-15 FLIERS, PART 2 CONTINUED

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My understanding is this process began as a hand operation, with the bullet to be pointed inserted into a die-like pointer tool, which pretty much closed up the hollow point. When these pointers came on the market one of our Team shooters bought one. The bullets looked very nice, so we loaded some for testing by shooters and via machine rest. Testing showed the pointed bullets produced fatter groups with more fliers, along with higher pressure and some blown primers.

Shooters reporting from the field made the same observations. I measured the diameters of unmodified bullets and compared them to the average diameters of pointed bullets. The pointed bullets averaged 0.0003" wider! So, something in the pointing process was putting some stress on the rest of the bullet. When one of my shooters wrote growling about blown primers from the ammo with the pointed bullets I asked him to measure the diameters of 10 pointed bullets and compare their average to that of regular bullets.

With no prompt or hint from me, he reported back with the same 0.0003" difference. Talking to experienced bullet pointers since that incident has helped to educate me. Those folks said that our team member simply needed to back off a little on his aggressive pointing and accept just a little less point. In fairness to him this was his first attempt at pointing.

If you are inspecting a customer's ammo and the bullets are pointed you might ask the customer if he bought the bullets as pointed at the factory or if he pointed them himself. If the pointing was a "do it yourself" project I would test against non-pointed bullets. Some bullet factories are doing limited pointing in house as the bullets are made. The Sierra 90 grain Match King boat tail is factory pointed and they are getting it right. No fliers and a very high B. C.!

Heat and Powder Many of us who shoot High Power, F Class, or Palma have experienced this. These disciplines all have long distance slow fire precision events normally shot from the prone position. A string of fire is often 20 rounds fired for record, usually with about one minute allowed per shot. Most shooters load their ammo fairly stout for these events. As you can well envision, barrels and their chambers all get quite hot during these strings.

Most shooters develop a sort of rhythm when shooting, although a host of distractions can commonly occur to interrupt, typically voluntarily waiting out a sudden change in range conditions. Quite frequently, if a shooter holds around in the chamber while waiting for issues to resolve, that round will go outside the group and the shooter's call. This can often result in a substantial flier.

I conducted a study on this and wrote up the results in an article in my June 2017 article which included a target scan demonstrating this. Heated ammunition changes muzzle velocity meaning "cooked" ammunition typically causes fliers. Best advice is to avoid keeping around in the chamber long enough to heat up. If something causes a hold up in shooting, pull that round out and place it last in your firing queue, then rechamber a cool round and fire it normally when ready.

During long strings of fire keep your ammo shaded as direct sunlight will also heat up the cartridges. Changes in bullet brand or powder can cause issues. Most AR owners charge their magazines with one type of ammo. On the other hand, High Power competitors frequently shoot short line (200 and 300 yard stages) with magazinelength ammo and switch to longer ammo with heavier bullets for 600-1,000 yard slow fire shooting.

The 200 and 300 yard ammo frequently consists of either a Sierra 77 grain Match King or a Berger 77 with some sort of ball

powder as the propellant; long line ammo typically uses a Sierra or Berger 80 or 90 grain boat tail because these fight wind drift better. Some sort of stick powder is normal for this ammo. When making these ammunition changes some High Masters noticed that a flier or two was common immediately after the switch.

I had heard about these component-induced fliers and started watching for them when operating my machine rest. The machine rest allows me to make more accurate assessments of the problem than anyone could hope to do when shooting off the shoulder or from a bench. I do see the tendency for this and the severity varies between guns as one might expect. The severity also varies according to whether one variable is changed or two.

Let's say you shoot a Sierra MK 77 grain bullet with some sort of ball powder at the short lines, then switch to Sierra 90s with a stick powder for 600. You have changed only one component which is the ball powder versus stick powder. Another shooter may also use 77 grain Sierra bullets with ball powder at the short lines but uses a Berger 90 B. T. with a stick powder. He has changed both bullet brand and powder type.

Likely any fliers that he may see immediately following the ammo switch will be more severe than the first case when only the powder was different. Concluding this topic, I think that, for the most part, this variance is often being overstated. Even when making a double component switch (both the bullet brand and gunpowder differences) I seldom see the first round impacting more than one minute of angle outside the remaining nine shots of a group.

Feel free to email me at NCC1701@pen-n.com to discuss this or any of the articles I've written. AG

RIFLES

New Sight Tools

Real Avid sight tools for optics and irons.

BY ROBERT K. CAMPBELL MARCH 2021

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I recently upgraded my modest scope mounting and iron sight adjustment toolbox. Here are the new tools I acquired for my shop from Real Avid (Real Avid. com, Level Right Pro The Real Avid Level Right Pro is a system designed to provide essential scope reticle alignment to the rifle's bore axis. While there are other systems for the job, I like this device very much and find it enjoyable to use. The Level Right Pro offers predictable point of impact alignment.

While firing the rifle to fine tune the point of aim and impact is always important, scope alignment tools are a big help and when done properly get the rifle pretty darned close. The Level Right Pro aligns the reticle with the barrel's bore axis to prevent left or right off set. This is far superior to the old trick of CZ 527 bases are easily mounted but are very rigid once in place. removing the bolt and bore sighting the rifle— not to mention bore sighting like this isn't possible with some action types.

There will be more lateral drift past the rifle's zeroed in distance if the reticle isn't in sync with the bore. I have used pretty complicated devices and bubble levels with some success but usually end up shooting a good bit of ammunition to sight the rifle in. Real Avid's tool makes the chore a bit simpler with greater precision. This tool goes straight to the issue and levels the reticle, not the turrets or tube. The Level Right Pro indexes with the radii of the barrel and the scope's objective bell.

A reticle light is used along with an alignment grip placed behind the rifle. The light

NEW SIGHT TOOLS CONTINUED

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The owner wished to retain his iron sights so the work was accomplished without removing them. It is lined up to project light onto the grip after mounting the device firmly on the rifle. With the light projected onto the grid, rotate the scope carefully in small increments until the projected reticle is aligned with the vertical and horizontal planes on the grid. The Level Right Pro includes an alignment grid, rechargeable reticle light, and standard barrel and Picatinny rail attachment mounts.

Clamp the device onto the front of the scope. Level the scope with the supplied level that is mounted on top of the device, then turn the light on to project against the supplied grid. The outline of the reticle is clear. It is surprising how you may be off a little and not realize it when using other devices. I think that we have a tendency to quickly cant or tilt the rifle to line the reticle up with the eye when checking our work.

It isn't unusual for a rifle to come into the shop with an offtilted scope that someone has been using and hitting the target—at one certain set range. This type of tilting will result in a shot far off the target at a different longer range. It is worthwhile to check the alignment of scopes in a well stocked gun shop, as an example. Quite a few are off base and the owner doesn't quite realize it. When I began testing the Level Right Pro I had on hand a CZ 527 rifle for scope mounting.

The rifle is a superb light stalker and all-around carbine for use at modest range. Chambered in 7.62x39mm and fitted with a single set trigger this is a very nice and reasonably accurate rifle. The owner wished to maintain the iron sights even though they were not visible with the scope mounted. The set up ended up with the objective bell

touching the rear sight but bolt clearance was fine, although close. The two mounting bases for the CZ are not identical.

The rear scope base has a step that meets a corresponding notch in the mount, a nice touch and typical of the CZ company's attention to detail. The mounts were screwed in place to the grooves on the receiver. Four small screws hold the scope upper rings in place. The scope was adjusted for eye relief and the proper eye relief was set and the scope rings lightly tightened. This base and ring combination is very rigid and makes for good accuracy.

The 527 is usually a 2 MOA rifle, although the general run of steel cased loads used for recreational shooting with the AK-47 rifle will demonstrate per- The Easy Torque handle (right) is a good size for an easy range of adjustment and also allows a great deal of leverage.

NEW SIGHT TOOLS CONTINUED

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The sight block offers several blocks for use with a wide range of handguns. haps 4 MOA and larger groups with some lots not accurate enough to zero with. Fiocchi 123 grain FMJ is much more accurate and affordable but more expensive. The Hornady Black JSP load is an accurate and useful hunting load. Looking for good clarity and maximum image at a fair price I used the Tru Glo Intercept rifle scope. The CZ 527 rifle had been found in a pawn shop in excellent condition and the owner wished to be conservative.

The Intercept is available at around \$170 with good eye relief, 3x9 magnification, and an illuminated reticle. The 43mm objective bell rather than the usual 40mm was close but not an overly tight fit. This is a good scope for light conditions that are less than ideal. This resulting rifle and the scope set up are ideal for many uses. The use of modern reticle leveling gear made a difference in the ease of set up.

The rifle was sighted in properly with only a half dozen rounds, sighting it 1.2 inches high at 100 yards. The Real Avid Level Right Pro

is an important part of my updated gear. Real Avid Sight Pusher Adjusting dovetailed handgun sights and installing self luminous iron sights is a common job. Sight replacement and adjustment is relatively simple on most handguns if you have the right tools. The barrier for most shooters and small shops is the ability to install sights.

Even though the process is simple, sight pushers are relatively expensive and several sets may be needed.

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They hold the slide stable while the sights are moved. Don't allow this to occur when using a sight pusher. The slide is removed from the cleared firearm and locked in a padded portion of the sight pusher tool. The sight pusher is manipulated in order to push the old sight out and then push the new sight into place. Adjustment of dovetailed sights is similar with far less movement required and much easier than a brass hammer and punch, although I still use these at the range as needed.

Very few universal or multi-use sight pushers are as versatile as they claim. The Real Avid Master Sight Pusher is well designed, operates in a straightforward manner, and is an improvement over previous products. This features an oversized Easy Torque handle with fine drive threads for precise adjustment. The press block is a universal type with numerous contact surfaces and contact points, compatible with most slides and sights using a non-marring cradle.

Spring loaded vertical adjustments are possible with adjustment knobs and a safe lock and anti-torsion frame are part of the design. The sight pusher can also attach to a bench if needed. The grip is well designed, non slip, and the universal press block is

sturdy and straightforward in operation. There are four side clamp adjustments, adjustable by four well-spaced knobs with vertical adjustment handled their own adjustment knobs.

When adjusting or changing sights, the first step is to select the applicable Universal Press Block face. Turn the handle to move the block face completely to the left. Without a stabilizing wall behind the block face it is easily turned to the best fit for the individual pistol. Eyeballing can determine which block face fits best. For example, a low profile sight or one using a slight dovetail should be used with the 4mm tooth sight of the Universal Press Block face.

The fitting should reach inside the dovetail and the block face lowered to a good fit. After turning the block, return it to the center of the push rod. Align the clamp guides at the center of the dovetail. Loosen the two vertical frame bolts for height clearance and visibility, being certain the hold down screw is aligned before aligning the slide. Align the slide in the raceway. Lock all four locks onto the slide. Using the adjustment knobs, lower the Universal Press Block to the proper height.

The vertical stabilizer is tightened to hold the handgun slide firmly in place. Take a moment to confirm the alignment of the sight pusher with the sight. Turn the Easy Torque handle to move the sight, either to adjust the sight or to push it out. Apply lubricant to the sight pusher's threads and use good light when adjusting the sight block to be certain the slide has not moved to one side or the other during the locking process. When adjusting the sight, turn the handle clockwise to move the sight.

There should be little resistance as there is plenty of leverage with this tool. I have on hand an old and very tight Para-Ordnance P14-45, one of the Canadian production pistols. This piece is quite accurate and the barrel bushing is so tight it requires a tool to disassemble, yet this tool made the adjustment easy. The Real Avid unit is more secure than a permanently mounted tool (always a good idea when using any device that requires leverage) while still being portable.

I like this tool a lot and it replaces several others I had been using for some time. AG

MAINTENANCE & REPAIR

Stuck Case Repair

Restoring a Single Action Army after a blown case.

BY ROBERT K. CAMPBELL MARCH 2021

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I have dealt with projectiles lodged in barrels and the occasional stuck case in a chamber. Recently I had my first experience with a jammed up single action revolver cylinder. It could have been avoided on the shooter's part with a bit more research—and truth be told he knew better, but forgot. There are times when a cartridge case will stick or rupture because of excess pressure. Most shooters know about this type of thing and avoid overly-hot handloads.

An improper cartridge loaded in a chamber may also cause problems. As an example, one time a gun scribe in the popular press noted

that the 9mm Largo could be fired in the 38 Super. At least he warned about doing the other way around! While perhaps this is true to an extent, the unfired 9mm Largo cannot be extracted from the chamber as it is too long, however, the spent case we preserved the finish and returned the piece to working condition. may eject.

By the same token, attempting to fire 32 Smith & Wesson Long in older 8mm Lebel and similar caliber European revolvers can lead problems. Even with the proper caliber and cartridge case, a too-light “puff” load may result in the case not adhering to the

cylinder wall and backing out due to no case expansion, pushing out against the recoil shield and tying the gun up. This seems most common with 9mm Luger and 45 Automatic Colt Pistol revolvers when used without moon clips.

ON THAT SUBJECT, FOR MANY YEARS SINCE THEIR INVENTION THERE HAS

STUCK CASE REPAIR CONTINUED

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been a general warning not to use 45 ACP shotshells in 45 ACP revolvers. Without proper case adhesion to the chamber the case may back out of the cylinder and tie the revolver up. After all, there is no chambering case rim and the 45 ACP headspaces on the case mouth. Perhaps more compelling, CCI factory shotshells use an aluminum case with an over-length cartridge case and upon firing the case mouth opens a bit.

This doesn't matter in a self loading pistol as the cartridge case is being pulled from the chamber and ejected immediately after firing. A shooter I know experienced a locked up revolver firing shotshells. His experience included 1917 and Taurus Tracker revolvers in 45 ACP but not in firing shotshells. After acquiring a Colt Wiley This base pin is possibly the tightest the author has found in forty years experience with single action revolvers.

Clapp edition Single Action Army 45 ACP revolver, he started using it as his go-anywhere gun. While the 45 ACP isn't quite as stout as the 45 Colt, Buffalo Bore 45 ACP 255 grain loads exit at about 1025 feet per second, about 70 fps faster than their 45 Colt 255

grain standard pressure offering. A button ejecting revolver isn't dependent on the case mouth or cartridge case rim for headspace and the shooter had fired a good number of cartridges in this excellent revolver with great results—until the incident.

The shooter's son had made up a number of shotshells using cut down 308 Winchester brass. They worked fine in a 1911 pistol and performance was a on a par or better than the factory CCI loading. The shooter had a few of these shells in his range bag and, think- They are made for straightalong work, not tapping at an angle. ing there wouldn't be any issues, test fired them in his Clapp SAA revolver. The result was a locked up revolver.

The cartridge case could be seen pressing hard against the recoil shield and the shooter knew what happened immediately. Un-Sticking The Revolver I was tasked with the work of putting the revolver back in operating order. At least the shooter had not tried to force the hammer to the rear with excess force to attempt to rotate the revolver cylinder as the hand could easily have been damaged. I carefully considered the situation.

While the gunsmith doesn't wish to damage or mar anything in his care, sometimes it may unavoidable in the case of a blown cartridge case. Then again, this is a \$2,000 revolver... It turned out a problem was the base pin. The Colt base pin was so tight that it could not be pulled out in the normal manner. Plus, there was alive shotshell remaining in one of the chambers to make things interesting. I know what it takes to set a primer off but considerable inertia would be involved in some of the steps.

I do not like working on a firearm with a cartridge in the chamber but at least this one wasn't under the firing pin. Still, every precaution was taken. I am not certain a double action revolver would have been any more or less difficult, but the single action revolver design offered a unique opportunity. Loosening the cylinder was accomplished in two distinct steps. First, the Colt SAA revolver was laid on the work bench and secured. The loading gate was opened. A small punch

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that would fit proved too light for this type of work, bending during use but not before the job was accomplished. With the loading gate opened, a tiny Real Avid punch was carefully placed against the cartridge case with a little leverage and tapped with a padded hammer. By aiming the tip of the punch at the cartridge case—which was pressed against the recoil shield—I was able to carefully break the case loose and push it back into the chamber just slightly.

This freed the case up slightly but not enough for the cylinder to turn. I was very careful in attempting to rotate the cylinder, just barely moving the hammer back and attempting to budge the cylinder by hand. You can see how the expanded case stuck in a revolver chamber. The revolver was placed in a padded vise. This is an important step, especially with a nicely-finished gun and I wanted to preserve the deep Colt blue as much as possible.

Realistically, the owner had taken as much as 25% of the value off the gun when he fired it but he is a shooter who appreciates Colt revolvers and there was no need to

damage the finish. The revolver was upside down. I kept my hands well away from the loaded chamber side and the barrel pointed at a heavy wall. I placed a heavy wadding of tape about the point of a screwdriver. Angling the screwdriver in order to avoid scratching the frame, the base pin was carefully tapped forward and then pushed out.

It's worth noting that Brownells offers a removal tool. Far The cylinder was tapped just slightly and was free out of the right side of the frame. The unfired shotshell fell out of the chamber and the spent case was tapped out. The expanded brass case had tied the revolver up. As it turned out, nothing was damaged by this incident. The base pin was a product of the vagrancies of even modern manufacture, although it was quite tight.

Despite considerable firing since, the base pin remains difficult to remove when the revolver needs cleaning. I could probably fix this with a bit of polish. The owner states the revolver is superbly accurate and credits the super tight base pin on this regard and will not stand for the base pin to

be polished. He decided to order the Brownells base pin removal tool. I have encountered stuck base pins for various reasons.

If the base pin runs against the base pin latch and produces a burr in the notch for the base pin latch, it may present a problem. When a base pin sticks another means of removing it is to cock the hammer and line the base pin up properly. Of course, be certain the revolver is unloaded! Then, release the base pin latch and bump the base pin to the rear. You may then drop the hammer. The base should be bumped forward enough to grasp solidly and remove. Sometimes there are burrs.

In this case there were none; the base pin was simply very tight from the factory. While this is an inconvenience in cleaning, the revolver's accuracy is excellent. The Colt SAA was salvaged with a bit of thought and improvisation. In the end, a sheepish owner went back to firing the proper ammunition. AG

FROM THE ARCHIVE

AR-15 Recoil Pad

To help fight recoil from an AR-15 chambered in 450 Bushmaster, here's how I installed a recoil pad.

BY CHARLIE BRIGGS MARCH 2021

ORIGINAL PP. 21-22

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A new customer brought me his wife's brand-new 450 Bushmaster. This is essentially your everyday AR-15 on steroids. He had purchased his own, largely for hunting Florida's abundant feral hogs, but his petite young bride had decided she wanted to join him on these potentially exciting hunts and wanted a 450 Bushmaster of her own. However, he thought the recoil was stout enough (about that of a 20 gauge shotgun) to warrant a recoil pad.

In the August 2020 issue of Shooting Times an article noted, "Shooting the 450 Bushmaster is an adventure. It's accurate, all right, but you know when you've touched it off! It kicks. For recoil figures, handloads ranged from 9.5 to 14.6 foot-pounds, bellowing huge, bright orange balls Above and A recoil pad helped. from the muzzle. But everything shot with it is apt to stay shot." Not surprisingly, after shooting his at the range, the recoil quickly became a problem for her.

My customer was initially interested in an "exotic" compensator for her rifle but I suggested anew recoil pad instead. Now neither of us had ever seen an AR or

derivative with a recoil pad, but since I had been doing a lot of recoil pad work all summer, the subject was fresh on my mind. I told him a recoil pad would be a lot cheaper than buying and installing compensator, exotic or otherwise, given the required barrel threading.

The added length to the rifle, due to the additional inch or so from the recoil pad would not be an issue because the rifle had an adjustable Magpul stock. He thought about it and said, "What the heck, if I doesn't reduce the felt recoil enough, we can still add the compensator later. A happy wife is a happy life!" I first removed the factory 1/4" thick polymer/rubber plate from the butt of the lady's AR and used it to trace a pencil and paper pattern to use in grinding the new pad to fit.

Next, I went online to the Brownells website to search for choices of various size recoil pads that would work. This time I struck out as most examples were marked "Back Ordered" and those that were in stock showed no dimensions other than thickness, if at all. Next, I went to the Kick-EEZ website (Kick Eez- Products.com, and

found an abundance of pads, sizes, and colors. Even more important, the site listed dimensions of their pads. Preferring black to match the Magpul collapsible buttstock, I found a pad just slightly larger than my pattern. For the few readers out there that haven't enjoyed the fun of being covered in rubber dust generated by belt grinding away-oversized recoil pad down to size, just take my word for it; you want a pad as closely sized to your pattern as possible.

The price was a little more than I was used to at Brownells or other distributors, but knowing that the size was close—and that it wasn't back ordered—made the slightly higher cost worth every penny. Moreover, the pad was 1.125" Free Gunsmith Book Just finished downloading and started reading the e Book, Gunsmith Tools, Cutters & Gauges: A Primer, offered by Fred Zeglin in your January 2021 issue. It is an easy read and informative for the average mechanically-inclined person like me. Thanks very much to Mr.

Zeglin for offering this great resource free for American Gunsmith subscribers! You're welcome. All subscribers can follow the link below and use the coupon code: sven204dRentals.com/product/ebookprimer Visit his website at FredZeglin.com.

MEASUREMENT & INSPECTION

Reader Forum

BY AMERICAN GUNSMITH EDITORS MARCH 2021

ORIGINAL PP. 22-24

Firing Pin Gauge I always enjoy reading my American Gunsmith magazine when it arrives, but I especially enjoyed RK Campbell's "Firing Pin Logic and Mechanics" in the January 2021 issue. I am an amateur gunsmith and work on my own guns. Over thick, which I was sure would be adequate, and was made of Sorbothane, which is claimed to reduce felt recoil by 94.7%. Sold! When the pad arrived, I noticed I would have to first grind the factory buttplate perfectly flat.

It had a little curve at the bottom, probably for quick mounting to the shoulder. I couldn't just discard it as the buttstock itself was essentially hollow, having just two polymer bosses, drilled and tapped for the buttplate screws. I needed that buttplate, but I needed it flat as the integral steel plate in the base of the Kick-EEZ pad would be too rigid to conform to a curved buttplate beneath it. In addition, most of the "waffled" underside of the buttplate had to the years I've had three firing pin failures.

When I became the proud owner of an M1 Garand it came with a broken firing pin. There is nothing louder, nor more disappointing and possibly dangerous, than when a loaded firearm goes "click", especially when it's new. I had a firing pin break in a Ruger Single Six; easy enough to replace. My third was very odd. My first Ruger Mini 14 had a sharp burr in front of the firing pin hole in the bolt left from the manufacturing process.

When a cartridge ignited and was pressed back against the face of the bolt, the burr cut a neat disk that was blown back into the firing pin channel. When the channel became filled with these disks the firing pin would no longer move. The fix was to carefully remove the burr so the face of the bolt was smooth. Gary Siegert I made my own firing pin protrusion gauge. I took a 1-inch piece of 1/4-inch hollow aluminum rod and drilled and tapped the middle for a 8-32 set screw.

In the center of the rod a put a length of 1/8-inch drill rod cut to the same length as be first degreased then filled with steel bed epoxy to provide sufficient "meat" for drilling and tapping for one of the two Kick-EEZ screws. For the steel bed epoxy I used J-B Weld to which I added about 10% Atomized Steel from Brownells (#081-021-104WB) as I feel this makes a stronger bed for tapping threads than other alternatives.

Please refer to the adjoining exploded diagram as I think it shows this part of my story better than I can explain it any further. The overall result was a very happy wife, and so a very happy customer! He insisted on paying me more than I asked! If you have any questions, please email me at AG the rod.

I zero my calipers to the length of the rod, loosen the set screw, press the center against the protruded firing pin so the drill rod extends beyond the end of the aluminum, lock the set screw, then measure the entire assembly. The drill rod is extended the same distance as the firing pin. Thank you again for your excellent articles. Roy Seifert RK Campbell responds. Thanks for reading! This is the type of mail I print out and file, good information. Please write up your gauge for a future article.

Spot Facing Tools I thoroughly enjoyed "Bluing Browning Shotguns" in the January 2021 issue and learned quite a bit! I started learning the gunsmithing trade after retiring seven years ago and am now in the process of refurbishing four family shotguns and one rifle. These range from a HHH 16 made in 1903, a H&R (1951) 16, a Stevens 16 (1954), a Winchester 22, and a JC Higgins 12 gauge double barrel.

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Currently I am working with 12 double which has rust with pitting and your spot facing tool would work very nicely on areas I have to complete next. Is it possible to obtain specs on this tool? I am a fair hand with making small tools as I grew up working in several machine shops starting in the 1960s with a certificate in Mechanical Drafting. With specs I can make this. We don't have specs on this as the author largely improvised it.

The basic idea is a length of flat hardwood (preferably recycled scrap) with the end cut off flat and an opposing face set about 45 degrees. Two inset cuts for a clip with a pair of screws secure each end of the sandpaper wrapping the end. The basic idea is to hold a strip of sandpaper with two ends at differing angles to best match up to the work surface.

For an inexpensive commercial option, Foredom (Foredom.com, offers round and square Sandpaper Holders (SKU: A-SS26, A-SS27) and Sanding Sticks (SKU: 37-752, 3772) that do the same thing. Shotgun Headspace Regulation Regarding "Shotgun Headspace Regulation" by Sergey Lyalko in the January 2021 issue, do I understand correctly that you use just a straight tinning flux for your entire soldering joint or do you use it as a means to make the solder easier to flow? Have you considered green Loctite 290 for this?

I have used it successfully for barrel liners. Do you see any issues with it? Sergey Lyalko replies. For tight joints like the

headspace ring I use Johnson Mfg. Co. (JohnsonMfg.com, E-127 Flux-'N-Solder as-is to hold the ring. It has enough tin powder in the mix. I add leadfree solder if I see any gaps in contact but the strength of it alone is sufficient for this fix.

Blue Loctite 246 (high temperature, medium strength like 29513) may be fine for the liner as it has a significant area of attachment but I prefer solder as it is stronger and also conceals the edge between the liner and the bore outside. G. Thompson Restoring a Type We have a Japanese Type 99 with a sporterized stock that we are trying to restore. We need to take the front sight off to remove the bands and transfer all the hardware and everything else. How do you remove the front sight?

Is there any other suggestions you might have with this restore? From David Manney. The front sight is pressed on. I was able to remove it with a plastic mallet, a brass bar (1" diameter) and a 12 ounce hammer. I made witness marks before moving and put it back on the same way after blueing. Jerry Michrina From RK Campbell. Front sights on Japanese rifles are held in place with a tapered pins. Look just above the top of the barrel on the sight and you will see a faint circles, which are the pins.

Place the left side of the sight on a steel surface with an approximate 1/4" diameter placed behind the pin and take a flat punch and drive from right to left. You have to hit the pin hard for it to move. If you can't see the head of the pin, take some fine sand pa-

per and scrub a little. After you get the pin out put a pad around the sight and clamp it in a good vise. Twist and pull on the barrel and work the sigh off. If you it off you will spring it and it will not fit back right.

After you get it off put it back on the same way. The old pin will be messed up so have to get anew one. I use a #2 taper pin or a soft 3/16" stick welding rod, cut off about 2 inches. Stick in a drill press or lathe and spin it; using a file I make the rod slightly tapered. With the sight back in place, drive the pin in hard from the left side. Cut with a hacksaw Steven Murfin a little long and brad the pin on the right side.

Then file/polish both sides down flush and put some cold blue on it and you're back in business. If the thing is a commercial sight and soldered on, you'll need a propane torch to heat it. Otherwise, the above should do it. Check Gun Parts/Numrich for parts, then Jack First, Bob's Gun Parts, then maybe large regional gun shows. From Mark Hollensen. The front sight is pinned to the barrel and that pin is tapered.

You will have to look very closely at the sight to spot it (sometimes you have to lightly sand the area to see the pin). Since the pin is tapered, you need to drift it out from right to left and you may be in a position of having to make anew pin when replacing the sight as it is hard to drift out without



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damage. Once the pin is removed, some heat (not too much) applied to the sight band while clamping the band in a sturdy vise with protective jaws will help when you work the barreled action back and forth to loosen and pull the barrel free from the sight band. Again, it is a very tight fit. If you are restoring back to military spec, then the front sight does not have to come off unless the barrel bands were originally removed. In that case, it does have to be removed to get the barrel bands back on.

I suspect others have an alternative method for the front sight removal but this works for me. Also, perform a hardness test on the receiver as many of these rifles are NOT heat treated properly. Essentially, running a file across the bottom of the action (receiver) will tell you. If the file bites, it should NOT be fired. If it slides over it and does not bite, it is probably OK. Ithaca Repair I was given an Ithaca Model 66 Super Single 20 gauge.

The lever to open the action was broken off and I've since obtained a replacement. I have never worked on an Ithaca before and am unsure of the disassembly/re-assembly procedures and need help with that. I understand Ithaca has been taken over by another company. Do you have any information on this? Bob Obarska

From Mark Hollensen. I haven't worked on one of these in many years, but I remember there is just one pin that secures the lever to the shotgun and I doubt fitting will be required.

Not knowing if the lever purchased is a complete assembly or not, you may have to remove springs or detents in the old lever and install them in the new one. Numrich has a great schematic (GunPartsCorp.com/gun-manufacturer/ithacaskb/shotguns-ithaca/66-2-2) of all Model 66 related parts and the lever.

William Henry Baker and partners started the Ithaca Gun Company in 1883, sold to General Recreation in 1967, then Ithaca Acquisition, Inc in 1987, then Ithaca Gun Company, LLC in 1996, and finally Ithaca Guns USA, LLC of Upper Sandusky, Ohio in 2005. Given the number of transitions, I doubt you will get much help from the current owners, especially for this particular shotgun. From Glen Calvert. The only online videos I've found on this shotgun were not much help. However, I did find a parts diagram.

The M66 is fairly simple and shouldn't be too difficult to disassemble and repair using the schematic. The diameter of the holes in the new lever should be measured to see if they are the same as the original. AG

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