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PRECISION ARMS WORKSHOP

AND THE AMERICAN GUNSMITH ARCHIVE

A TECHNICAL JOURNAL OF CRAFT, REPAIR & RESTORATION

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ARCHIVE ISSUE NUMBER

INSIDE THE ARCHIVE

GAS GUN BARREL BREAK-IN

INDUSTRY RESEARCH • PRECISION BARREL FITTING, PART SEVEN • THE RIGHT TOOLS ARE NOT ENOUGH • RUGER MARK...

ORIGINAL METHODS. MODERN ACCESS.

ARCHIVE EDITION 130

DIGITAL ARCHIVE EDITION

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IN THIS ISSUE

Contents

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

-
- | | |
|---|--|
| 2 Industry Research
AMERICAN GUNSMITH EDITORS • ORIGINAL PAGES 2 | 3 Precision Barrel Fitting, Part Seven
CHICK BLOOD • ORIGINAL PAGES 3-5 |
|---|--|
-
- | | |
|---|--|
| 6 The Right Tools Are Not Enough
TORY MANNING • ORIGINAL PAGES 6-7 | 8 Ruger Mark II Pistol
WENDELL DEANER • ORIGINAL PAGES 8-13 |
|---|--|
-
- | | |
|---|---|
| 14 Gas Gun Barrel Break-In
JOE CARLOS • ORIGINAL PAGES 14-20 | 21 Fitting Remington Model 504 Extractors
NORMAN E. JOHNSON • ORIGINAL PAGES 21-22 |
|---|---|
-
- | | |
|--|--|
| 24 Reader Forum
AMERICAN GUNSMITH EDITORS • ORIGINAL PAGES 24 | |
|--|--|

FROM THE ARCHIVE

Industry Research

BY AMERICAN GUNSMITH EDITORS OCTOBER 2014

ORIGINAL PP. 2

The National Shooting Sports Foundation (NSSF) has been supplying the firearms and ammunition industry with a variety of research reports and data on industry indicators for nearly 10 years. Each year, NSSF builds upon past research and fulfills member requests for information on new segments. Glaring gaps in participation of hunting and target shooting among minority groups prompted NSSF to perform a targeted study: Understanding Diversity in Hunting and Shooting Sports.

The findings of this report also assisted in developing a new strategic goal of NSSF for 2015–2020: Retain, Expand, and Diversify Participation in Hunting and the Shooting Sports. Economic data was widely requested and NSSF responded with the release of Hunting in America—An Economic Force for Conservation. Built using data from the U. S.

Fish and Wildlife Service's National Survey, this report provides state-specific economic contributions from all hunting activities and contains hard figures useful to state agencies and the industry alike. Since 2009, NSSF has been administering an annual survey to firearms retailers released as the Firearms Retailer Survey Report. With 752 firearms retailers participating, this report provides trend data on product lines, sales, and financials, as well as consumer trend data such as female customer tracking.

One interesting, ongoing trend identified by this report was the increase in the percentage of customers who are first-time gun buyers. A study was commissioned and administered last year to determine the primary purchase drivers of first-time gun buyers and to under-

stand their preand post-purchase behaviors. Utilizing a research technique known as Maximum Difference Scaling, the First-Time Gun Buyers Report was released.

Adding to this is the study, An Analysis of Sport Shooting Participation Trends 2008–2012, which provides key demographic data for new gun owners and differences between them and established gun owners. Knowing that state department of fish and game agencies also rely on NSSF for research, the report Hunter Education Graduates' Proclivity to Purchase a License was released.

A more circulated study, the Modern Sporting Rifle Comprehensive Consumer Report, focused on popular self-loading rifles and their consumer sales, ownership, and usage data. This is not only useful to retailers and gunsmiths, but also for fighting anti-gun legislation that intends to ban such firearms.

As in past years, NSSF continued to provide membership with timely updates on leading industry indicators such as NSSF-adjusted NICS, firearm-production figures, firearm import and export data, hunting-license sales, and excise-tax obligations. Additionally, NSSF produced more than 150 Customized Market Reports for people looking to open a firearm retail establishment or shooting range. To access these reports and view new NSSF industry research, visit nssf.org/research.

While some NSSF research is available to nonmembers, all research can be obtained by members either for free or at a deep discount.

MACHINING

Precision Barrel Fitting, Part Seven

In this part we'll dive deeper into possible problems faced in chambering and how to avoid them.

BY CHICK BLOOD OCTOBER 2014

ORIGINAL PP. 3-5

My assumption that the sheer cost of full length barrel boring and rifling machines plus the space required to house them will not exclude requests you rechamber a rifle remains unchanged. All that is required to fulfill these requests area well-made, consistently-accurate machine lathe along with a couple of additional items proven to be precision tooling. Whether the work piece is an OEM or aftermarket action, the most expressed wish is for a change in caliber.

Among the more experienced, including serious hunters and High Power rifle competitors, the chamber switch will often be accompanied by a second request to blueprint it as well, along with a test target showing the results. The rifle owner giving out those instructions wants you to believe you're dealing with a no-nonsense shooter. These requests cost plenty and the person making them knows that. Or should. So should you. The tooling used and illustrated in this article totals out at slightly over a grand.

That cost can of course be spread out over a number of rifle overhauls. In that respect, it partners with the purchase price of your lathe and figuring the time required to get the entire job done. There's no how, no way, atop notch chambering request happens on the cheap. Exactly the same can or should be said of blueprinting.

When you receive a request for either, or both, I suggest you don't rush to enter the object into your records until you have determined the request to be possible, will achieve the desired objective, be fully paid

in a reasonable span of time and, most importantly, be safe. Providing an example or two serves to underscore the last requirement. I remember the day I was handed an original 1873 Trapdoor Springfield in .45-70. The owner wanted to switch to .45-90.

He turned a deaf ear to all advisory words warning him the alteration would drastically drive down the value of the old beauty. He was going after large, dangerous game and wanted nothing less than .45-90. I managed to regain his attention with the notification he had handed over a .45-70 Trapdoor carbine.

In cavalry use the carbine had never been charged with more than 55 grains and that by increasing the charge more than a third in a 107-year old timer could be fatal to him while doing nothing but alert the trophy Grizz or Alaskan Brown he wanted on his list of previously taken game that he was in the area. If he were close enough, either might charge and maul him just for making such a ruckus. That commentary was heard loud and clear. The Trapdoor remained untouched except for a thorough cleanup.

The owner of the trapdoor was not exceptional in his lack of retained knowledge about the gun. Another example can be given regarding the owner who wanted a chamber reduction. His wish was to lessen the recoil of his wife's lightweight .30-06 hunting rifle to .223. I informed him that lightweight rifles in larger calibers have a kick to match and that reducing the caliber could well reduce the kick.

I was self-inspired to add that sending a 0.24" diameter slug rattling down and out a 0.30" diameter bore would be highly unlikely to seriously impact the object at which she had shot. Wound? Maybe, but not immediately fatal. The husband, wanting his hunting partner to remain a happy hunting partner, traded in the .30-06 on a neat Sako in .243. I saved a marriage and made a profit. It was a good day.

I had inverse but not dissimilar concerns when a known to me and (reportedly) experienced reloader asked that his own .30-06 be rechambered to .35 Whelen. His objective was for a larger diameter but not necessarily an increased bullet weight. While it is true the .35 Whelen case mirrors that of the .30-06, the .30 caliber bore diameter is smaller. I reminded him this difference would at least generate increased pressure resulting in back primer setback plus bulged brass and possibly a blown receiver or bolt face.

After thanking me for reminding him of a reloading factor he'd temporarily overlooked, the gent purchased several hundred large rifle primers and the same number of 168 grain .30 caliber HPBT jacketed bullets he had allowed to run low. Another customer walks away smiling. Another good day. Now that I've raised a red flag or two with which you should be concerned before logging in a chambering job, I'll rely on your common sense to lock in to your memory as

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The next article, part eight in this series, will be getting into blueprinting an action. Shown here is some of the precision tooling needed. Before whipping out your checkbook or credit card, note this tooling totals out at slightly over a grand. much as it will retain regarding interior ballistics and move right along. Reaming The Chamber Slow spindle speeds are required whenever reamers are in use. Going too fast is the most common cause of reamer chatter. Chatter is the sworn enemy of concentricity.

Lack of concentricity is a prime contributor to a lack of precision. Lack of precision always results in less accuracy. A means of reducing or totally resolving these concerns up front will be revealed shortly. The illustration showing chambering to a finished depth shows the lathe setup for reaming. The reamer handle is held in one hand while the other hand rotates the tailstock wheel to push the tool into the barrel. All reamers need liberal lubrication and frequent brushing off of metal chips.

Sulfur-based cutting oils are the best. Fill a small diameter plastic container with oil, brush off any metal chips and submerge the reamer in the oil. The practice of brushing off and rebaptizing the reamer should be followed every time a reamer is withdrawn from a barrel. That goes for any reamer. You may see or feel a slight oscillation as you feed in the roughing reamer. It's not

the problem it appears to be. Despite multiple corrective attempts to end this mini runout it has never been totally eliminated.

Fortunately, no chamber has ever been reamed oversize in diameter because of it. Ideally, a roughing and finishing reamer should be on hand for each caliber. Whassamatteryou, Blood? Reamers are expensive! Quite true, and while there is no substitute for a caliber-specific finishing reamer there is a perfect substitute for investing in an equal number of roughing reamers. It's the Spiral Flute Interchangeable Pilot Roughing Reamer from Dave Manson Precision Reamers (MansonReamers.com).

That is quite a mouthful but as its lengthy product name hints, Dave's rougher wears a caliber-specific pilot when it is inserted into the bore of a rifle being subjected to chamber work. Slide the pilot on to the cutter shaft, lube the cutter, insert the shaft into the bore and initiate reaming. These pilots make it possible to rough out many different calibers that are based on the same case design with a single reamer.

For example, a Manson .25-06 reamer wearing the appropriate pilot can go to work on a whole host of other calibers based on the .30-06 case. It's the pilot that fits the bore and that maintains reamer alignment with the bore during the reaming process. A caution is in order. Beware of roughing a chamber too deep for the shaft of a finishing reamer to seat well in

the bore. The shaft is the caliber specific end of the finisher. It replaces the pilot and must be allowed to complete a chamber all by itself.

Let's discuss how to alternate roughing and finishing reamers during chambering, applying finishing and roughing reamers as a team. It is possible to initiate and complete a chamber job by using a finishing reamer exclusively but the practice is not universally followed. A major objection to it is that accelerated wear will dull the reamer prematurely. Countering that is the fact that double-teaming will save time.

The specific details of the process described in the next paragraph might tempt a disputing of the fact. Don't bother. Once you have the know-how committed to memory no time will be lost. It will be saved. You begin with the rougher. When the chamber has been cut 3/8" to 1/2" deep, switch to the finisher. Continue the cutting with a series of 1/32"-1/16" increments. Remember what I said before about cleaning and lubricating a reamer after each cut? This is the perfect time not to ignore the advice.

Application of the finisher can continue until the chamber has been cut to 0.030-0.050 from the finished depth. Stop. Cease. Halt. Do not go deeper. Not right now. Not yet. See the drawing illustrating removing the sharp edge at the chamber entrance. Radius the sharp edges of the chamber accordingly. Reenact the brush-off/baptism and insert



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The square object on the extreme end of the reamer is a caliber-specific pilot. Note how it has contacted the bore, giving a major assist to maintaining concentricity. the finisher again. Continue reaming to the final chamber depth without forgoing an additional reenactment after each and every increment has been cut. Final Cleanup Place both reamers in a container of good quality solvent. Allow to soak. Spray the chamber with solvent to dilute cutting oil residue and loosen any metal chips.

Blow the chamber and bore clear with compressed air. Wipe out the chamber with lint-free cloth The description in the illustration fully explains what it is all about.



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The rest of it illustrates how to perform the task described. wrapped around a wooden dowel to form an oversized cotton swab. Run a clean patch through the bore and all the way out the muzzle. If all this clean talk is boring you stiff, know that I'm understating its importance. Look at it this way. Clean and lubed reamers don't scratch chambers.

Pilots don't scratch bores. Metal chips left behind in any chamber work, however, do scratch bores. Enough said. Part eight in this series is next up.

MACHINING

The Right Tools Are Not Enough

Why gunsmiths need to regularly calibrate their measurement tools.

BY TORY MANNING OCTOBER 2014

ORIGINAL PP. 6-7

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For any gunsmith, whether amateur or professional, having the right measurement tools is critical. Firearms are designed to exacting tolerances and precise measurements. In order to meet the tight specifications, your machining must be skilled and accurate. To verify this, a range of precision measurement equipment can be used. The equipment you need obviously varies depending on the work you're doing. For simple modifications, a precision micrometer and dial calipers may be enough.

For full scale design and fabrication, additional equipment like hardness testers, bore gages and torque wrenches may be required. Reloaders and ammunition manufacturers will need linear measuring tools, balances and possibly chronographs. However, the right instrumentation is only half of the story. Ensuring that your measurement equipment is calibrated and working perfectly is also vital.

If you are measuring with a gage that is out of tolerance, it will not give you the precise data that you require to confirm that production meets specification. There is so

much time, labor and materials wrapped up in producing a firearm. If only one piece is not correct, the entire weapon may not function correctly. And worse, it could create a potentially harmful situation for either the gunsmith or the shooter. Proper calibration quantifies and improves the measurement performance of an instrument.

It will reduce errors in measurement and ensure consistency between the measurements you take. Too often, calibration is neglected because of cost or a lack of time. However, the improved results, and therefore better quality product, make it worth the time and money. Simple day-to-day use is enough to put a tool out of calibration. Metal measurement surfaces, like on calipers or micrometers, can build up debris over time, particularly if used in a less than spotless environment.

If oil gets onto the tool, carbon dust can stick to it and interrupt the correct function of any gears it may have. When you think of all the human factors, like employees who don't treat tools with the same care as their own or worse, customers who touch

and don't respect, you can easily see why regular calibration is necessary. Headspace and timing gages are particularly important to have tested regularly. Because of the way they're used, they wear even faster than many other gages.

In fact, the US Army, in their Technical Bulletin 43-180, requires all headspacing and timing gages to be calibrated every 360 days, regardless of how much the gage is used. Failure to calibrate could result in serious injury. For all gages, unsurprisingly, dropping them can necessitate a calibration. The jostling that comes with moving (think gun manufacturers moving from the Northeast to more gun-friendly states) can also make them deficient.

If you're using gunsmithing screws, it's likely you have thread gages to check the quality of the threads you've tapped. It's tempting to use just a little extra force to make it pass, but each time slightly distorts the threads on the gage. Over time this can result in an inaccurate piece of equipment. For spring testers, make sure you're using them in a clean environment away from other equip-

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ment. Something slightly leaning on the top plate over time can affect measurement. Lean hard enough and you completely blow out the load cells, making the device useless. Hint: If you can't zero your spring tester, your load cells are probably blown. To get the right amount of torque on your rings and bases, you're probably using a torque wrench. However, the delicate adjustable wrenches for gunsmithing are very easy to overtorque.

If you've got a wrench that goes up to 80 inch pounds and you give it an extra hard twist, it will go out of tolerance. Dropping it can also make it deficient. The Army specifies that any torque wrench dropped farther than three feet must be recalibrated. One common mistake people often make with torque wrenches is to store them loaded. For example, you've got an adjustable wrench which goes from 40-80 in/lbs. You torque a bolt down to 75 in/lbs and then put your wrench away.

This leaves the load on the spring which wears it out prematurely, so always zero the wrench and clean it before putting it away. If you are taking linear measurements down to or less than 0.001", it's advisable to have a surface plate, a solid, flat plate used as a horizontal reference plane. Most are made with black or pink granite, with the quartz content of the plate determining its wearability. Pink wears better than black, but it's also more expensive.

Whichever you use will ensure you have a baseline that is perfectly horizontal. However, like your gages, surface plates can

go out of tolerance even with proper care. Use it only for measurement, not for a table or a workbench. Also be aware of how you are using your surface plate. If you have a height gage on it and use it repeatedly, the surface will wear unevenly, resulting in inaccurate measurements.

Make sure you clean it, with either specially designed surface plate cleaner (Starrett makes a good one) or denatured alcohol. Note, never use isopropyl alcohol to clean any of your instruments or gages. It leaves a film which can build up over time and affect your measurements. Enough of the negatives. What can a gunsmith do to calibrate their measurement tools? First and most practically, you can do it yourself, if you don't require a high degree of accuracy or certified calibration.

A set of grade "B" gage blocks, with tolerances $\pm 1.27\mu\text{m}$, can be used as the standards for calipers, micrometers and dial indicators. Here again, though, you need to take care of your gage blocks. Store them in the case when not in use and wipe down or use gloves every time. A good rule of thumb is to treat them like you treat your gun. Handle them carefully, clean after each use and they will give you good results.

Make sure the environment where you use your gage blocks doesn't change much in temperature, as they will expand and contract, giving you variable results. Don't drop or bang your blocks together. This can change the molecules in the steel and alter the size of the block, sometimes significantly. Like other measurement equipment,

however, repeated use over time will slightly alter the gage blocks, no matter how carefully they are handled.

This means they'll need to be calibrated and this is where the measurement professional comes in. Precision measurement companies are in all of the 50 states and most can verify or calibrate all of a gunsmith's measuring tools. It is surprisingly affordable if you do not require NIST traceable or ISO 17025 accredited calibration. However, if you are manufacturing for sale, it is recommended that you choose a calibration company who can provide 17025 certification.

This means the laboratory and/or the technician has been found competent and proficient to perform specific calibrations by an international regulatory body. Not only is the lab accredited to perform the work, but they will have a robust system to ensure the quality of their laboratory processes and measurements. Many large customers require their suppliers to have ISO certified calibrations. A precision measurement company such as J. A. King (jaking.com) can help handle such calibrations.

To wrap up, proper handling of your measurement tools can help ensure they continue to give accurate results. It is important to realize that over time and through repeated use, even the best-kept tools need to be calibrated. With regular calibration, gunsmiths can ensure they produce the most accurate parts which meet spec and combine to create a high quality firearm. AG

HISTORY

Ruger Mark II Pistol

Maintaining the target quality Ruger Mark II, with thoughts on the Standard, Mark III and 22/45 models.

BY WENDELL DEANER OCTOBER 2014

ORIGINAL PP. 8-13

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When shopping for a .22 caliber auto-loading handgun there are many to choose from but none of the current offerings can compare to the Ruger Mark I, II and III pistols. I'd love to have a pristine Colt Woodsman or one of the old High Standard autos but they are history. Browning makes a good one in the Buck Mark. Why they call it that since we are not hunting deer with it is a mystery.

There are many 1911 clones chambered for the venerable .22 long rifle and there are shorties, including Ruger's own LCR, however, reasonably priced full-sized auto guns with barrels at least five inches long are rare in today's market. What happened to the art of bull's eye pistol shooting with only one hand? I guess it's been relegated to old farts like me. The official explanation is it's dead because it doesn't play well on TV.

[Editor's note: While participation has waned, conventional rifle and pistol competition is still highly contested and sup- 22 pistol. Photos courtesy Ruger, ported by the service teams. Camp Perry continues to host the largest national marksmanship championships in the United States.] Maybe that's why we enjoy it. I like to get away from the squawk box and computer

now and again. A competitive rig for this discipline can be a high dollar proposition but a Ruger Target model will get you in the game.

The specimen I have in the shop is stamped "Ruger .22 cal Long Rifle Mark II Target" on the left side of the gun's tubular bolt housing and "Government Target Model" on the right. It sports a nice pair of wooden target grips with a thumb rest on the left side for right handed shooters. The grip appears to be Ruger factory, since it contains an escutcheon on the right side with the Ruger logo in black and silver.

It is a hefty gun for a .22, tipping the scales at two pounds, fourteen ounces unloaded and sans magazine. A substantial 5-1/2" barrel measuring 0.973" thick with no taper is installed. The adjustable, square notch rear sight is dovetailed in. The front sight is also square and hooked at the rear to aid against the glare of sunlight. In use it forms a Partridge sight picture. It is attached to the barrel with a single screw. As on all Mark II pistols, the magazine catch is at the bottom of the magazine well.

The trigger is pure target with a series of longitudinal grooves to aid control. This pistol "hangs well" and was shipped from the factory with a one-hole test target not-

ing the serial number and tester's initials. Range and ammunition was not specified. Disassembly Before starting, be careful when removing all these little pins and springs and such. Put them somewhere in order and together so you know what goes where and what goes with what. Also, it doesn't need to be said the gun must be unloaded.

That being said, let's go. Remove the magazine and pull the trigger to lower the hammer into firing position. This is best accomplished by holding the bolt open just enough so the firing pin can move forward without peening the chamber. Pull out the mainspring housing latch with a small screwdriver being careful not to mar the finish. With the hammer down it should not be under a lot of tension. Pull out and down on the mainspring housing until the bolt stop pin comes out.

A gentle tap with a plastic hammer may be required to loosen the stop pin on new guns. The mainspring housing and assembly are riveted together and should not be taken apart. Move the hammer strut up so the bolt can be pulled towards the rear and removed. The upper assembly with barrel moves forward and is released from its seat,

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allowing the whole thing to be taken apart from the lower part of the gun. Sometimes it may be necessary to tap the rear of the upper to break it loose from its seat. At this point the gun is ready for cleaning by the home hobbyist. For the gunsmith, we will take the process further. As far as the upper part of the gun is concerned, there is very little to do to it. The ejector is riveted in place and should be removed only as a last resort. The sights are dovetailed in at the rear.

They can be taken apart from the base should the blade be damaged, otherwise there is no sense in removing them. The front sight is either pinned in or screwed on depending on the model. They can be removed if damaged but is an unnecessary job for general maintenance. At this point I get out the Gun Scrubber or similar with an old toothbrush and get to work on cleaning the upper. You will find a lot of crud in there, especially if your customer has been shooting the so-called promotional .22 ammo on the market.

Let's place our upper part of this gun aside and move on to the bolt. The mainspring on the bolt is easily removed as a unit by simply prying it out of its seat. It shouldn't be taken apart and the whole assembly is

available as a replacement part from Ruger (KA-57). Next, the pin that holds the firing pin in the bolt. It usually comes out very easily with just pressure from a punch or dental pick.

The firing pin can then be slid out the back and the firing pin return spring (rebound spring support, A03900) can also be removed. These parts may be dirty and should be cleaned thoroughly for good function. One reason to take this pin out now is because it limits how far our extractor plunger may travel back to release the extractor. Place a pick or other small tool in front of the plunger and push it back far enough so the extractor can be pulled up and forward to be removed.

Remove the extractor plunger and spring. Again, all these little parts should be clean when they are replaced. Lower Disassembly Remove the grips which are held in place by two screws on either side. Push out the hammer pin, which usually isn't too tight, and pull up on the hammer. You may have to pull the trigger to move the sear which will be in its seat on the disconnect assembly (KA011). The whole thing—disconnect, hammer, and bushing—will pivot up. It "hangs" well. and forward.

The bar will still be held in the frame by the trigger pin. The hammer bushing on the right side will come out easily and the hammer can be removed from the bar. The hammer strut and its bushing are staked in. No sense in taking this apart unless you have to. The safety can be pushed out. There is a small detent plunger and spring in the back of the safety. Do not forget to replace these small parts during reassembly. On top of the trigger is a small plunger and trigger spring that can be taken out and set aside.

A trigger pin holds the trigger and disconnect assembly in the frame. It has ahead that is larger on the right side than on the left, so it must come out that way. On the older models the pin is held in place by a C-clip that can be removed by working it out with a dental pick. With the clip removed the pin pushes out easily and the trigger and disconnect assembly can be pulled up and removed. The new models (Mark II and III) have a slightly different configuration which I will discuss later.

The sear pin is now pushed out and the sear can be removed as well as the small sear spring. Please remember how the spring is posi-

RUGER MARK II PISTOL CONTINUED

ORIGINAL PAGE 10

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Make sure hammer is in the fired position to take off tension. tioned in the frame for re-assembly. The last parts in the gun are the magazine catch and the magazine catch spring. They have separate pins. Remove the catch first, then the spring and the lower part of our Ruger is stripped. Reassembly Put everything back in the gun in reverse order. OK, I'm finished. See ya later. No, I wouldn't do that to you. Wouldn't you like to have a serious conversation with whomever writes instructions like that?

Start with the magazine catch. Slide the spring in the magazine well first in its proper position. The schematic will help you determine what that is if you don't remember.

Line it up with its pin and install it. Push the catch in on the spring, again in its proper position, depressing the spring slightly until the pin lines up and can be pushed in.

Sometimes, if you don't have the catch lined up perfectly with the spring, it can take more than one try but persevere until the catch is under spring tension and installed properly. Next is the sear. Note the position of the sear spring in relation to the sear itself. The little leg goes on the sear and the longer leg goes under another pin through the frame which I didn't remove. Slide the sear in from the top of the frame and start the sear pin in from the right side of the frame.

Do not put the pin in all the way as you want This assembly should not be taken apart. to insert the spring in the left side before seating the pin. It's really not that difficult as long as the sear and spring are in proper relationship to each other and the frame. A small pair of tweezers may help. Install the pin that holds the long leg of the sear spring in position (if you have removed it) and that's it. Make sure the sear is under spring tension.

Moving on to the trigger and disconnect assembly, put the trigger on its pin on the disconnect and slide it down into the top of the frame until the trigger pin can be installed. Remember on the Standard

RUGER MARK II PISTOL CONTINUED

ORIGINAL PAGE 11

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model a little C-clip must be installed on the pin to hold it in place. On the Mark II the pin is held by along spring that should be installed before the pin itself. The spring has a hook on one end that goes on the right side of the frame and the other end fits in a small hole towards the front. The Mark II also has a bolt stop assembly that is captured by the trigger pin on the left side of the trigger next to the frame.

Its stud protrudes through the magazine well to hold open the bolt when the last shot is fired from the magazine. The bolt stop plunger and spring fit in a hole in the front of the frame. The spring goes in the hole and

the plunger, which has a flat side, pushes on the bolt stop to hold it in position during function. The flat side of the plunger should be positioned towards the left side of the frame. I install the trigger and disconnector first then the bolt stop plunger.

The trigger pin will hold all of this in place and the long spring secures the trigger pin. Use the schematic if you're not sure exactly how these parts interact but it's pretty easy to put them back together. The safety and hammer can be installed next. Push the hammer bushing in on the right side of the hammer. Don't forget the little spring and

plunger that goes in the back of the safety. Install the safety and move it into position so the hammer pin can pass through.

You may have to push down on the sear to get it out of the way. The hammer bushing fits into the hole in the disconnector and the bolt stop thumb piece (I call it the slide release) can be positioned on the outside left of the frame with its small hook over the protruding pin from the bolt stop. The hammer pin goes through all this stuff and holds everything in place. Install the safety, the "slide release" and put the hammer pin through the left side just enough to hold these two parts in place before

RUGER MARK II PISTOL CONTINUED

ORIGINAL PAGE 12

putting the hammer itself in and installing the hammer pin completely. Move the safety to the fire position to free the sear and make sure the hammer can go to full cock and be released by pulling the trigger. That's it for the lower assembly of the Standard model and Mark II. Now let's start on the reassembly of the upper part of the gun and put the whole thing back together. Install the extractor spring and plunger flat side toward the middle of the bolt.

The extractor can sometimes be pushed into position with finger pressure until it snaps in place or use a pick to hold back the plunger if necessary. The firing pin spring has a bent plunger that is positioned downward and fits into a recess in front of the bolt with the spring behind. The firing pin is positioned so that the small corner will contact the spring when the pin is slid forward in its groove.

Push it in until the firing pin retaining pin can be inserted and check to make sure the firing pin is operable, meaning it has a little movement back and forth and is under spring pressure. Insert the recoil spring assembly with the flats in front down and into the groove in front of the bolt. It will snap into the bolt easily. The rear needs to be positioned so it doesn't bind when being reinserted into the receiver. Make sure the hammer is in the ready-to-fire position and reinstall the bolt.

The bolt must go in straight and not slightly cocked. It should go in easily with no binding. The upper is then installed on the lower. A gentle tap (mine took more) on the barrel end may be needed using a padded part of your bench to seat it. If it is not seated properly the bolt stop pin will not fit in its hole. Now, pull the trigger and push the hammer forward in the fired position so there is no tension on it when the mainspring housing is replaced. Push the bolt stop pin up and through the hole intended.

The hammer strut should be to the rear where it can seat itself when the mainspring latch is closed. You should have just a tiny bit of spring pressure on the latch as it is finally closed. This means the strut has seated. Pull back the bolt, release it and make sure the firing pin falls after pulling the trigger, again, holding the bolt open slightly so as not to do any damage. If all is well, repeat the process, keeping the trigger pulled when the bolt is released.

The firing pin should not go forward in this manner. Release the trigger to reset it and depress it again. If everything functions normally, the disconnecter is working as it should and your customer will not spray a lot of lead over the range master's head. Mark III Variations The first difference with the Mark III is the magazine release is located on the left side of the frame similar to the 1911 instead of the magazine well.

Releasing the hammer to the fired position, which is what we need to do now, requires that the magazine be inserted because the gun has a magazine safety and won't fire without one in place. The mainspring latch is opened as usual. On the upper part of the gun there is a loaded chamber indicator. It has a blind pin holding it in that is removed from the left side by using a pick or knife blade to pull it out enough so it can be grasped with fingers or pliers.

Once this pin is removed the loaded chamber indicator comes out as an assembly. This assembly has a few springs and can be taken down easily, but no sense in taking this apart unless you really need to. A small screw retains the magazine release. Take it out and the catch can be removed. It does have a little plunger and spring, so don't lose them.

Pushing out the hammer pin will free the hammer, of course, but also the new part the magazine disconnecter and its spring

which will not allow the gun to fire unless a magazine is inserted. I never understood this as a safety feature but I guess the government knows better than I do. Please remember (or take a picture to help you) the relationship of the spring and the magazine disconnecter.

Of course we have the long spring that as with the Mark II retains the trigger pivot pin. 22/45 Variations The first difference is the sear spring. The sear is in the same position but the spring has a different relationship than does the Standard, Mark II or III models. It is easily seen when removed and should be returned the same way. There, I did it. Reinstall in reverse order. Just to be nice, the sear pin has a groove in it that retains part of this spring.

Anew wrinkle is the long spring that retains the trigger pivot pin. On this model it also retains the magazine catch. Push down on the front of this spring so the disconnecter can be removed. This will release the tension on the spring for its removal. There is a small groove in the frame to house it. Hold the magazine catch when this spring is removed because it is under some spring pressure. For those of you that want to disassemble the magazines for cleaning, there are two types.

The standard is easily taken apart using a non-marring plastic or wood pusher to hold down the follower until the hold-down button on the side of the magazine can be pulled out. This will release the spring and the follower can then be taken out. For the Mark II and others, there is a small plunger on the bottom of the magazine. When pushed in with a 3/32" punch the plastic piece of the magazine can slide forward, releasing the coil spring.

The follower can be removed from the bottom after the little button used to hold it down for loading is removed. Not much left to say about the different models of this wonderful Ruger firearm. Was there genius involved here? I think so. AG

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XR07600 Front Sight Screw A03 602 Front Sight
A01501 Mk2 Tgt. Front Sight A01500 Mk2 Std.

Front Sight A02606 Front Sight Pin MR05902 Rear
Sight Elevation Screw A06100 Rear Sight Base
MR05907 Rear Sight Windage Spring E05903 Rear
Sight Windage Adjustment Screw MR05600 Rear Sight
Pivot Pin MR05901 Rear Sight Blade MR05906 Rear
Sight Elevation Spring A15901-100 Rear Sight
Complete A06000 Rear Sight (fixed) KA57 Recoil
Spring Assembly KA0220 Extractor KA02510 Extractor
Plunger KA20300 Extractor Spring KA01300 Firing Pin
A03500 Firing Pin Stop A03900 Rebound Spring
Support A02101 Bolt Only Ruger Mark II-series Pistol
(Specifications subject to change without notice)
Schematic and promotional pictures courtesy of Sturm,
Ruger & Co.

Inc.

A2000 Rebound Spring A03400 Trigger Pivot Pin
A01800 Hammer Only A02505 Hammer Bushing
A01000 Hammer Strut A04900 Hammer Strut Pin
AN53-100 Safety Assembly Complete KA011
Disconnecter Assembly AN37 Bolt Stop Assembly
A02508 Trigger Spring Plunger A20400 Trigger Spring
A01200 Trigger A04700 Bolt Stop Thumb piece A02601
Sear Pivot Pin* A01901 Sear A03100 Sear Spring
A02603 Sear Spring Stop Pin A00900 Mainspring
Housing only A00100 Bolt Stop Pin A02602 Bolt Stop
Pivot Pin* A00700 Mainspring housing Latch A03000
Mainspring Latch Spring A02602 Mainspring Housing
Latch Pin* KA02509 Mainspring Plunger KA20100
Mainspring A04100 Mainspring Detent Ball A00501
Magazine Latch A02601 Magazine Latch Pin (2) M10
Magazine Assembly Complete A00800 Grip A02503
Grip Screws A01201 Trigger KA05800 Trigger Stop
Screw KA04600 Bolt Stop Plunger Spring KA04200
Trigger Pivot Retainer A04300 Bolt Stop Plunger *Ap-
parently same dimensional part

FROM THE ARCHIVE

Gas Gun Barrel Break-In

precision AR-15 barrels.

BY JOE CARLOS OCTOBER 2014

ORIGINAL PP. 14-20

In a former life I spent 28 years as a full time Pennsylvania Game Warden. In tracking down poachers and solving various game law infractions I often asked the same questions as any other law enforcement officer: Who, What, When, Where, and How? Let's use that approach with regard to the topic of gas gun barrel break-ins. Who? We gunsmiths can either do the break-in ourselves or leave it for the customer. Most of us in the profession are busy, real busy!

While we probably don't want to add such tedious tasks to our already full plates, we are the professionals and have many tools that shooters don't have or need. One such tool that is helpful to properly breaking in a gas gun barrel is the bore scope. As professionals we have a greater understanding of how easily damaged the bores of our firearms are, especially if they are made of stainless metal. This extra knowledge and care, coupled with tools to observe and avoid unintended damage, makes our firearms better.

There is another, somewhat selfish reason for the gunsmith to break-in the barrel. Regarding the Bay of Pigs, JFK noted, "... victory has 100 fathers and defeat is an orphan." Would any of us want to see a real tack driver leave our shop only to come back a few days later ruined by an improper break-in? I have seen it happen! Who is that gun owner going to blame? One of two "orphans" being either the barrel maker or the gunsmith who installed it.

He will not blame himself and, in his defense, damaging a barrel via improper cleaning is easy to do yet hard to detect that he probably won't even know he was at fault. So, at the very least, if we don't

tackle the job we owe it to our customers to inform them of the proper tools and techniques to do the job right. What? What are the goals of a proper barrel break-in? To burnish the pores of the metal forming a smooth surface less prone to snag at the bullet.

Smoothing out any angular tool marks left as a result of the chambering process. Removing any burrs at the gas port caused by the drilling process. "Above all else, do no harm" to the barrel while achieving the first three goals. That misquote is often attributed as part of the Hippocratic Oath. While it was said by Hippocrates, circa 460 BCE, it was not apart of the oath itself. Nearly twenty five centuries later, I think that in our jobs as gunsmiths it is still a very good work ethic to embrace. When?

The very term "break-in" alludes to the answer to this question. A breakin needs to be done starting with the first shot through the barrel. Even a few shots before beginning the process will exacerbate the frustrations, time, effort and danger of doing harm to the barrel. If you are a gunsmith who doesn't elect to do the whole break-in process but likes to function fire the gun (a good idea) please bear this in mind.

My advice in that event is to proceed as follows, assuming you have already double checked your assembly, weighed your trigger and used the appropriate headspace gauge. Don't assume that the barrel came to you from the maker free of metal chips, cutting oils, dirt or other contaminants that could damage it. With a quality bore guide in place flush the barrel with a clean patch saturated with Windex without ammonia. Then run about four dry patches.

Charge a magazine with two rounds, keep the muzzle pointed in a safe direction at all times and begin with the safety on. Lock the magazine in place with the bolt forward, pull the bolt completely rearward and release it smartly (don't ride it forward). If the bolt was locked to the rear, simply chamber the first round by tripping the bolt catch. With the muzzle still pointed down range, attempt to fire around. The gun should not discharge.

Rotate the safety to the fire/semi position and fire the first round only into a safe backstop while holding the trigger rearward. Keeping the muzzle at the backstop, slowly release all pressure on the trigger. With issue triggers and many match versions there will be a metallic click signifying the disconnecter has done its job. Observe that the second round has successfully chambered.

While keeping the muzzle pointed in a safe direction, put the weapon back on safe, eject the chambered round (the magazine should lock the bolt to the rear) and continue to clear the rifle by removing the now empty magazine. I grant this isn't the most thorough function firing but you have checked many important things. The magazine has successfully fed from both sides and held the bolt to the rear when it has been run empty. You verified several trigger, safety and disconnecter functions.

The rifle has extracted and ejected a fired case which you can use to visually verify signs of pressure or any overt problems. I usually give this case to the customer to show that I successfully fired the gun without blowing my head off.

GAS GUN BARREL BREAK-IN CONTINUED

ORIGINAL PAGE 15

Congratulations, at this point, you are poised to begin the actual break-in. The first shot of the break-in is almost always the most difficult in terms of getting the copper out. If you elect not to proceed with the break-in you need to let your customer know that he needs to thoroughly get the copper from your test fire removed from the bore before he fires the next shot. We need to talk briefly about salt bath nitriding as it has become popular with AR barrels.

The smart folks that apply this procedure advise that you thoroughly break-in the barrel before sending to be processed. From personal experience I can tell you that all traces of fouling need to be removed after firing the last shot. If you fail to get all the copper out the nitride will go on right over it. When the barrel is sent back and you bore scope it, any trace copper that you missed on your last cleaning will really show up, far more so than before the coating process.

Scrubbing that trapped copper out will be difficult and you run a greater risk of bore damage. Also, once you have removed the copper deposit you may have a small section of barrel that failed to be sufficiently coated with the nitriding chemical. Such a section could tend to accumulate copper in the future. Before sending any barrel out to be coated be especially meticulous in your final cleaning and bore scoping to ensure you are sending the cleanest possible barrel for processing.

When you get the barrel back don't rush out to the range and immediately fire the gun. It will perform horribly! To get the barrel to shoot right run several patches wet with Windex without ammonia through the bore. Follow that with a quality clean bore brush also wet with Windex. It won't hurt at all if that bore brush has been previously used as long as you have thoroughly cleaned it.

You will find that whatever bore brush you use the first time will have a lot of resistance, even more so if it is new, and there will be much cleaning rod flex that can

damage the bore quickly. A used brush will cut down on the flex a bit. After brushing, use more patches wet with Windex. It is not uncommon for the black nitride compound to bleed out during cleaning for months after. Don't be concerned about that. After about three wet patches go to dry patching.

Then head for the range and expect groups to be pretty much normal right from the get go. Where? From Star Trek episode "The Devil In The Dark," one of Dr. Leonard "Bones" McCoy's famed quotes was, "I'm a doctor, not a brick layer!" My degree is in Wildlife Management, not Chemistry. I did have to take a bunch of boring chemistry classes, however. I don't remember much from them except Bunsen burners and that most chemical reactions take place faster in higher temperatures.

Unless you have your own private range adjacent to your work shop as I do, you will probably be firing at a public outdoor range and you might not be allowed to occupy a firing position for hours at a time while you wait on solvents to attack the copper. Chemical solvent reactions will take place faster in summer temperatures than they will at freezing 32 degree winter temperatures.

Many copper solvents "tell" us when they are accomplishing their purpose by discoloration of the bore patches but the solvents can commonly give false readings in the winter, and sometimes even in the summer, by showing patches with no bluish or greenish color. You can be fooled into thinking all the copper is out when, in reality, you just haven't been patient enough for the slow moving chemical reactions to take place.

I recommend following the particular solvent manufacturer's recommendations on how long to soak the bore. Just remember in colder temperatures to go to the absolute time limit because the chemicals will be reacting slowly. It is important at any time of the year to verify what the patches are telling you by actual bore scope observations.

When you think you have all the copper out, verify it in the bore scope before firing that next shot or you'll be fooled and need to go back to cleaning to get persistent copper deposits completely removed. I bore scope for all ten shots religiously. Getting careless or rushing to the next shot before removing every last trace of copper from the previous shot is defeating the purpose of breaking in a barrel.

We professional gun builders can't tell our customers that they have to wait until summer for delivery when it is easier for us to break in a barrel. What you may be able to do, however, for winter break-ins is get the gun into a heated environment between shots, such as a range shack or club house, permitting the solvents to do their job quicker and more effectively. You can also rely more on abrasive cleaners in the winter to speed break-in.

I don't like that because the back and forth scrubbing motion of abrasives (not the actual abrasives themselves) can cause rod flex and damage to the delicate bores. The first thing I do when a shipment of barrels arrives is break them when a customer sends me his upper to install anew barrel I can just pull one out of storage and get his finished product back quickly.

If you live in the north where winters are long and you don't have good range facilities, batched summer barrel break-ins may be an option you might want to consider. How? Armorers have to know quite a bit about a wide variety of guns, ammo and shooting topics. Barrel makers only need know everything about their subject. Most big barrel making companies have web sites discussing barrel break-in and other topics.

I have studied many of these sites and one commonality seems all of them talk only about bolt action rifles and ignore gas ports. Many of them focus on the back of the barrel in the throat area where those angular ridges are likely

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present. If you follow most of the barrel maker's web site directions you will likely get the back 2/3 of your gas gun barrel properly broken in while leaving the front seven inches or so loaded with residual copper and not properly broken in at all! The majority of barrel makers recommend a ten shot shoot and clean method. Fire a shot, thoroughly clean out the copper and repeat for a total of ten times. A few advocate continuing after that with additional shots with more rounds fired between cleaning.

Two shots, five shots, etc. If you follow this approach you will find that the first shots will be difficult to clean and some time around the seventh to tenth shot copper cleans out easier. That is a good sign but doesn't always happen. Even in those instances where the barrel starts responding earlier I continue to shot ten and don't take short cuts. Be sure your cleaning procedure is not causing any damage to the delicate rifling.

Some people have the extra patience to go a couple of additional shots if the barrel fails to respond by shot ten. More power to them! Barrel maker's recommendations for cleaning between shots are roughly divided in half between two fairly distinct camps. The first camp advocates solvent only cleaning, maintaining that any use of abrasives during break-ins is counterproductive and will open up the pores in the metal that you are trying to burnish.

The second camp often recommends abrasives in connection with solvents. Their theory is that the mere passage of ten bullets alone won't be enough to work down those ridges that the chambering caused and that the abrasives help "sand down" the roughness. The emphasis of the second camp is mostly in the back of the barrel while the first camp addresses all of the barrel. Which camp is right? I agree with parts of both and tend to blend them together depending on the specifics of the barrel I am working with.

From the first camp, I like the idea of burnishing the pores of the whole barrel and limiting cleaning as much as possible to solvents. From the second, I don't fear the use of abrasives but have seen damage caused by flex in cleaning rods when short stroking abrasives. Using abrasives for break-ins or general cleaning at the back of the barrel is probably less risky. Two-thirds of the way down the barrel in the area of the gas port entails more rod flex danger to the barrel.

I do agree with the second camp that ten shots won't likely smooth out all the chambering ridges at the back of the barrel. Instead of using abrasives there, however, I prefer to fire more rounds in what I call the "extended break-in." Equipment With the exception of a bore scope, you won't need a lot of fancy or expensive tools to break-in a gun barrel. I rely on a bore scope for barrel

break-ins and assume gun building professionals already have one, though the cost may be prohibitive for hobbyists.

Even an entry level bore scope used with the absolutely essential 90 degree mirror attachment will cost more than the most expensive barrel. Adding just a few options can drive the cost of a bore scope to double that of a quality rifle barrel. While the rest of the necessary equipment is more common and less expensive, it must be spot on. A quality one piece straight rod of the correct diameter for the caliber is a must. Don't use a .22 caliber rod to clean a .30 caliber firearm.

The smaller the caliber of rod, the more flex with more potential to damage. One of my two Anschütz squirrel rifles is a .17 HMR. The cleaning rod I have for it is so skinny and flexes so much that I can't even drive a bore patch down the barrel from the breech. I have to very carefully insert the naked rod through the muzzle, then put a patch on the end of it at the breech and pull it back through the bore. It takes me forever to clean that thing.

The rod needs to be just long enough to accommodate the length of barrel you are breaking in. The rod I use for 20" Service Rifle AR barrels is shorter than the one I use for 26" barrels on Match Rifle ARs. If I were to use the longer Match Rifle rod to clean the shorter 20" Service Rifle barrel I would surely run a much greater risk of rod flex and accompanying damage to the barrel.

GAS GUN BARREL BREAK-IN CONTINUED

ORIGINAL PAGE 17

Also make sure you have a clean shop rag or paper towel to wipe the rod down frequently keeping it clean. Next, you need a quality bore guide. In Stoner platform guns these replace the bolt carrier assembly and some are tight fitting with O-rings to help center them up. The best are made out of metal.

I recommend either JP Enterprises (JP Rifles.com) or Wheeler Engineering (WheelerEngineering.com) models and avoid the cheaper plastic ones due to an incident that happened out at Camp Perry Commercial Row at my store there during the CMP Service Rifle National Matches a couple of years ago. A competitor came to me with an AR barrel that he said shot out prematurely. I bore scoped it and the back was almost completely void of normal fire cracking, telling me the modest round count was true.

I noticed, however, that the lands were uneven at the back with regard to where they started. I dropped a throat gauge in the back of the barrel and it went in clear to the handle! As I continued to scope it I noticed other evidence of cleaning rod damage. I asked him to fetch his cleaning stuff. He returned the next day and I inspected everything. He had been using a plastic rod guide designed for the AR. No moving parts, what could go wrong with that? His coated rod was the right length and not too long.

I verified that it was straight and that the handle rotated freely. He said he used J-B Bore Cleaning Compound and wiped off the rod with a rag frequently. Finally, in desperation, I picked up the rod guide a second time and looked a little closer. The hole in the guide for the .22 caliber rod didn't look right. I dug out a set of digital calipers and measured it at almost 0.35!

The very rod guide that should have prevented barrel damage was undoubtedly accountable for letting his rod go crooked into the back of the barrel, damaging it. I gave him my last new JP bore guide made out of metal in exchange for his worn out plastic unit. Come see it in person out at Perry in the summer during CMP Service

Rifle week at Building 910-A. You can bet I will also have quality metal bore guides for sale.

He said he had used the worn out plastic one for over twenty years and that it had "lasted" for many barrels. Nothing felt abnormal, such as scraping the sides of the back of the barrel, during cleaning. Shooters can damage barrels without even realizing they are doing so. We armorers can too! For rifles like the old M14/M1A you can buy bore guides that fit over the front flash suppressors.

Most are made of plastic so I recommend occasionally measuring the inside diameters of these to make sure they aren't getting too worn to keep the rod going straight. If you think the back of the barrel is easily damaged by a cleaning rod going in crooked, you don't even want to think about what will happen to the crown of the muzzle if subjected to similar rough handling. You'll also need a fair quantity of the right size bore patches, solvent of your choice and Windex without ammonia.

Why the Windex and why does it need to be the harder-to-find variety sans ammonia? I am indebted to my friends at Northern Competition for this tip. The Windex is used near the end of each cleaning to kill two substances that may be present in the bore. Many bore solvents are petroleum based and their residue can contribute to carbon fouling. Carbon fouling is best removed with abrasives and we are trying as much as possible to not use abrasives during the break-in process.

The solvents that you will be using will have lots of ammonia in them to remove the copper. I am told that trace ammonia left in the bore can combine with chemicals in the burning of gunpowder to form a third substance that can be corrosive to the barrel steel. What chemical solvent should you use? I use Hoppe's #9 Bench Rest Copper Bore Cleaning Solvent to remove copper during normal cleaning after break-ins. It says on the bottle it can be left in overnight.

While it isn't as fast acting as some other copper solvents, it is more forgiving. Because I normally clean indoors due to my shop being on my private shooting range I am always involved in other gunsmithing chores while I wait on solvents to react with the copper. If a fifteen minute gunsmithing project turns into thirty minutes I don't have to worry about Bench Rest damaging a fine rifle bore. I am sure Bench Rest would be just fine for breaking in bolt guns.

For gas gun break-ins, however, I have been using the most potent copper solvents on the market, stronger than Hoppe's Bench Rest, because of what occurs at the port. Enhancing AR-15 Break-In We'll start discussing the differences between .22 centerfire five and six groove barrels compared to three and four grooves. Each barrel maker is free to set his own groove-to-land ratio and there are differences between makers. 2:1 is common, meaning the groove is twice as wide as the land.

The ratio would be roughly 66%:33%. RKS Enterprises in Canada, makers of gain twist blanks, uses this ratio. 70%:30% is also common, meaning the groove is just a little more than twice as wide as the land. Bartlein uses this ratio in both their 5R and 4 groove barrels. Brux uses a wider land in their regular barrels. Their ratio is 60%:40%. The width of their lands is cut in half on their narrow land option, resulting in a 80%:20% ratio. Most barrel makers don't state their ratios on their web sites.

Some will tell you if you inquire while others hold that information closer to the vest, though I don't see any logic in not giving this information out to professionals. The goal is to get the gas port located in a groove and not cut the lands. All other things being equal, that goal is easier if the groove is wider, such as in a 70%:30% ratio or even bigger 80%:20%. The number of grooves is also key.

For the most part, when you try to "crowd" six lands and grooves into a .22 caliber bore the actual groove widths are going to be more narrow

GAS GUN BARREL BREAK-IN CONTINUED

ORIGINAL PAGE 18

than most five groove barrels. The US military uses six groove barrels in the M16, guaranteeing the gas port will cut a land. A full discussion on what's wrong with G. I. barrels and how to make them shoot "more better" is a full article in itself. Generally, you can expect grooves to be wider still in four groove barrels and even wider in three groove barrels.

I inquired with a popular maker of five groove .22 centerfire barrels whose groove-to-land ratio is 70%:30% and was told that the width of their grooves is on the order of 0.098". Most AR-15 gas ports measure between 0.093" and 0.099", making it almost impossible to drill the port without at least cutting the edge of a land. Try drilling such a port in the more "crowded" six groove barrel and you are nearly guaranteed to cut a land. Compare this to a four groove barrel where the groove-to-land ratio is 70%:30%.

In that case your groove is going to be much wider at 0.123", a much easier target to try to center that gas port inside. A three groove would likely be even easier. Remember NCIS Special Agent Leroy Jethro Gibbs Rule #8: "Never assume!" Opting for the wider 0.123" groove of a four groove barrel doesn't mean you can just poke a 0.093" hole in the top of it and automatically guarantee that you won't hit a land! Its not that easy.

Properly locating the port in such a barrel requires that a "feeler" trace a groove from its origin at the muzzle back to the position you are going to drill. This is probably not a job for hobbyists. If your barrel maker doesn't know how to do this and doesn't guarantee that your port will be located in a groove I suggest you select another barrel maker. Krieger Barrels guarantees that their AR-15 gas ports will be drilled in a groove on four groove barrels that they do in their shop.

There's good news for you folks shooting bigger caliber gas guns like the M1A. Generally speaking, .30 caliber barrels are

going to have wider grooves. I stated above that a 5R barrel in .223 Remington may have a rather narrow groove width of only about 0.098". A .308 barrel (5R) from the same maker has a much wider groove at 0.138". On top of that, the M1A gas port is smaller at only 0.078", making centering the gas port in such a groove is much easier. What's The Big Deal? G. I.

M16 barrels have six grooves, guaranteeing that a land will be cut when the gas port is drilled. Obviously, the military doesn't think that cutting a land is a big deal. Well, look at their accuracy standards, such as they are. I am assuming that shooters and armorers reading this have higher accuracy expectations than the military. When a land is cut it forms a surface similar to a potato peeler. As the bullet spins past that surface, tiny specs of copper are shaved off the sides of the bullet.

Those tiny pieces of copper are propelled forward by the same gas that is pushing the bullet. After only one shot I frequently see a solid layer of copper laid down in the top of the bore from the gas port forward for a couple of inches. The width of that deposit will be about the same as the diameter of the gas port. It is very difficult to get out. The problem will normally be worse if the leading edge of the land is cut in drilling the port versus the trailing edge.

In right hand twist barrels the leading edge of the land as viewed from the rear is to the left. Since gas ports in most AR barrels are about in the forward third of the barrel it is easier for me to locate them in the bore scope if I come in from the muzzle, in which event the leading edge of the land will appear to your right. If you ignore this problem and don't remove this heavy copper deposit it may act to pull more copper from other bullets passing over it making the buildup increase.

Obviously, shaving copper jacket material off your bullets will have ill effects on accuracy. There are two ways to deal with removing this copper. One carries a high

probability of damaging the barrel. My first inclination when I found these heavy copper deposits in front of the gas port was to use abrasive J-B Bore Cleaning Compound on a patch and "short stroke" it in about three inch passes just forward of the gas port.

I found that I had to do a lot of scrubbing to get all the copper out so I could fire the next break-in shot. Given the amount of back and forth scrubbing needed I became concerned that cleaning rod flex could be damaging my lands. Even though I use a high quality metal bore guide I could see in the bore scope that the cleaning rod was flexing into my lands just forward of the chamber and wearing them prematurely and unevenly.

In terms of success this method was smoothing out the surfaces of the bore near the port to the point where at the end of a ten shot break-in the barrels weren't accumulating that streak of copper. However, the damage that the back and forth scrubbing action was doing to the rear of the barrel was enough to negatively impact accuracy so I knew I had to modify my technique. Plan B consisted of switching to the most aggressive chemical copper solvent on the market.

Sweet's 7.62 Bore Cleaning Solvent did a good job but Montana X-Treme Copper Killer 50 B. M. G. was even better! First, flush out the gas port and chamber with some kind of aerosol such as Birchwood Casey Gun Scrubber. Do not install the front sight housing or gas tube. Using a quality bore guide, follow with a patch soaked with Windex without ammonia. Dry out with about four clean dry bore patches. Fire the first shot into a safe backstop.

Replace the bolt carrier assembly with the bore guide and start patching out the bore with solvent. While doing so, position the upper receiver upside down so the solvent will pool around and forward of the gas port where the

GAS GUN BARREL BREAK-IN CONTINUED

ORIGINAL PAGE 19

most copper will be found. Continue to patch until the bluish discoloration of the bore patches subsides. Let the upper sit with the gas port still pointed down for about 15 minutes and try another patch wet with solvent. It will probably show some coloration as an indication that copper still remains. Let it sit another 15 minutes and repeat. At some point your patches will start coming out without any color and that should indicate that all copper has been removed.

Shoot a shot of Gun Scrubber into the gas port to flush excess solvent out and run a patch of Windex through the bore. Dry patch and then inspect the bore with your bore scope, paying particular attention to the throat area and the gas port. If all traces of copper has been removed, it is time to fire the second shot. Don't be surprised, however, if you find copper, especially near the gas port. If the slightest bit of copper remains don't shoot the next shot. Go back to the solvent.

If a lot of copper remains you may want to saturate the bore with the 50 B. M. G. solvent and follow with some Montana X-Treme Copper Cream. As a general rule, don't mix cleaning solvents as it may create unintended compounds harmful to the bore, however, mixing one Montana X-Treme products is fine. You can also follow regular Hoppe's No. 9 with their Bench Rest, but don't follow a Hoppe's product with Shooter's Choice or a Montana X-Treme solvent, or vice versa.

The Montana X-Treme Copper Cream contains no abrasives and is meant to be worked back and forth like J-B. Do this judiciously, avoiding as much rod flex as possible. Only resort to the cream in cases where the copper is particularly persistent and you are unable to completely remove it with solvent. When you think you have all the copper out this second time, flush everything as before and verify with the

bore scope. Fire the next shot and repeat the cleaning procedures described above for each.

After the tenth shot clean everything up and assume most of the break-in has been successfully accomplished. After shot ten, start cleaning the bore normally. The copper won't tend to hold as tenaciously as during the break-in, so drop the excessively "hot" solvents and go back more moderate ones like Hoppe's products. The pores of the metal will be somewhat burnished by the break-in and you should use a bore brush every time you clean to get the hard carbon fouling out.

Extended Break-In A lot of barrel manufacturers will tell you that a mere ten shots isn't nearly enough to fully break-in a rifle barrel. I agree and believe the figure is closer to 200 rounds, though this will vary a lot between barrels. There are a few things I recommend during this extended period. First, clean a little more frequently than normal. If you normally shoot 80 to 100 shots in a practice session, consider taking short break-ins mid session to clean the bore during the first through the barrel.

Try to not over heat the barrel by firing rapid fire strings during this extended break-in period. With fast twist barrels (1:8 or 1:6.5) I recommend never firing more than two back-to-back ten round rapid fire strings. Any more is a waste of ammo because the fast twist barrels heat up so much, giving off a lot of barrel mirage, tricking your eye and resulting in misplaced groups, false zeroes and fat groups. Limit your rapid fires to one string during the extended break-in period.

The "registration point" is sort of a memory that the barrel develops. After the harmonic whip subsides, a gun with a good registration point will bring the muzzle back to the same point where it was before the shot was fired. Barrels with faulty registration points will not return to the same

point, resulting in fat groups and wandering zeroes. Some barrel manufacturers believe that overheating barrels early in life can result in less repeatability of their registration points. Why run the risk?

Keep the barrel cool for the first couple hundred rounds and be on the safe side. Making It Easier Work smarter, not harder. We have all heard that phrase and it applies to breaking in gas gun barrels. Barrett Tillman and Derrick Martin wrote the very informative *The Complete Guide to AR-15 Accuracy*. In it the difficulty of locating gas ports in the grooves of AR-15s due to narrowness is discussed. At the time, the best advice was to just shoot off burrs.

This can happen during the official ten round break-in but may require more shooting in severe cases. Getting those gas port burrs worn clear down along with any angular ridges caused by the chamber reamer at the back of the barrel are what we are accomplishing during my suggested 200 round extended break-in. to avoid having to shoot off burrs is to not create them in the first place.

Many barrel makers make the initial gas port drilling slightly smaller than specification and then ream it out to the final diameter in the belief that doing so will help avoid burrs. Martin mentioned in the book that he makes his ports at 0.099". The military specifies theirs to be 0.093" and Krieger Barrels and other custom shops use that size. I prefer the slightly more narrow 0.093 myself and find that most rifles will function well at that size.

If I identify a gun that doesn't I can always ream the port to the fatter size. The skinnier 0.093 port may miss cutting a land that the fatter port would nick in a few cases. Another approach is a device called an E-Z Burr (ezburr.com). Their web site has a short video demonstrating how the tool works. The device consists of a retractable spring loaded carbide cutting blade.

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Drill the gas port to your desired diameter and push the E-Z Burr in from the top of the gas port. When the cutter contacts the top of the hole the blade will be pushed back into the arbor (the thin shank.) When the arbor is pushed sufficiently far enough down into the bore to clear, the cutter will spring back out into the cutting position. As you retract the spinning cutter it will automatically remove any burrs.

As it enters the port further it will collapse back into the arbor until the tool reaches the top and comes back out. It takes seconds for the entire process. After you have flushed out any metal chips by spraying a high pressure aerosol like Gun Scrubber down from the top of the gas port, run patches wet with non-ammonia Windex through the bore and dry it out with about four clean and dry patches.

When you observe your handiwork in the bore scope later you should see a nice chamfer all around the circumference of the inside surface of the port. Other times you may see less of an obvious chamfer. What you will hopefully not see are any remaining burrs. A handy test for burrs at the gas port, regardless is using the E-Z Burr or not, is to push your rod with a clean dry patch slowly past the port. In the case of large burrs you may be able to feel the patch hesitate as the burr grabs at it.

Usually this will result in some white patch fabric clinging to the burr just at the gas port and this should be readily visible in the bore scope. There are two very small issues with the E-Z Burr. First, in the case of where the gas port nicks or cuts through a land, some minor chatter may occur in the cutting of the E-Z Burr and you can actually raise a burr that wasn't there to begin with. This is very rare but easily explained.

The video on the E-Z Burr site shows the tool being used on a flat surface like a thick piece of metal. We are working on a curved surface inside the bore. On top of that, the land sits above the groove by about the same thickness as a sheet of paper. If the gas port cuts a land the E-Z Burr is trying to do its business on a curved surface with two irregular heights. Chatter can occasionally happen. I elect to use the E-Z Burr because this is rare and most barrels are improved by the deburring process.

In the few exceptions where I have seen chatter raise a small burr it always shot off within the first couple of break-in shots. Regarding the actual chamfer itself, its sloped surface is below the groove and the groove is normally cut at the same diameter as the bullet (0.2240") so any chatter on the sides of the chamfer shouldn't ever contact the bullet surface anyway.

If you opt for three or four groove barrels and religiously locate the gas port in a groove you will get a really nice job with the E-Z Burr, creating a fairly even chamfer around the circumference of the hole and seldom raising a burr. This, in turn, will cause less copper to accumulate forward of the gas port, making your break-in much faster and simpler and risking less cleaning rod damage to other parts of the barrel. Regarding the second issue, look at the photo of the E-Z Burr.

You will notice that the distance from the top of the cutter blade to the bottom of the arbor is 0.24". You must have that much empty space inside the bore of the barrel in order for the blade of the tool to pop back out into the cutting position before it is rotated back up through the gas port on its return journey. The problem is that you don't have that much space inside a .22 centerfire bore!

If you use the tool as it comes from the factory it will jam down through the top and not stop until it bottoms out on the reverse side, hitting the bottom of the bore, damaging it, and the blade will still not come out. To fix, simply grind off enough of the bottom of the arbor to achieve a safe clearance. I recommend beveling the finished product to mirror the original contour and remove any sharp edges.

In the event that you don't feel confident in making these modifications contact E-Z Burr directly to have this as custom service performed at their factory. Remember to set up your drill press to limit the downward travel stopping the tool before it bottoms out on the far side of the bore. The stock number of the tool you will want to order is the Micro Deburring Tool #CAR0880-B. If you plan to work on AR-15 carbines they have smaller gas ports and will require a tool with a smaller diameter arbor.

The M14/M1A, whose gas port lies between the standard AR-15 and the carbine, would require a third tool of a different size. Conclusions Properly breaking in bolt gun barrels is pretty simple and straight forward. The risk of damaging them is considerably less. Because of the gas ports, breaking in AR barrels is more time consuming and requires greater attention to detail. If you have to use a back and forth scrubbing action up around the port you will have cleaning rod flex which can damage the barrel.

FROM THE ORIGINAL PAGE

Use the right equipment and the tips in this article to make the job easier and less prone to damage. The time you spend doing a very slow non-invasive break-in when the barrel is brand new will more than make up for itself over the life of the barrel in easier cleaning. Properly broken in barrels also shoot better. The key, however, is to start with atop quality barrel to begin with. Don't expect the best break-in to compensate for a poor quality barrel. AG

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PEOPLE & COMPANIES

Fitting Remington Model 504 Extractors

Not all gun parts, right out of the package, are ready for functional installation. The Model 504 Remington is no exception.

BY NORMAN E. JOHNSON OCTOBER 2014

ORIGINAL PP. 21-22

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In working with three Remington Model 504 target rifles, all showed a defect in cartridge extraction. This was particularly true when attempting to extract unfired cartridges from a Bentz match chamber where the bullet would engage the rifling leade. Extraction was sometimes a problem with full velocity loads where the fired cartridge would fully obturate the chamber and cling more tightly to the chamber wall.

The underlying problem was in the hook effect of the extractor, apart which is located on the right side of the bolt. .22 rimfire bolts are often described as having two extractors, though this is not the case. The extractor is positioned on the right side of the bolt and extracts the cartridge case, whereas the laterally-opposing, similar-looking part on the opposite side of the bolt is the ejector. It serves two purposes.

First, it holds and helps in aligning the cartridge as it is picked up from the magazine and cams over the case rim when a cartridge is loaded as a single shot. Its secondary purpose is to hold the cartridge, loaded or fired,

in alignment with the bolt face as the bolt is withdrawn until the case contacts the ejector lip. At this stage of extraction and ejection, the left side of the case rim bumps the extractor lip and jumps off the ejector, throwing it out to the right.

Both the extractor and ejector have Extractor and ejector are both recessed into the back of the barrel for case chambering, extraction and ejection. The bolt (left) shows the ejector on the left side and extractor at right. Bolt head at right shows extractor at left and ejector at right. angled noses and are spring loaded within a slot and hole in the bolt. Understanding the function of these two little parts is the key to understanding malfunction causes and their correction.

Extractor Hook Angle Problem A close inspection of the Model 504 Remington extractor showed the hook angle to be too open, causing the hook to slip off the case rim during extraction, sometimes leaving the case in the chamber. The secondary contributing cause for failure to extract was too weak an extractor

FITTING REMINGTON MODEL 504 EXTRACTORS CONTINUED

ORIGINAL PAGE 22

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spring, which allowed the case rim to slip off the extractor too freely as the case was partially extracted. Solution And Testing Two basically simple remedies were applied in correcting the problem. The extractor is easily removed by simply swinging it outward from the main axis of the bolt. A spring and plunger hold it in position. Caution must be exercised to not lose this tiny part or the spring and plunger.

Carefully examination of the extractor hook showed a slight angle away from square, which will cause Along with increased spring pressure these measures solved erratic extraction problems. Below center: Top side view of the Model 504 Remington bolt. Extractors are shown at right on each bolt with the more rounded nose of the ejectors

on the left side. The improved hook angle of the extractor is shown here. The improved hook effect on the extractors is clearly shown here. it to slip off the case rim.

I used a small machinist file to correct this angle. Be sure not to remove metal from the very tip of the extractor as the angle is being re-formed. After changing the extractor hook angle I replaced the existing spring with a stronger one, which was also a bit longer. The parts were tested for function by chambering and extracting actual live rounds as the gun barrel was directed at a safe back-stop. This was done from the magazine and single loading.

I then fired several live rounds using both match Far The case is held by the extractor (left) and the ejector (right.) Note the more beveled lip of the ejector on right and more pointed lip of the extractor on left. Metal is removed up to the broken line, as shown in photo, thereby improving extraction. Extractor is shown below, hooked onto rim of .22 long rifle cartridge. ammunition as well as higher velocity loads. In all cases extraction was without flaw.

Conclusions It is not infrequent for a very small gun part to cause a big problem. Where extraction failure is the case, it must be solved. Sometimes small changes solve the problem as we saw here with the Model 504 Remington. Sometimes we must dig deeper. AG

PISTOLS

Reader Forum

BY AMERICAN GUNSMITH EDITORS OCTOBER 2014

ORIGINAL PP. 24

Röhm Handgun Parts I need some help obtaining several parts for a handgun made by Röhm GmbH chambered in .357 with a serial number of 5265. It came into the United States through their US division, RG Industries in Miami sometime in the 1960s. What I need is the cylinder release thumb slide and its attaching screw. I have checked with Numrich Gun Parts without success. All they have is a RG in .38 Special which might be on the same frame. My catalog from Jack First doesn't list any RGs.

Brownells doesn't even list the company. James Halderson American Falls, ID Given our usual recommended sources have fallen short, try Bob's Gun Shop Parts Distribution, Royal, AR 71968. Phone J. C. Higgins Shotgun I'm anew gunsmith, though I've been around firearms all my life. My Grandfather is turning 84 and as a present, I'd like to repair his old J. C. Higgins 12 gauge goose gun that one of my friends broke.

He's long since forgiven me and said pal but the shotgun has been in the family for many years and it has great sentimental value. The shell carriage broke at the carriage arm after firing 12 gauge magnum shotshells through the gun. To date, I haven't had any luck in repairing it and would appreciate your input concerning parts replacement and repair. The shotgun you describe puzzles us more than a little. We have found no mention of a J. C. Higgins "Goose Gun" in the cross reference files.

The only such description is associated with the Marlin model 55 with a 36" barrel and lacking a shell carriage. It was/is a bolt action shotgun with a two-round magazine and the capability of reaching high flying honkers despite the fact of being cylinder bore. Perhaps

Grandpa's gun was his pet for similar reasons so that's the way he referred to it. If there are any parts available in the aftermarket you will need the name of the original manufacturer and model number of the gun to find them.

H&R Revolver I received atop break, auto eject H&R revolver in my shop. When it arrived the trigger would not engage the sear. Thinking it was a weak sear spring, I replaced it. Everything worked fine during reassembly until the hammer was installed and I found out I still had the same problem. Having no references on this particular gun, I'm stumped. Is there a procedure or trick to reinstalling the hammer?

Ron Giblin Millerton, NY It would have been of considerable help if you had provided a model number with your query. However, there are three H&R revolvers covered in the hardcover manual The NRA Guide to Firearms Assembly: Rifles & Shotguns/Pistols & Revolvers. Determine which one matches the revolver in question, read the instructions and react accordingly.

Eric Cox Lubbock, TX Specialty Tools For Gunsmiths When I read "Specialty Tools For Gunsmiths" in the August 2014 issue I remembered something I found in Walmart: Interdental cleaning brushes available in the tooth brush section. They are like a nylon bore brush except the brush is 0.1 inches in diameter. They are well made and work great on cleaning small screw holes, firing pin holes, and small cracks and grooves. Price is three or four dollars for a pack of 8 to 16 brushes with protective caps.

Brand names are GUM and Den Tek. Very handy. Bill Ramirez From author Wendall Deaner. What's not to like? I'm going shopping! AG

SEARCHABLE ISSUE RECORD

Archive index

Industry Research American Gunsmith Editors	2	Gas Gun Barrel Break-In Joe Carlos	14-20
Precision Barrel Fitting, Part Seven Chick Blood	3-5	Fitting Remington Model 504 Extractors Norman E. Johnson	21-22
The Right Tools Are Not Enough Tory Manning	6-7	Reader Forum American Gunsmith Editors	24
Ruger Mark II Pistol Wendell Deaner	8-13		

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