**Championship Chambering With a Grizzly Gunsmiths Lathe**

by **Gordy Gritters**

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In this article I am going to tell you about the design and birth of a very special metal lathe, a lathe designed specifically for gunsmiths, with features made especially for building high-accuracy rifles. I also thought you might find it very interesting to hear a little about the history of the company that makes this lathe – Grizzly Industrial – and the owner/founder of Grizzly, Shiraz Balolia, who is not only a really great guy, but a very serious F-Class competitor who competes at the national level, and has been winning so much recently that he has been invited to try out for the United States F-Class Shooting Team in 2008.

I am also going to go into quite a bit of technical detail on how I set up barrels for chambering and crowning, which is definitely a little different than the way most gunsmiths set up barrels, but I have complete control of how straight I align the beginning part of the bore up to the action and to the chambering reamer. This gives absolutely perfect chambers and throats every time. I have never found a better way to do it, and this lathe is perfectly designed to do this.

For those of you who want to see this lathe in operation and this chambering method in much greater detail, we made a DVD that I mention later on in this article.

This all began not too long ago, when I was in the market for a new lathe for my gunsmithing shop (Gordy’s Precision). I build highly accurate target and hunting rifles in my shop, and really specialize in long range competition rifles that compete against the very best in the world, so I needed a high quality lathe capable of building these guns.

Since there was no such thing as a lathe made specifically for gunsmithing, I needed to find one that had all the basic structural features I needed, and then I could spend a bunch of time and some expense modifying it into a lathe that was capable of doing the quality of work I needed to do.

Some of the features I needed on the basic machine were first of all it needed to be a high quality lathe capable of holding very close tolerances, it needed a spindle hole through the headstock larger than 1 ½” (I hold the barrel entirely through the headstock when chambering as opposed to doing it between centers), a quick-change gear-drive headstock as narrow as possible to allow working on short barrels, a very heavy precision ground and hardened bed for accuracy, rigidity and long life, a heavy stiff cast iron base for rigidity, and a Camlock spindle to easily and accurately change chucks back and forth when needed. I also wanted it to have a single phase motor since I live and have my shop “out in the boonies” where there is no three-phase electric service. But after finally getting a lathe and having it converted to single phase (and taking the motor out and sending it off to get balanced for smoother running), I found out that a three-phase motor running on a phase converter would probably have been an even better choice for smooth-running lathe operation. Oh well, live and learn!

Once I found a lathe that was basically a clone to the lathe I had been using almost my entire gunsmithing career, I bought it and had it shipped to my shop. Then before I could start to work with it, I had to do a number of modifications to it to be able to use it for chambering/crowning barrels and truing/blueprinting actions the way I feel is the very best way that can possibly be done.

Since I do all my barrel work with the barrel held entirely through the headstock, I drilled and tapped the outboard end of my headstock spindle for four opposing screws which makes it basically into another four jaw chuck. Now when I put a barrel through the headstock, it is being held by a four jaw chuck at both ends, making it infinitely adjustable at both ends in all directions so now it is possible to completely control how the barrel is dialed in.

The next thing I do is modify the tailstock hold down lever to accept a torque wrench (this modification is thanks to Greg Tannel). This allows me to find out how much to tighten the tailstock to get it to align exactly with the centerline of the headstock. When you slide the tailstock into position on the bed of the lathe and then lock it down to hold it, the harder you tighten the locking lever the farther down the nose of the tailstock goes – at least .001” to .002” on most lathes. It is surprising just how much a big heavy machine can flex, especially on smaller lighter lathes, but even big heavy lathes will have a little variance here- just put a very sensitive dial indicator on top of a center or chuck mounted in the tailstock and alternately tighten and loosen the tailstock locking lever and you’ll see just how much vertical movement there is when you do this.

Make sure you take the time to get the bed of your lathe leveled absolutely straight and true with a high precision machine level, then when that is done you can measure and find out exactly what torque setting it takes to perfectly align the tailstock centerline to the headstock centerline. Check your lathe level often as the concrete floor it sits on can and will change slightly with the seasons and time. Every time you re-level your lathe you need to double-check that your tailstock torque requirement hasn’t changed also since this goes hand in hand. It is also good to check the torque required after the lathe has run awhile – it normally will change a little as it warms up. Tailstocks can be easily adjusted horizontally to bring them into alignment, but some lathes are quite a ways off vertically and can take quite a bit of work and expense to get the tailstock to align vertically to the headstock – you better know what you are doing before you try to correct this. Thankfully both my lathes came into alignment without any expensive modifications, so all I had to do was just figure out the proper torque specs for each one. One of my lathes right now takes 12 ft/lbs of torque to align perfectly and the other one takes 25 ft/lbs.

Now with everything perfectly aligned vertically as well as horizontally, when you chamber a rifle barrel you can use a precision reamer holder to push and guide the chamber reamer forward into the barrel, making for absolutely perfect reamer to bore alignment and a correspondingly perfect chamber, and not have to rely on a “floating” reamer holder to try to compensate for misalignments. Floating reamer holders work somewhat OK, but in my opinion they aren’t perfect and are not as precise as when everything aligns perfectly from the get-go. When I build a rifle, I like to know everything is aligned perfectly rather than just hoping it comes out OK.

The reamer holder I use and like better than anything else I’ve ever tried is one made by Greg Tannel at GTR Tooling that uses a precision center with a spring loaded collar to hold the reamer in place against the center. This is hands-free and not only drives the reamer perfectly straight, but it doesn’t try to torque to the side like so many other holders with a handle can do.

One of the biggest advantages to being able to dial the barrel in this way is it allows me to get the end of the bore that I am working on to run perfectly straight and true. The bore in every barrel out there, custom as well as factory, has some curvature to it – I’ve never found a bore yet that is perfectly straight, and I’ve checked and measured many hundreds of them in the past 21 years.

So when I’m working on the chamber end of the barrel, I can dial the bore in so that the first two to three inches ahead of the chamber is straight and true and then the farther you get down the bore the curvature of the bore will get more pronounced. So now when I thread the barrel and ream the chamber, the threads, the chamber, the throat and the bore ahead of the throat for the first couple inches are all in perfect alignment with each other and to the receiver, which I feel makes for the very best accuracy.

One of the ways I used to set up my barrels, and a lot of gunsmiths still do it this way today, is to run the barrel through the headstock like I do now, and use a dial indicator to get both ends of the bore running “true” at the throat and the crown. The problem with this method is it does not account for the curvature of the bore. No matter which way you indicate a barrel in, when you cut the crown or the chamber, they are going to be cut straight and true to the centerline of the lathe (not the centerline of the bore unless it is set up to be running true to the lathe also), that is just basic machining.

*But in my opinion no matter how much we may want it to be otherwise, since no barrel has a perfectly straight bore, if you indicate both ends of a bore at the throat and at the crown to be running true at those two points, the bore WILL be curved in between those two points, and therefore the bore WILL be coming down to the chamber and to the crown at a slight angle, which really bothers me.* I know lots of top gunsmiths that still do it that way today and most of their barrels obviously shoot very well, but after doing it both ways myself over the years I have absolutely no doubt in my mind that doing it the way I do now gives just a little accuracy edge over the old way. And I like to do everything I possibly can to give an accuracy edge for my customers when I build their rifles!

When I bought my Hawkeye borescope a number of years ago, I started to see that some throats were not as perfectly aligned as I knew they should be, even though I had both ends of the bore at the throat and at the crown running within .0001”. I soon noticed that in barrels that had noticeable curvature in a bore, I could visually see with my borescope that the throat often didn’t look quite as “true” as on barrels with less curvature. When I double checked the finished chamber with a dial indicator I noticed that when I would run the indicator in, the whole chamber itself and even the throat would always be running perfectly straight and true in the lathe, but as soon as I moved the indicator forward into the bore right ahead of the throat, the indicator immediately would start to show some runout. The further up the bore I measured, the worse the runout became, which was not good and told me the bore was obviously running at a slight angle to the chamber, and it really bothered me since I knew it had to be adversely affecting the accuracy a little.

I called almost every barrel maker I knew and a number of well-known gunsmiths and they all had varying advice, none of which really cured this problem completely. Some of them did not know what I was even talking about, and the others said it didn’t matter since guns shot fine even with noticeably curved bores. But I really felt that some accuracy had to be sacrificed when the chamber didn’t align perfectly to the bore, and now after changing my methods and seeing the results I am absolutely convinced of it.

So after much experimentation, I have settled on what I feel is the very best way to set a barrel up to get a perfectly aligned chamber and bore. I’m probably not the only gunsmith around doing it this way, but I do know it works extremely well and better yet, it works extremely well every time without fail!

What I do is dial in the first few inches of the bore to be running perfectly straight and true as close to .0001” as I can get (not really very hard to do this at all), then when I thread and chamber the barrel, the action and the cartridge itself are all lined up perfectly to the beginning of the bore. When the centerline of the bullet aligns just a little straighter with the centerline of the bore, once it gets going down the bore, it will follow the curvature of the bore just fine and will fly straight and true when it leaves the bore. The same thing holds true at the crown end. When the last few inches are aligned to run straight and then the crown is cut, it makes for just a little straighter, truer crown, which helps accuracy.

A couple other quick notes here: The more curvature there is in a bore, the farther off-center the outboard end will run in the lathe, although it normally isn’t by much at all. The slight amount of muzzle offset in the finished rifle you get by setting a barrel up like this is so small that you usually can barely even tell it in the barrel channel. Although I occasionally find a barrel that will runout almost .040” off-center at the outboard end (.080” total indicator reading), most benchrest barrels I’ve measured are somewhere in the .004” - .032” range, and I’ve seen a few inexpensive non-match barrels much worse than that. If I feel there is a real problem with a barrel I will return it to the barrel maker, but any normal amount of curvature doesn’t seem to matter if the chamber lines up with that end of the bore properly.

I have recently started to index barrels so the curve goes up at the muzzle end, rather than off to one side or the other. I don’t know that it makes any difference on accuracy, but this helps with long range shooting by giving just a few more minutes of elevation you can use. If your scope has limited windage adjustment and you left the curve off to one side, you may run out of windage adjustment on your scope before you get it sighted in. I have also observed that the curvature isn’t always a straight curve, but can be a slight compound curve where it curves up and slightly to the side also. I also like the idea of the weight of the barrel at the muzzle to be at the 12:00 or 6:00 position, not off to the side at the 3:00 or 9:00 position which I feel may impact the barrel harmonics a little, especially on long barrels.

Not long after I got my new lathe up and working well like I wanted it to, I started to do barrel work for Shiraz Balolia, and found out he was the founder and owner of Grizzly Industrial, Inc, a very large machinery and tooling company. He was very interested in knowing all about how I set barrels up for chambering. I was explaining to him how I do my barrel work and was telling him everything I had to do to my lathe to be able to use it like I wanted to. It was obvious Shiraz immediately grasped the concept of what I was doing, and it really got his mental wheels turning. It wasn’t very long at all and he called me and said he wanted to design a lathe specifically to be able to do high grade gunsmithing, and he asked me to send him a list of features I would like to see in a gunsmiths lathe along with some photos of the modifications I had done to my lathes. He then worked with the factory that makes his lathes and in no time he had them in production. He initially had two lathes made for gunsmiths – a big 16”x40” Professional Gunsmiths lathe (item # G0509G) and a smaller 12”x36” Gunsmiths lathe (item # G4003G), and now Grizzly has a new high-end 16”x40” lathe that has a lot more bells and whistles even than the Professional Gunsmiths Lathe.

In May of 2007 I went out to Shiraz’ place in Bellingham, Washington to chamber one of his 1000 yard F-class barrels using the Grizzly 16”x40” Professional Gunsmiths lathe, and to do it on camera to make a DVD so people could see how I chamber and crown championship match barrels, and just how well the Grizzly Gunsmiths lathes work to do this. This was a very interesting project, and even with all the distractions, the barrel came out absolutely perfect, which you can really see on the DVD (DVD’s are sold through Grizzly as item # H8396).

I went to the SHOT show in February 2008 after Shiraz hired me to work in the Grizzly booth to demonstrate the Gunsmiths lathes for them there. I chambered three barrels while I was working at the show, and even with all the people and constant distractions all three chambers came out absolutely straight and true. When I was done with each one, I double checked the finished results with my .0001” dial test indicator, and all three chambers were running so true that the indicator needle didn’t even wiggle, and the bore ahead of the throat had less than .0001” runout for at least 2-3” before you could start to measure some curvature. I have to say, now that I’ve done four barrels on it that I really like this lathe!!

Now let me give you a little background on Grizzly Industrial, which is quite an interesting story. Shiraz Balolia was born and raised in the British-colonized country of Kenya, and displayed an early aptitude for mechanics and initially learned many of the tools of business from working in his father’s accounting business.

Shiraz and his family immigrated to North America in 1972 and eventually he ended up in Bellingham Washington, where he lives today. After completing night courses in Machine Technology and Machine Shop Practices, Shiraz tried to buy a metal lathe for his own shop through the classified newspaper ads, and every time he called on an ad, he would find that the machine had already sold. So he went to the newspaper printing office to buy the first papers off the press so he could be the first caller on an ad.

“It turns out the only lathes you could find were in really awful shape” Shiraz recalled. “After buying and renovating my first lathe, I realized I enjoyed the process of rebuilding a fine machine as much as I enjoyed my other metalworking projects. It wasn’t long and I was making a pretty fair living rebuilding and reselling used machines”.

By 1976, Shiraz had started to purchase new Taiwanese lathes from a major importer and reselling them. But he was a little too successful doing this, and soon this importer refused to sell any more machines to Shiraz since other dealers were complaining about his low prices and putting a lot of pressure on this importer. By now however, using connections and international friendships he had developed, Shiraz was able to create a working relationship himself with some of the manufacturers in the rapidly growing Taiwanese machine industry.

So he ordered five metal lathes, and had all five sold in two days! His next shipment was for ten lathes, and he had all ten sold before the ship reached the harbor. Soon, Shiraz started to order and sell other machines also – milling machines, drill presses, grinders. Then he branched into woodworking equipment like jointers, planers and other woodworking machinery.

Shiraz said he hated the idea of selling products he knew little about, so he took night courses in woodworking and began experimenting with a variety of projects of his own. Today Shiraz is an extremely accomplished woodworker, and said his background in machining and metalworking gave him an intuitive sense for woodworking.

So by 1983 Shiraz had used his growing business savvy, his highly regimented work ethic, and his longstanding business ties and friendships with some of Taiwan’s best machinery manufacturers to start Grizzly Imports (name later changed to Grizzly Industrial) based in Bellingham, Washington.

The business grew rapidly and Shiraz continually modified and improved the designs and quality of the machines he was having made in Taiwan and China – many of these modifications have become the standard in the machinery industry. Shiraz to this day continually strives to improve the quality of the machines he sells, and Grizzly has become a name synonymous with high quality!

By 1986, Grizzly had expanded by building a huge sales, service and shipping center in Williamsport, Pennsylvania. A third distribution facility was added in 1999 at Springfield, Missouri. Currently, Grizzly has over 1.2 million square feet in its three American facilities as well as offices in Taiwan and China where quality control is overseen directly.

Grizzly’s first full-color catalog came out in 1983 with 43 pages and they sent out 10,000 copies. It now has grown to 700 pages with catalogs being sent to over 1 million customers worldwide every year. This is truly an American success story. It has been extremely interesting for me to get to know Shiraz and work with him not only on his many rifle projects, but also being able to be a part of designing the Gunsmiths Lathes and working with Shiraz on the DVD project.

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GTR Tooling, 29742 W.C.R. 50, Kersey, CO 80644, 970-353-6176, www.gtrtooling.com

Gradient Lens Corp (Hawkeye Borescopes), 207 Tremont St, Rochester, NY 14608, 1-800-536-0790, www.gradientlens.com

Pacific Tool and Gauge (reamers,bushings,range rods), 598 Ave C, White City, OR 97503, 541-826-5808, www.pacifictoolandgauge.com

Gordy’s Precision, Kansas City, MO (formerly Pella, IA) 641-780-5085 www.GordysPrecision.com