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PRECISION ARMS WORKSHOP

AND THE AMERICAN GUNSMITH ARCHIVE

A TECHNICAL JOURNAL OF CRAFT, REPAIR & RESTORATION

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INSIDE THE ARCHIVE

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ORIGINAL METHODS. MODERN ACCESS.

ARCHIVE EDITION 213

DIGITAL ARCHIVE EDITION

Preserved for the bench.

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MACHINING

Bantam Tools CNC

BY AMERICAN GUNSMITH EDITORS SEPTEMBER 2021

ORIGINAL PP. 2

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The Bantam Tools Desktop CNC Milling Machine is a desktop CNC machine optimized for machining aluminum parts. Intended to be an easy transition for users of 3D additive printers, this CNC machine features a 28,000 RPM spindle, 1/4" tooling, and a 7" × 9" × 3.5" build volume. The 5/8" solid aluminum frame weighs 70 pounds and can be moved with relative ease. This CNC machine ships with a T-slot bed, two toe clamps, and a right-angle bracket to make setup fast and reliable.

Bantam Tools Software uses 2.5D AUTO-CAM, allowing users to drag and drop SVG files and use the built-in automated computer aided design to quickly add engravings to parts or mill simple 2D objects. It also automates material probing routines and provides SVG support, Autodesk Fusion 360 templates, and more. Ian

Schon of Schon DSGN uses his for prototyping custom work. "The Desktop CNC Milling Machine is all about material removal in my arsenal.

I was shocked at how much it could do in a short amount of time, and the Bantam Tools software enables you to do things faster than before." Being a desktop unit, this CNC machine is ideal for prototyping and easy enough for use in a classroom to teach CNC as an ideal companion to a PCB mill. The machine comes fully enclosed, is easy to maintain, and ready to use right out of the box. Bantam Tools CNC machines work with Windows and Mac operating systems and the company provides subscription options for software.

Tutorials and project demonstrations are available for free on the company's website at BantamTools.com. The Desktop CNC Milling Machine is ready to ship to your door for \$3,999.

RIFLES

Salvaging Grandpa's Marlin

Repairing and restoring a heavily-used Marlin Glenfield Model 60.

BY KENNETH FINLEY SEPTEMBER 2021

ORIGINAL PP. 3-7

Just before the 2021 February snowstorm my next-door neighbor asked me to look at a project. It was his Grandfather's pickup and tractor gun—a Marlin Glenfield Model 60 22 Long Rifle rimfire semi-automatic. My neighbor wanted to know if the rifle could be salvaged enough for his children to shoot so they could have that connection with his Grandfather.

In that vein, he had a rather strange request: the rear sight elevator had been lost with a dime substituted and he wanted the restoration to include leaving the dime in place. He admitted that he had his doubts that the rifle could be salvaged. Looking at it, I didn't blame him. That dime was going to be the least of my problems. There was another complication. The breech bolt was rusted to the breechface and the safety corroded in the Off position.

That was a problem because my neighbor didn't know whether the rifle was loaded or not. Let's be honest—this rifle was not worth the full cost of a restoration, however, the project was justified on the basis of sentimental value for the owner and fun for me. I got started in gunsmithing by restoring what I call “ugly” or “closed” guns. These are firearms often neglected but still having utility or sentimental value if restored with some tender loving care.

On the other hand, the snow was deep between the house and the shop and this looked like a good “kitchen table” project. I broke this project down into four phases. First, somehow get the bolt open to determine if there was a live round in the chamber. Second, disas-

semble the rifle to determine whether any parts required replacement. Third, address corrosion on the metal parts and devise a protective coating for future activities. Finally, repair and refinish stock.

This is not a collector's rifle; the customer wanted a shooter to share with his children that had family sentimental value. Clearing the Action With the action rusted shut and the safety corroded in the Off position, I could not touch the trigger. I removed the rod and plunger from the magazine tube to confirm there were no additional rounds in the magazine before working on the action. First step was to apply Liquid Wrench to the bolt and trigger group.

Considering the condition of the rifle I was not worried about possible damage to the metal or woodwork. After sitting overnight, I was able to work the safety to On by placing it in my arbor press and gently moving it. I then took a brass brush to the ejection port and exposed a portion of the bolt, removing as much rust and dirt as possible. I was able to move the bolt slightly to the rear before it stuck again. I worked the bolt back and forth until I was able to confirm there was nothing in the chamber.

Having confirmed the rifle had not been loaded all this time (much to my relief!) I was ready to move on. The Stock The stock had to come off to access parts within the receiver shell. Removing a screw in the forend and the screw at the rear of the trigger group allowed the receiver, magazine tube, and barrel to be lifted

SALVAGING GRANDPA'S MARLIN CONTINUED

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from the stock. Removing the screw at the front of the trigger guard allowed the trigger guard to fall free. The trigger was pinned to the frame of the trigger guard and heavily plated. All that was left was the bare wood stock and plastic buttplate. I decided to leave the buttplate attached for now. Otherwise, “bare wood” was a pretty good description. Whatever finish it originally had was long gone. Some sections had been bleached by exposure.

An attempt had been made to varnish at least a portion of the stock because I found runs along the comb and semi-pistol grip. There were only patches remaining. As you can see from the pictures the stock was distressed from years of banging around in a pickup and exposure on Grandpa's tractor. The goal was to make the stock safe for young shooters and retard future weathering, while maintaining some of the character of the “experienced” stock.

I went over the entire stock with 00 steel wool to remove surface grime and splinters from the deeper gouges and scratches. I

didn't want to remove or reshape the wood as the stock displayed very graceful lines. The foregrip and pistol grip surfaces had originally been embossed with a mixture of leaves and reverse checkering but this was now very worn. To help the pattern stand out a little more, I took my 16 LPI veining tool and deepened, and in some places restored, the original pressed outlines.

I did not touch the embossed leaves or reverse checkering except to scrub out the grime. I then rubbed over everything with 0000 steel wool to even out all the surfaces. To smooth out the color, I rubbed in a dark hardwood stain. I let the stock dry overnight, rubbed again with steel wool, then hand rubbed a coat of Birchwood Casey's Tru-Oil, which is my favorite stock finish. The first coat was not as smooth as I like, so I repeated the process until the fourth coat displayed the desired results.

As this process took a week, I was free to work on the rifle internals as the coats were drying. A quick plug for a great product—hobby shops sell mats from Testors (now

part of The Rust-Oleum Group) for applying finishes. Almost nothing sticks to it and the surface interacts with very little. I can literally lay a still-wet stock down and not leave a mark. Disassembly The trigger guard forms a frame containing the safety, the pinned trigger, and trigger spring.

Examination of the trigger group showed that the trigger itself was heavily chrome plated, and the springs and pins were free of corrosion. A simple cleaning and light lubrication was all that was required. The trigger guard itself was wire brushed to remove flakes of old finish and any surface corrosion before being masked for refinishing. To remove the action sideplates from the receiver shell and breech bolt, remove two small screws from the front and a screw/sleeve combination from the rear.

Removing the fasteners allows dropping the assembly within the sideplates straight down from the receiver shell and bolt. The Marlin Model 60 action employs a heavy bolt and a recoil spring and guide for a direct blowback action. The firing pin is a bar

SALVAGING GRANDPA'S MARLIN CONTINUED

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that freely slides in a recess in the bolt. Rails below the slide contain a hammer and sear assembly that pivots up between the rear ears of the breechbolt to strike the firing pin, driving it forward. This is not a striker-fired action. The rails, hammer, disconnecter, sear, and springs are maintained in a rigid relationship by two pins held in place by C-clips. Removing these clips allows total disassembly of the action group. Upon examination, in this case it was not necessary.

Brushing the action with a brass brush to remove any old debris and spraying with an aerosol cleaner and light lubrication sufficed. Proper function in conjunction with the trigger group was verified. For the record, the internal hammer was fully cocked and the firing pin free to move in the bolt. Had I touched the trigger, and had there been around in the chamber, Below center: Breechbolt ready for reassembly. the rifle would have fired, regardless of its apparent external dysfunction.

Turning the remaining receiver assembly upside down clearly shows the breechbolt held firmly against the breechface by the recoil spring and recoil spring guide. The firing pin is visible in its slot in the bottom. With careful movement, the breechbolt can be removed from the receiver and the charging handle removed. To achieve this, shift the breechbolt back slightly to remove the bolt-face extractors from their recesses in the breechface. Be very careful as the recoil spring is under a great deal of tension.

The left and right extractors are held in place by pins and can be easily removed for cleaning and clearing the recesses within which they reside. As usual, be very careful with the small springs involved. Once disassembled, the breechbolt was soaked in rust remover, lightly sanded, and given a final polish with 0000 steel wool before reassembly.

Non-Steel Surface Preparation Now that I knew the rifle could function again, it was time to turn my attention to the condition of the barrel, magazine tube, and receiver shell. The receiver shell was the easiest place to start. A flat jeweler's file served to smooth out the pitting. I used 0000 steel wool to polish the soft aluminum, taking care to not damage the recesses cast in the shell.

Several times I stopped to slide the breechbolt back and forth in the shell while looking for any areas where drag hindered the function. Once I was satisfied with the interior works of the receiver, I turned my attention to the outside. I wire brushed all the surfaces to remove peeling and bubbled finish and then polished with 0000 steel wool. I was very careful to be certain the serial number was still clearly legible. When finished, I wiped the shell down with acetone and set aside to dry.



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Given the corrosion between the barrel and magazine tube, it was essential that I separate the two. This was accomplished by driving out the small tube band pin. With that removed, I was able to slide the tube out of the receiver shell and through the tube band clearing it from the barrel. As with the receiver shell, the magazine tube was set up on the 4" bench grinder with wire wheel and scoured to remove rust, flaking, and bubbled paint. A final step was to polish the tube with steel wool.

It was wiped down with acetone and set aside to dry. Barrel Preparation I was concerned about the condition of the bore. The muzzle and crown showed corrosion and I had no idea how much had migrated down the barrel. A pass through with a cleaning rod showed no obstruction. I ran a borescope down the barrel and, for the most part, the barrel appeared okay. I scrubbed briskly with a brush filled with Hoppe's #9, swabbed dry, and scoped again.

The picture wasn't very good, but except for some discoloration, the bore looked much improved. To be sure, I took the time to lap the barrel and scrub again to

make sure all of the lapping compound was removed. Previous pictures have shown the initial condition of the surface of the barrel. I first scrubbed the metal with 00 steel wool soaked in acetone. With anew pad of steel wool, I scrubbed the barrel with Birchwood Casey Blue & Rust Remover. This gave me a good view of the damage done to the barrel.

Using a flat jeweler's file, I carefully dressed the worst areas before polishing with 200 and 400 wet/dry sandpaper. I used the "shoe shine" method to go over the barrel. As I planned to use paint instead of a chemical blue process, the 400 was as fine as I needed to go. Again, I was very careful to not erase any of the identifying marks on the barrel. Fortunately, the area identifying the make and model of the rifle was only lightly corroded and a light polish over that area was sufficient.

I washed the barrel down with acetone and allowed it to dry. Recrowning The impact damage and corrosion around the muzzle was a concern. I can't shake the fact that I am a Bullseye shooter and driven to wring out Far

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every degree of accuracy I can. On top of that, I knew that this rifle would see young people learning to shoot. As an instructor, I can't see any sense in letting a young learner be frustrated by a rifle that won't shoot straight. Worse yet, they may decide it is their fault, not the rifle's, and lose interest in the sport. When teaching I make sure whatever rifle a youth picks up will group appropriately or I down check it for repairs.

Pacific Tool and Gauge makes excellent crown cutters for a variety of calibers. I chose their 11-degree Crown Tool to cut a recessed target crown. Metal Finish Originally, the rifle appeared to have a blued barrel and painted magazine tube, receiver shell, and trigger guard. I decided to use the same finish on all the metal parts that needed refinishing. I had some Dura Blue left over from a prior project and since I was trying to keep the cost down on this project I went ahead and used that.

Instead of firing up the compressor and using my airbrush, I decided to try out a starter kit I had picked up consisting of a can of compressed air and a paint bottle. It is designed for people who only want to do a couple of small projects and not invest in a lot of equipment.

My initial impression is that it works very well. I would caution, however, that you make sure your light is very even and bright as any shadows can mask areas where coverage is not quite even. I let the parts dry for three days.

Reassembly Putting Grandpa's Marlin all back together was straightforward. I put the magazine back in place and reinstalled the retaining pin. I very carefully reengaged the recoil spring, breechbolt assembly, and charging handle in the receiver shell. To install the siderails and action assembly, I first made sure the hammer was fully back in the cocked position, lined up the siderail holes, then fastened the two front screws, rear bolt, and sleeve assembly.

Setting the barrel and receiver assembly to one side, I inserted the trigger guard and trigger assembly into the stock and fastened the front screw. I then dropped the barrel and receiver into the top of the stock, inserted the rear trigger guard screw and the action screw in the fore end, and tightened everything down. After test firing, I gave the rifle one last cleaning and returned it to a very pleasantly surprised owner. AG

FROM THE ARCHIVE

Gunsmithing Business Tips, Part 3

An overview to working as a gunsmith.

BY MARK R. HOLLENSEN SEPTEMBER 2021

ORIGINAL PP. 8-11

Many years ago, I made the decision to undertake a career as a gunsmith and as part of that goal I opted to attend an accredited Gunsmith School. A couple of years later, I left school with a degree and began my search for a gunsmith job opening in shops located in my home town. Before graduating, we were asked to create a résumé listing our accomplishments, both from school and previous experience. That was the easy part. Getting hired on as a gunsmith was not. Or at least it seemed that way.

I did get hired on right after graduating and rushed back to my hometown to get started with my new career choice. At that point I felt it would just naturally happen, especially since I had a formal gunsmithing degree in hand now. However, I found that was just the very beginning of the journey. As I began working as a gunsmith, I learned on the fly some things I'd like to pass along to future gunsmiths and shop owners.

While I don't claim to be an authority on the gunsmithing business, I have walked the walk and have insights to help your career journey. In my book *The Business of Gunsmithing: A Practical Strategic Compendium* I cover various aspects and core elements of the job one is likely to encounter. The following are additional experiences and observations. First, there's the difference between what is learned in a formal course compared to what a practicing gunsmith and experienced shop owner knows.

Don't assume the shop owner immediately knows what you can do or are bringing to the table. You might walk into that shop with exciting ideas about your future as a gunsmith apprentice with a degree that says you are an educated gunsmith and ready for the job. However, the owner is more interested in how to increase the shop's sales and bottom line.

Since you were professionally trained and have the degree to prove it, you must know absolutely everything there is to know to work on all guns and perform quality work. The owners may be taking into account that your pay will be reflective of how much you'll increase shop income. Establishing realistic expectations will be your first crossroad and requires some communication.

As a new gunsmith working that first job, your thoughts probably concern how to best set up your new work area, how to get all the machinery you just had access to at gunsmith school, and how you can convince the owner that making these equipment purchases will make him tons of money. At least in your mind it will. In the shop owner's mind, he is thinking more minimal as far as equipment and tooling.

Mainly because it costs money—hard earned profit from the retail business money and profits your presence is supposed to add. The owner already knows the ins and outs and peaks and valleys of gun, accessory, and ammunition sales and how to man-

age that pot of money to pay overhead and other bills, for the shop and at home. During the initial hiring process, make sure you discuss and understand what the shop owner's thoughts, expectations, and goals are with you as the new gunsmith.

This is an important start point as well as periodically throughout your tenure there. If you don't, you'll be working in one direction while the owner wants to go somewhere else entirely. Remember, the owner assumes that a trained, papered, and knowledgeable gunsmith is a shop asset that can be utilized beyond the actual gun work itself.

You are now "available" to perform floor sales when gun work is slow, ordering, packaging, stocking, inventory tasks, administering log books, running a cash register, conducting background checks, buying used guns, sweeping the floor, etc. These assumptions can quickly put you in a position of scheduling your gun work around helping run the shop. If the shop is busy, you are busy not doing gun work. Expenses strain this further.

Telling the new boss that you need a lathe, mill, bluing tank set up, a well-made drill press, a surface grinder, etc. will not be easy, mainly because you are a new gunsmith and haven't built up a reputation with customers yet. That makes new equipment costs a drain on profits. What's the answer to this dilemma? The only solution is working with your new boss in agreeing on a plan that might not im-

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mediately get what you both want. But you can develop a plan where you can be more engaged in your gun repair work, building clientele with your refined “gunsmith persona” and then that increase in profit can increase your pay and/or get you more equipment that you want. Don’t walk in to your new job being inflexible about what you will be doing as you may not be working there for long. Plan on earning experience as you go and helping with non-gunsmith work as needed.

This delves back to those positive “gunsmith persona” skills discussed in the previous article. Just because you have an idea about how you plan on interacting with your customers, providing your skill, and demonstrating your integrity, honesty, and positive attitude doesn’t mean that the shop you just hired into has the same ideas in mind. Sure, you’ll both agree that making money (sales and gunsmithing work) is the end game but how you go about that can be an issue.

It could be that you later learn the shop you are working for is less than honest in their dealings with customers and don’t have any plans on curbing their bad attitude. This may put you in a difficult position, not because you can’t still be an honest and fair-minded gunsmith but because you are now a part of that shop and, consequently, share in that shop’s persona, good or bad.

So, here you are, fresh out of gunsmith school, doing everything right and you land your first job in a less-than-moral environment.

Can you make it work? Should you stay or leave immediately with the possibility of not landing another gunsmithing job in a reasonable amount of time? These are important questions that only you can answer. Depending on just how bad the shop is run could negatively impact your long-term future, even if you are fair and honest. You’ll have to decide if staying for the experience and short-term convenience is worth the cost.

If the shop is not customer friendly, your repair traffic will lesson and that will put you in a situation where gun work will take a backseat to floor sales, forcing you to leave anyway. However, leaving immediately may protect your integrity and persona but limit your experience, especially if anew work option isn’t forthcoming. Personal experience tells me to weigh just how bad the reputation of the shop is in the community first. If really bad, look elsewhere soonest.

If not horrible, this will be a challenge to developing your reputation as a developing gunsmith. The goal will be to project to your customers that you do have integrity regardless of the shop’s reputation. Being mindful of your persona, be careful of pre-

sending the shop as a “bad guy” as it can end your work there. Instead, lead by example. A positive, responsible persona without painting the shop in a bad light will be your best bet.

Get your positive, good things in when you can and back away from the negative stuff. This type of scenario is the sort of thing gunsmith school can’t teach. Another area to consider as anew gunsmith hire is your work area and environment inside the shop. While things will necessarily change, do some pre-planning before your official first day. One of the shops I worked in had my work area in the back of the store. That was great, at first.

As the owner increasingly relied on me more for daily shop operations (something you should expect) I began wearing a hole in the carpet between my workspace and the retail area. It also became a security issue as there were times I came out from the back and had customers standing in the shop looking over the display cases. There are simple fixes for some of this (a bell or alarm system on the door to notify when someone comes in, for one) but that situation wasn’t sustainable.

I was able to convince the owner to allow me to build a free-standing wall with a large window opening in the front of the shop just past

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the front entry door. I then set my shop area up so that I could work at my bench and still see the retail floor area. Consider safety risks if something goes wrong during a repair. It's usually a bad idea to test function firearms with live ammunition indoors, but believe me, it might be necessary sometimes. Also, consider a repair job involving a broken but loaded firearm that can't be cleared. For example, I've used a "shooting tank" behind the shop for this.

What if this occurred while working alone with customers in the shop? Even if it isn't for intentional test firing, have a bullet stop area in the shop to use as needed. Hazardous materials in the shop are another concern. Do you have countermeasures in place, such as the correct types of fire extinguishers, an eye washing station setup to use if you can't see, and MSDS (Material Safety Data Sheets) for all products being used in the shop readily available?

These things are sometimes forgotten when the excitement of starting your new career begins. Another area I like to acknowledge, mainly due to my being 6' 8", is how user friendly the workspace is. I have to build height into every machine tool I use or risk hunching over all day long. Set up your grinders and belt sanders so as to have clear view of the project while stand-

ing erect. You need to be keenly alert as to what you are doing and watching closely so as not to remove too much material.

For me, a free standing drill press (overall height) is too short and I have found myself conducting drilling and milling operations while on my knees just so I could get visually closer to the work. Consider how your cleaning station will be set up and what safety measures you have in place. Most cleaning solvents are flammable and some product inevitably splashes out over time, increasing the possibility of afire if not kept clean. You need to use this area without being hunched over. Flooring is another concern.

A concrete floor is easier to clean but what if you drop a \$5,000 gun on it? I recommend floor padding that can prevent a broken wooden stock after dropping from any angle from about work bench height. Inexpensive floor padding or even rolls of carpet remnants stacked can provide excellent gun dropping protection. It's also more comfortable to stand on all day. Another important area to consider is your parts inventory, storage, and identification. It's easy to become "parts overwhelmed".

Organization takes time but it is well spent. Throwing excess parts in a cigar box thinking that one day you will sort them out is

nothing more than kidding yourself and the more time spent neglecting it makes it further out of control. Go in thinking you will at least identify each part by firearm, part name, and potential cost, then label it and place in a baggie for storage.

From there, I'll inventory that baggie-filled box when completely full by logging its contents in a Microsoft Word document (or other word processor file) by manufacturer name and model. I'll title it "Parts Box #1" with the list of inventoried contents below, then go to Box #2, and so on as needed. Doing this organizes inventory for immediate search as needed. This prevents buying parts that you already have on hand and makes them available to find and sell or use as needed.

Plus, they're already bagged and labeled to go when you need. Finances and Management Let's talk about shop finances for a bit. Even if you work as the gunsmith for a shop, it makes good sense to track all shop funds spent and how much income the gunsmithing shop area is bringing in. You will have to do this if/when you run your own business anyway, so you might as well begin that process early on. Track each part purchased

GUNSMITHING BUSINESS TIPS, PART 3 CONTINUED

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for repairs, any postage and sales tax spent, and where it was purchased from. Yes, the shop owner is going to be tracking this for business and tax purposes. Why the redundancy? Keeping your own set of financial books can help you and the owner see how much money gunsmithing is netting. You'll need to know this to gauge how you're doing and so that you can explain in detail your effect on the bottom line.

This can rightly justify adding anew tool or machine, how much time you should be spending on gunsmith tasks versus the retail area, or to ask for a raise. If you don't track this, you are leaving it up to the owner to tell you that they believe it costs too much or that you are under performing. Don't be afraid to track what the shop does even though that information is already reported in the overall financial records.

The next time you need to discuss your time in the gunsmithing repair area compared to time spent on the sales floor, or need to add a tool or something to your shop, you can show why it will be good for the owner, not just you. Run your area as if it were your own so that you learn early on how to do it if/when you have your own shop. Now let's discuss time management. This will be at the core of your new career.

Spending some time looking for ways of managing your time better will directly benefit your bottom line. When working for a gun shop as the gunsmith, time can be an issue when trying to turn out quality repairs and craftsmanship. As a gunsmith, you will want ample time to inspect, function test, diagnose firearm issues, order parts, and repair tasks. Once repaired, additional time may be needed for test firing. Having a range at or near your shop is a tremendous time saver.

If not, you'll have to schedule time for any needed live fire testing. And there will be cases where you need to make more than two trips to ensure it is working or was repaired properly. In addition to the time

needed above, you may be spending a great deal of time on the sales floor while in-between repairs or awaiting parts to arrive. All of this takes up time during your day. More importantly, you need time to ensure that you are doing your work correctly and to the best of your ability.

Every gunsmith is different when it comes to the time they personally need to carry out repairs. When starting out, repairs take much longer. I like taking time before I even get started on a repair to check the owner's manual for any clues as to why it is not working properly along with the method of taking it down for cleaning. Then I check if others have had the same issue to speed up my inspection time.

If you are going back and forth from your work area and retail sales floor, you will quickly see an eight-hour day slips by too fast to truly and effectively carry out your gunsmithing work. The biggest risk here is not only less than desirable work, the pressures of rushing repairs can become a major liability issue, especially if you overlook something and the customer (or person next to them at the range) gets hurt or worse.

The problem with your time management plans are the inability to specifically request the allotted time that you may need from the boss due to each repair job being different. Some jobs are predictable, such as recoil pads, deep cleaning jobs, scope mounting and bore sighting jobs, and the like, so you can schedule time more accurately.

However, refinishing a stock (the entire process), bedding or pillar bedding a stock, making parts that are no longer available, going through semi-automatic firearms with all kinds of jamming or ejecting issues, to name just a few, can be difficult to estimate specific time allotments. Add that to range trips, final troubleshooting, and then finding even more needs to be done on the firearm to make it right, and you quickly start spending more time gunsmithing than on the sales floor.

This is something that the owner may not like because this seeps into profit margins as your need for repair time compared to sales increases. You know going in that the goal is to make money and the owner of the shop counts on that happening. Again, communication with the owner coupled with your intake, output, and profit margins will be your strongest voice towards getting the time you need to spend on repair work.

You don't want to produce sub-par repairs, skip steps, or let a dangerous condition go out the door because you didn't have the time to address it. Throw in the pressure from the customer wanting their repaired gun back soon and you will find yourself hurrying your work. Keep in mind that as you become more familiar with guns, how they work based on make and model, and the time you need taking them down and reassembling them, time management will get easier to formulate, allowing your work product to get better.

Be patient, take the needed time, and work with the owner to make this is mutually understood. The shop doesn't want a liability issue either so that is your main point when balancing your workload. I could probably go on about the nuances of the job but I believe that I have covered the most problematic issues for you to think about when you enter the field as a gunsmith. When first starting out, this information will be foreign to you and you more than likely will not fully understand it all.

In time, you will see these things crop up. Having a resource like this can definitely help you embrace these circumstances. Between this article series and my book, I think you can ramp up your knowledge of what lies ahead in your chosen path to become a working gunsmith. Give it your all and you will be amazed by what you can do. AG

PISTOLS

Nighthawk Custom DTS

The Nighthawk Custom Drop-In Trigger System provides an option for 1911s similar to AR-15 and other drop-in units.

BY ROBERT K. CAMPBELL SEPTEMBER 2021

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Among the advantages of the 1911 pistol is its straight-torear trigger press. This trigger was usually found to be six to eight pounds of compression on military pistols. Good work could be done in combat shooting with this trigger, although there is a huge difference between a smooth, tight, but heavy trigger compared to a rough, heavy trigger typically found on cheap pistols. Shooters want a smooth and lighter trigger action, especially for accuracy work.

Of course, this is achievable providing the gunsmith doing the work is skilled. Quality trigger action can be expensive consider the time involved in honing parts by hand. Even purchasing a trigger set from a maker doesn't guarantee that fitting isn't needed and some parts require more fitting than others.

Nighthawk Custom has introduced an innovative and interesting trigger component to address this with their Drop-In Trigger System.

A trained gunsmith will It was invented by Mark Dye, the Director of Gunsmithing Program at Montgomery Community College. find the DTS a great option compared to ordering an ignition set and then installing it. While the home hobbyist is discouraged from working trigger actions, a gunsmith skilled with the 1911 and its function will find the DTS a workable system with a minimum of experience. The DTS combines the hammer, hammer strut, disconnect, sear, and sear spring into a single compact housing.

The machining is excellent—first class, in fact. All of the ignition parts are held together by the DTS unit's housing and the parts are constructed of 416 stainless. Given the needed skill and time is involved in fitting trigger parts, the DTS saves a great deal of effort. The unit consistently yields a 4.0 pound trigger action—smooth, crisp, and tight. A great advantage is that every single unit is the same.

As those who have owned Nighthawk Custom handguns will tell you, there is practically zero variation between pistols as far as fit, finish, and trigger compression is concerned. I have done dozens of 1911 trigger jobs. Some time ago I realized

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that attempting a trigger job on existing parts isn't a good idea, largely due to indifferent metallurgy in budget-grade pistols. MIM and cast parts are not the best candidate for this work. I use quality aftermarket ignition kits for these upgrades. Just the same, there is some fitting as even purchasing a quality ignition kit doesn't guarantee the job will be fit free. The Nighthawk is a quality unit and much easier to use.

To install, strip the frame of the pistol to remove the grip safety, hammer, hammer strut, sear, and trigger. The DTS is installed by angling the drop-in unit from the rear. The disconnect will slip into the frame opening. Next, work the sear and hammer pins into the DTS. There are a few concerns. As one example, I had to call Nighthawk and get a

few tips as the unit did not seem to sync properly with the grip safety of the pistol I was using. The Springfield Range Officer I was using wasn't quite drop-in.

If the grip safety requires fitting with the DTS unit, file the grip safety. The slide lock safety of the 1911 also may require a degree of fitting. There is a chance the slide lock safety, if already filed to a tight fit with the existing sear, might need to be replaced though this won't happen often. According to Nighthawk, they foresaw this possibility and made certain the sear is tight enough that almost all thumb safeties will fit properly.

In this case the grip safety required fitting while the slide lock safety required only a minimal amount—a few passes with the file was enough for crisp operation. After work-

ing the DTS into a 1911, I had occasion to talk with the folks at Nighthawk. They are a good group, very helpful. The actual inventor of the unit is a gunsmith and instructor named Mark Dye who has taught gunsmithing on a university level and is currently the Director of Gunsmithing Programs at Montgomery Community College.

The unit is designed by an accomplished gunsmith and built by one of our reputable custom shops. Once the unit is installed the action is very good. The DTS unit features a very short take-up—what we call tight. The only factor that may affect the trigger pull weight or trigger compression that is the mainspring weight is out of the control of the maker. Nighthawk says the trigger compression may

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be slightly higher before a modest break in period. In the case of the DTS unit I have, trigger compression settled in at 4.0 pounds. An interesting innovation of the DTS is that the sear spring is hardly recognizable. The Nighthawk DTS sear spring features a single finger rather than the standard three finger sear spring. The system is simple and works just fine. Going over the Nighthawk DTS with magnification I found the machined stainless 416 parts very well made and finished.

This is a drop-in unit that lives up to the name. Gunsmiths will find the Nighthawk DTS a cost effective option and viable for any

pistol needing an upgraded trigger action. There may be an occasional need to hand fit the slide lock safety but this isn't likely—and if needed, the work is not difficult. I believe it is more likely the grip safety may require fitting. Figuring out what was going on took more time than applying the fix itself and the phone call to Nighthawk Custom was pleasant and informative.

Most importantly, the Nighthawk DTS drop in trigger system works as designed and offers a real improvement over standard trigger actions. The slide lock safety and grip safety may require some fitting. Let's take a look at the economics. The Nighthawk DTS unit lists

for \$299. The unit allows installation of the same type of unit in several pistols—say a competition pistol and back up pistol—and is economical based on how long this work normally takes.

Most ignition units cost over two hundred dollars and then there is the time involved in fitting and stoning the parts, not to mention the time involved in all of the side work of choosing parts. The DTS may be a good choice and economic option for your next custom 1911 project. AG

HISTORY

Arma Lite History

For nearly seven decades, the original maker of Eugene Stoner's famed rifle remains among the best gun manufacturers.

BY DEAN MEIER SEPTEMBER 2021

ORIGINAL PP. 15-20

The AR-15 and derivatives might be among the most famous rifles, made so by its genuinely effective design equally admired by precision Service Rifle and action shooters alike—and also in part by prohibitionists that have never handled one. As you might expect, its history is similar to many great designs and it well combines simplicity, function, and utility. Fairchild Aviation Corporation was an aerospace manufacturing company founded by Sherman Fairchild in 1924, producing the Fairchild FC-1, the first U.

S. aircraft to include a fully enclosed cockpit and hydraulic landing gear. Arma Lite was founded in the early 1950s as a small arms engineering concern created by George Sullivan, the patent counsel for Lockheed Corporation, focused on using the latest advances in material design. Initially working independently for several years with a few employees and leased equipment, Arma Lite's ideas caught the interest of Richard Boutelle at Fairchild, which bought Arma Lite and made it a subdivision 1954.

While testing an early Arma Lite prototype at a local shooting range, Sullivan met Eugene Stoner. Stoner, a former Marine in World War II, had been working a variety of jobs while building gun prototypes in his spare time. Sullivan hired him as Arma Lite's Chief Engineer. Arma Lite's initial project was the AR-1 Parasniper, a lightweight bolt action rifle. Shortly after

Fairchild bought Arma Lite, the company was invited to submit anew survival rifle design to the U. S. Air Force.

A few weeks later, Arma Lite submitted the AR-5. Chambered in 22 Hornet, the Air Force adopted it as the MA-1 Survival Rifle. This success with the AR-5 led Fairchild to reverse its strategy of focusing on the commercial market first and direct all development to military firearms. Arma Lite's next big project was developing what would become the AR-10.

Based on Stoner's fourth prototype, two hand-built production AR-10s were tested by the Springfield Armory (not to be confused by the commercial gun maker of the same name) in late 1956 as a possible replacement to the venerable M1 Garand. The AR-10 faced competition from the two other designs, the Springfield Armory T-44 and the T-48, an FN FAL variant. The T-44 and the T-48 had a lead in development and trials testing, with the T-44 having the additional advantage of being an in-house Springfield Armory design.

The AR-10 was very different than the other designs, being made of aircraft grade aluminum and plastic. The Army eventually selected the T-44 as the M14. Based on what they saw in the AR-10, however, other Army officials asked Arma Lite to develop a smaller version. The ensuing prototype was called the AR-15. The mid-to-late 1950s was a period of intense development at Arma Lite. The engineering staff was strong, with Eugene Stoner, James Sullivan, and Robert Fremont present.

In addition to the AR-15, development of the AR-17 shotgun as well as the AR-5-based AR-7 22 Long Rifle survival rifle. The AR-7 entered production for the commercial market and small numbers were sold to various military forces. S. military history, was invented by Arma Lite. The M16A2 (bottom) improved the sights and lead to the AR-15's dominance in Across The Course shooting. The M16A4 MWS (Modular Weapon System) added flexibility with Picatinny rails.

The M-15TBN (top) keeps all this while doubling accuracy and being more compact. es. The company also developed the AR-16, a sheet metal version of the AR-10. Three specimens were produced. The adoption of the M14 by the Army and Arma Lite's focus on the AR-10 caused the AR-16 to be dropped. Arma Lite was late with the AR-10 and early with the AR-15. Tired of repeated failures in the market, Fairchild licensed the AR-15 to Colt and the AR-10 to Artillerie Inrichtingen, a Dutch state-owned munitions company.

The engineering team started to split up at the end of the decade. Fremont left for Colt in 1959, Sullivan left in 1960, and Stoner left in 1961 to serve as a consultant to Colt. With both models gone Arma Lite was in trouble. Its only rifle in production was the AR-7. After buying it from Arma Lite, Colt contracted the AR-15 to the U. S. Air

ARMA LITE HISTORY CONTINUED

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Force to arm base security troops. Commercial models were then sent to Special Forces in Viet Nam, who reported great success with the weapon. This led to it being adopted by the Army in 1964. Early Colt AR-15s, their magazines, and their operator's manuals were marked with Arma Lite's name. Colt's retained the AR-15 designation on commercial rifles and retained the AR (originally, "Arma Lite Rifle") model designation. Frustrated by production delays at Artillerie Inrichtingen and poor sales, Fairchild dropped A.

I's license to produce the AR-10. Disappointed with Arma Lite's slim profits, largely derived from licensing fees, Fairchild dissolved its association with Arma Lite. The original principals of Arma Lite acquired the company from Fairchild, including rights and title to all Arma Lite designs except the AR-10 and AR-15, which had been licensed away.

The organization continued from this time on as Arma Lite, Inc., however, with both the AR-10 and AR-15 designs sold off, Arma Lite was left without a viable design to market and set about to develop rifles that wouldn't violate Stoner's gas system patents. The company resumed development of the 7.62 mm NATO AR-16, which had a more traditional gas piston design, and stamped and welded steel construction in place of aluminum forgings. Ultimately, it was produced only in prototype quantities.

The AR-17, a two-shot autoloading shotgun based on the short-recoil principle, aluminum and plastic construction, and weighing 5.5 pounds, was released but only 1,200 were ever produced. AR-10/15 Indepth AR-15-based rifles remain the most commonly issued 5.56 NATO rifles around the world, having been adopted by 15 countries in NATO and over 80 militaries total. As an employee of Fairchild Engine & Airplane, Stoner filed the original patent (#2,951,424) on August 14, 1956.

One of the goals of the design stated in the patent was to "provide a gas system which is lighter and less expensive to produce because of its simplicity than the present gas systems now used in automatic rifle mechanisms." Stoner noted, "the most widely used method of operation of automatic rifles today is the conventional gas cylinder, piston and actuating rod assembly... It is a principal object of this invention to utilize the basic parts of an automatic rifle mechanism such as the bolt and bolt carrier to perform a double function." While the primary function of the bolt carrier rotates, locks and reciprocates the bolt, it also serves as a movable cylinder to actuate the mechanism.

The bolt serves as a stationary piston in addition to its role in locking the breech. This eliminates the need for a separate gas cylinder, piston, and actuating rod assembly. Stoner's system is best described as an internal piston design, with the older, more conventional design being an external piston. This is not "direct impingement" despite being a common but incorrect descriptor.

In fact, in the official patent filing, Stoner states, "This invention is a true expanding gas system instead of the conventional impinging gas system." While designed to reduce parts and save weight, it also eliminates many causes of inaccuracy in self-loading designs. Stoner essentially created a straight pull bolt action rifle that uses gas pressure to self-operate. One of the stated goals in Stoner's original patent was light weight.

Using an efficient, parts-saving design coupled with 7075 aluminum alloy and plastics, early full-length AR-15s were about 6.5 pounds without magazine or sling, the same weight as the current M4. Curtis Le May viewed a demonstration of the new design in 1960. By 1961 the Air Force fielded 80,000 copies. The rest of the U. S. military began adopting the new rifle in

1962, with a halt to M14 production in 1963 and a U. S. Army order of 85,000 XM16E1s.

There were several deficiencies with the M16 as implemented, largely due to ignoring key features implemented by Stoner and the lack of even minimal maintenance training that will keep any AR-15 at top reliability. Despite being over a half century old and having five major revisions to the original, issue version, Viet Nam-era problems that have long been rectified are still circulated as flaws.

This is like claiming personal computers will never catch on because the Digital Equipment Corporation PDP-7 (\$72,000 in 1965) is too complex and expensive for individuals. Mark Westrom, who owned Arma Lite from 1996 until 2013, commented on the perceived reliability problem in an interview with Small Arms Defense Journal: "The criticism of the M16 family of rifles comes from basically two places. One, it comes from commercial guys who bad-mouth the weapon so that they can sell their product.

The other comes from weak maintenance—things as simple as bad magazines. Virtually all of the problems with M16 rifle malfunctions could be solved by throwing away bad magazines. "When I was assigned to Rock Island, I hated the M16. And I had a lot of time on my hands, so I initiated a study of the M16. I had access to the technical library at Rock Island, and researched deeply into historical documents that hadn't been accessed since the 1960s. "One of the things that bothered me with the M16 was that gas tube.

I've since realized that the gas tube is a brilliant piece of engineering. People talk about going to a piston gun. The M16 is a piston gun. The piston on an M16 is in the bolt carrier, but the M16 system is still a piston gun. The gas tube system keeps recoil forces in a straight line. The M16 gas tube system does not have

ARMA LITE HISTORY CONTINUED

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This fixture was designed and built in-house for proof testing the AR-50. an issue with moving masses that arise when using a connecting rod or a piston. The gas tube system is a brilliant design, but I didn't like the dust, dirt, and carbon that was deposited in the receiver. "The problem with the Army is that they have a white-glove mentality, and they want their rifles clean. It's easy to tell when the rifle is absolutely clean. It's hard to tell when the rifle is clean enough.

That white-glove mentality is a powerful influence within the U. S. armed forces. Soldiers don't realize that wiping down and lubing the rifle components is enough on an M16. Instead, they overdo it." The Army standardized an upgrade of the XM16E1 as the M16A1 in 1967 and the M16A2 rifle entered service in the early 1980s, ordered in significant numbers by 1987.

Features included a faster twist to stabilize NATO-approved, Belgian-designed SS109 (M855 "green tip") ball, click-adjustable rear sight for windage and elevation, heavier barrel, and case deflector built into the upper receiver. Full auto was replaced with three round burst, implemented via a cam that made an already mediocre trigger less consistent, as the pull weight differs as the cam rotates. The M16A3 rifle is an M16A2 rifle without the burst cam, like the M16A1 with semi-automatic and full automatic fire.

The M16A4 features a flat top upper receiver with a Picatinny rail, allowing various optics to mount in place of iron sights.

MIL-STD-1913 (STANAG 2324) rail, standardized, tested, and evaluated at Picatinny Arsenal in 1995, was based of the Weaver rail and originally intended for mounting optical sights on top of receivers. However, the versatility was quickly realized and catalogs of various accessories have been made available.

The M5 RAS (Rail Adapter System) by Knights Armament Company was developed to expand the A4 into the Modular Weapon System. The M5 is a non-free float handguard that is a drop-in replacement for the A2-type handguards originally issued with the A4. With four rails running the length of the forend, any number of accessories can be mounted. AR-18 The 5.56mm AR-18 began development as anew rifle to compete with the AR-15.

Combining lessons of the AR-15 and AR-16, the AR-18 is largely sheet metal and features a floating piston gas system instead of the Stoner-designed internal piston system found in the AR-10 and AR-15. Designed by Art Miller, the AR-18 was the main focus of Arma Lite's efforts for the next two decades, however, the sales success of the AR-15 proved the undoing of the AR-18, and the latter failed to garner substantial orders.

In response to criticism of the rifle's performance in trials by the military in the United States and Great Britain, a few minor improvements were made to the original design, but little else was done. Arma Lite manufactured some AR-18 and semi-

auto-only AR-180 rifles at its Costa Mesa facility and later licensed production to Howa Machinery Co. in Japan.

However, Japan was prohibited under its laws from selling military-style arms to combative nations, and with the United States involved in the Viet Nam war, production at the Howa plant was limited. Arma Lite then licensed production to Sterling Armaments in Dagenham, Great Britain. Sales remained modest. Today, the AR-18 is best known for its use by the Provisional Irish Republican Army in Northern Ireland, who received small quantities of the rifle from black market sources.

The AR-18 gas system and rotating bolt mechanism would later serve as the basis for the current British small arms family, the SA80, which are essentially AR-18s in bullpup configuration. Other designs, such as the Singapore SAR-80 and German G36, are based upon the AR-18. In order to concentrate full effort on the military sales program, Arma Lite elected to discontinue its other commercial firearm activities.

In early 1970s Arma Lite sold the AR-7 rifle to Charter Arms and the company effectively ceased operations. In 1983 Arma Lite was sold to Elisco Tool Manufacturing Company in the Philippines, with tooling, remaining parts inventory for the AR-17 and AR-18 and some of the employees from the Costa Mesa shop. Arma Lite continued to market existing rifles and parts. Elisco Tool had successfully produced the M16A1 for the Philippine armed forces and po-

ARMA LITE HISTORY CONTINUED

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Most other sellers are contracting out parts manufacture to a company like Arma Lite. Arma Lite forges, machines, and broaches lower and upper receivers in house for their own rifles and for other companies. Difficulties with Colt over M16 licensing prompted Elisco to seek another 5.56mm rifle and the AR-18 was the only real contender. Unfortunately, this ultimately failed due to political events in the Philippines themselves.

With Ferdinand Marcos overturned and in exile, the political and economic links of the government were dramatically shifted and Elisco was unable to carry out the AR-18 production. Independent of Arma Lite, Karl Lewis and Jim Glazier formed a company called Eagle Arms in Coal Valley, Illinois in 1986. Lewis had manufactured a wide variety of both commercial and military parts for M16 rifles, and Eagle Arms assumed the increasingly distracting retail business from Lewis's company, Lewis Machine and Tool (LMT).

Eagle Arms initially marketed M16 and AR-15 type rifle parts. The early Stoner patents had expired and Eagle was able to build both parts and complete rifles. In 1989 Eagle commenced production of complete rifles, with LMT serving as the major supplier. In January 1994, Mark Westrom purchased Eagle Arms. Westrom was a former Army Ordnance Officer and a civilian employee of the Weapons Systems Management Directorate of the Army's Armament Materiel and Chemical Command (AMCCOM) at nearby Rock Island Arsenal.

After the purchase, the company continued producing Eagle Arms EA-15 rifles and Westrom's background in Service Rifle competition produced a focus on high grade target rifles just before the AR-15 began dominating Across The Course matches for Service Rifle shooters. Westrom also initiated the design of a 308 AR-10 type rifle, the M-10, in line with Eagle's 223 Remington M-15. The bulk of the engineering work was contracted out to LMT.

In early 1995, Westrom purchased Arma Lite's trademark rights and production of Arma Lite rifles resumed in Illinois. The corporation was reorganized as Arma Lite, with Eagle Arms converted to a division of Arma Lite. First shipments of new Arma Lite rifles began in 1995. With the reorganization as Arma Lite, the M-10 rifle was renamed. Arma Lite/Fairchild had already used the AR-10 designation with its 1950s era 308/7.62 rifles and had developed the AR-10A as an improvement on it.

The planned M-10 rifle series was designated the AR-10B series and deliveries commenced in 1996. The AR-10B rifle was developed with a then-unusual reliance on computer design and simulation. In fact, the rifle was never prototyped. Individual sub-components were tested on a special lower receiver made of two slabs of aluminum fitted to an SR-25 upper receiver assembly. The first full prototype AR-10B was the first rifle off the production line.

This approach was risky, but required by the limitations on cash at that time and proved successful. Results from the prototype and the first production rifles disclosed that the only error was in not installing a firing pin retarding spring. The spring was planned early in the development but left out of the final design because there seemed to be no need for it. Subsequent problems with the surplus ammunition used by some customers required manufacture of the spring.

Fortunately, space for the spring was built into the bolt carrier, and it was quickly dispatched to the field and the production line. In late 1997, Arma Lite began development of the AR-50, a single shot rifle chambered for 50 Browning Machine Gun cartridge and designed strictly for the commercial market. It was introduced at SHOT in 1999 and is still in production. The success of the AR-50 prompted a smaller version, the AR-30 in 7.62, 300 Winchester Magnum, and 338 Lapua.

For the first time in company history, Arma Lite created a line of handguns. Mark Westrom met with representatives of Sarsilmaz, a firearm manufacturing company in Turkey, in 2005. Sarsilmaz had been making the Sarsilmaz Kılınç 2000, their version of the Czech CZ-75 with design elements similar to the SIG P210. With input from Westrom, the design was improved and is now the AR-24 line. Arma Lite continues to produce firearms and design new ones. It has

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Here, Mark Westrom demonstrates use of a coordinate measuring machine for checking components back when he owned the company. shipped far more 5.56/223 rifles than Arma Lite did during its first through third phases and more AR-10s than Arma Lite/Fairchild and Artillerie Inrichtingen did combined.

Strategic Armory Corps Strategic Armory Corps, which also owns Surgeon Rifles, AWC Silencers, Mc Millan Firearms, and Nexus Ammunition, acquired Arma Lite in 2013, initially retaining the company's 90 employees as well as appointing Westrom to SAC's board of directors. The expansion created more active development projects than any time since 1961. In 2015, Arma Lite introduced 18 new products including AR-10 and M-15 platform firearms.

During 2016, Arma Lite revived the Eagle Arms brand, introducing an entry level M-15 rifle. In mid 2018, Arma Lite relocated from Geneseo, Illinois to Phoenix, Arizona. Arma Lite Firearm Overview AR-1 (1954) The 7.62mm "Parasnipr" rifle was a light-weight bolt action rifle and began life at Arma Lite's first location in Hollywood, California. It broke new ground by using a foam-filled fiberglass stock and an anodized aluminum barrel with a thin steel liner.

A variety of actions were used with Remingtons being most common. The rifle with scope weighed six pounds. Very few were made. AR-5 (1955) A 2 3/4 pound bolt action four shot 22 Hornet survival rifle adopted by the Air Force in 1956. Its distinguishing characteristic was the ability to detach the barrel from the action, the ac-

tion from the stock, and place both inside the stock. With the buttcap replaced, the rifle would float.

The government specification for the MA-1 called for a second, 22 Long Rifle barrel to be attached outside the stock. The AR-5 led to the AR-7 and further government contracts. AR-7 (1959) The AR-7 Explorer was the first commercial item to be put into production by the Arma Lite Division of Fairchild and is a civilian version of the Air Force-adopted AR-5. Chambered in 22 Long Rifle, it disassembles without the use of tools and stows inside its plastic butt stock.

The AR-7 weighs 2 3/4 pounds and floats, either assembled or in the stowed configuration. The action is semi-automatic and is fed from an eight-round magazine. It has been in intermittent production since. AR-10 (1956) This 7.62mm NATO rifle was conceived by Eugene Stoner and tested by U. S. Ordnance at their Springfield Armory in 1956 with licensing to Artillerie Inrichtingen in Holland in 1957.

The AR-10 combined a number of previous features with a new gas system patented by Stoner, such as gas ported off the barrel via a tube back into the upper receiver, into the bolt carrier, and entering an expansion chamber where it expands and drives the carrier to the rear. The rearward movement of the carrier transferred by a cam pin riding in a curved path and engaging the bolt, forces the bolt to rotate to unlock. Common reports that the Stoner system is copied from the Swedish Ljungman system are incorrect.

The Ljungman system has a tube carrying gas ported off the barrel but the tube simply directs the gas into a cavity in the top of the carrier to blow the carrier to the rear. AR-15 (1956-59) In a joint effort, Arma Lite and Remington developed the 223 Remington cartridge for this Eugene Stoner design. The AR-15 was licensed to the Colt's Patent Firearms Manufacturing Company in 1959.

The US Air Force completed tests of the AR-15 and procured 8,500 rifles in 1961, and standardized it in 1963, purchasing 85,000 rifles. The Army also ordered 85,000 rifles that year with an additional 35,000 in 1964, 100,000 in 1965, and 100,000 in 1966. These rifles were first issued primarily to combat troops in the Dominican Republic and to Special Forces, Airborne, helicopter crews, Air Commando, and other special category troops in Viet Nam.

Labeled M16 by the Department of Defense, it was type classified standard A1 in 1965 and became the military's basic service rifle. AR-16 (1959-60) A folding stock equipped infantry rifle in 7.62mm NATO caliber and capable of launching rifle grenades without modifications or attachments to the rifle. The primary reason for development of the AR-16 was to produce a weapon with the performance capabilities of the AR-10/AR-15 series, but at a greatly reduced production cost and without advanced technological resources.

Although the AR-16 didn't enter production, elements of its design influenced the 1995 design of the AR-10B.

ARMA LITE HISTORY CONTINUED

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AR-17 (1956-62) A semi-automatic shotgun featuring a hard-anodized aluminum receiver and barrel, and a brown wood grain plastic stock. The barrel was equipped with replaceable chokes. The AR-17 was called the "Golden Gun" due to the color of the aluminum components. Two thousand sets of parts for the AR-17 were produced but only 1,200 guns were sold. The AR-17 never met commercial success. It was semi-automatic and held only two shots.

It was lightweight but was marketed to trap and skeet shooters who normally fire many shots per day. AR-18 (1963-65) Just as the AR-16 is basically a sheet metal version of the AR-10, the AR-18 is a sheet metal version of the AR-15. The AR-18 was an effort to correct the mistake of selling the AR-15 to Colt. As the AR-15 became successful, Arma Lite needed a rifle that could compete in the same market and put Arthur Miller and Eugene Stoner to the task of making it.

The AR-18 is a gas operated, 6.9 pound rifle equipped with a folding stock and capable of full and semi-automatic fire. Firing the same cartridge as the AR-15, the AR-18 uses steel stampings instead of alloy forgings, simplifying manufacture and greatly reducing production costs. The main functional differences include the use of a Tokarev-style sliding gas cylinder under the handguards that avoided violating the Stoner gas system patent.

The second difference was the use of dual operating springs on rods in the upper receiver, which allowed the stock to fold to the side. The AR-180 (1963-65) was a semiautomatic version. M-15 (1994) In order to avoid a conflict with Colt's trademark of "AR-15" Arma Lite has since designated its versions of Stoner's patent as the "M-15". AR-20 (1998-99) The AR-20 was the initial designation of Arma Lite's 50 BMG rifle. The designation was changed to the AR-50 to emphasize the caliber of the rifle.

AR-22 (1998) The AR-22 is a Blank Firing Device for the Mk 19 Mod 4 40mm Grenade Machine Gun, designed for training and testing and employing a standard 7.62mm NATO blank. The AR-22 was conceived by CW4 John Miller, and designed by George Reynolds, President of Knox Engineering Company of Altona, Illinois. Reynolds brought it to Arma Lite when he began work on the Arma Lite AR-50 rifle.

AR-23 (1998) The AR-23 is a Sub-Caliber Training Device for the Mk 19 Mod 4 Grenade Machine Gun employing a special tracer cartridge designed to follow the same ballistic arc of the 40mm grenade. The AR-23 was conceived by CW4 John Miller, and designed by George Reynolds. Like the AR-22, Reynolds brought it to Arma Lite when he began work on the Arma Lite AR-50 rifle. AR-24 (2006) In 2005, Mark Westrom met with representatives of Sarsilmaz, a firearm manufacturing company in Turkey.

Starting with their basic CZ-75 pistol, Westrom made changes that he felt would appeal to the American consumer. The result, in 2006, was a set of four 9mm pistols that bear the Arma Lite name. AR-50 (1998) Arma Lite's normal pattern of designation of models was altered for the AR-50 to reflect the rifle's caliber. It is chambered for the 50 Browning Machine Gun cartridge and is capable of being built to accept the more powerful Russian 12.7mm cartridge. It features a unique stock made largely of aluminum.

The forend is an extrusion with V-cross section that mates with an octagonal receiver. This allows precise, repeatable bedding with no hand labor. The buttstock includes a vertically adjustable butt pad and adjustable cheek rest. The initial AR-50 departs from Arma Lite's normal trend towards lightweight rifles as it weighs 41 pounds. It is intended for the commercial market, where the weight adds comfort

when firing the powerful cartridge. AR-30 (1999) The AR-30 is scaled down version of the AR-50 50 BMG rifle.

The rifles are based on an aluminum stock that merges a machine rest with a rifle stock. Intended for high-accuracy use, the machine rest elements consist of an octagonal receiver, a matching V-shaped channel in the stock and a recoil wedge. Conventional action screws draw the action down into the stock and the recoil wedge forces the recoil lug into intimate contact with the stock.

The AR-30/AR-50 requires no hand fitting or bedding compounds, the action can be removed and re-installed without significant loss of zero, and is immune to changes in temperature or humidity. In addition to conventional threaded holes for mounting optic bases, the receivers are equipped with mounting slots mating with an Arma Lite-designed sight base that lessens recoil loads on the scope mount screws. The AR-30 is built to handle cartridges up to 338 Lapua.

AR-180B (2001) Featuring a lower made of high strength polymer, the AR-180B uses standard AR-15 magazines and parts. The upper is formed sheet metal and features the AR-180 gas system. The 19.8" chrome moly barrel features an integral muzzle brake and Arma Lite's adjustable front sight base. The AR-180B is a semi-automatic, 223 Remington, gas operated rifle weighing six pounds and equipped with a fixed stock.

The AR-180B's upper and lower receiver groups are interchangeable with of the 1st generation AR-180s, so earlier models may now be repaired by replacing the upper or lower half. AR-19 (2021) The AR-19 is a PCC (Pistol Caliber Carbine) chambered in 9x19mm. Using a self-loading blow-back-operated action, the AR-19 uses controls identical to all AR-type long guns and feeds from Glock magazines. AG

PEOPLE & COMPANIES

Conversion Cylinders

Working with and understanding conversion cylinders for blackpowder revolvers.

BY ROBERT K. CAMPBELL SEPTEMBER 2021

ORIGINAL PP. 21-22

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Conversion cylinders are a modification for blackpowder cap and ball revolvers to take metallic cartridges. The typical conversion cylinder may be a five or six chamber cylinder designed to fit a Pietta, Uberti, or Ruger Old Army revolver that is specific to the handgun. As an example, Taylors & Company (Taylors-Firearms.com, lists seven different cylinders for Pietta and Uberti handguns. A Pietta cylinder doesn't fit a Uberti and even with the correct cylinder, some fitting may be needed.

Conversion cylinders are designed to accommodate firing modern cartridges such as 38 Smith & Wesson or 45 Colt, depending on the conversion cylinder. A cap and ball revolver with an original caliber of .36 takes a 38 Special conversion while .44 caliber guns take a 45 Colt conversion cylinder. They are of strong steel and quite safe but common sense tells us that brass frame cap and ball revolver may 44 caliber black

powder cap and ball cylinder, left, compared to the five-shot 45 Colt cartridge cylinder, right.

It is a neat trick to design a five-shot cylinder that works simply by sliding it onto the revolver's arbor. not stand up as well in long use as steel frame revolvers. Fortunately, the strength is in the cylinder, although small parts and the frame may take a beating. In every case conversion cylinders are limited to standard pressure loads. +Por heavy loads would be a real problem and should be discouraged. A standard loading such as the Black Hills Ammunition cowboy loads are recommended.

The cylinders normally do not require fitting if they have been ordered correctly for a specific To the right is the original .44 caliber cap and ball cylinder. In the lower part of the photo the firing pin plate for the conversion cylinder is illustrated. firearm. Just

the same, when it is considered that thousands of these revolvers have been manufactured over a span of decades, we may find some fitting is needed.

The cylinders are installed by removing the old cap and ball cylinder and replacing it with a conversion cylinder. The conversion cylinder is a machined unit with standard cylinders like most revolver cylinders. The firing pin, however, is a special design. A backplate lines up on a single pin on the rear of the cylinder. This backplate contains five or six firing pins, one for each cartridge. The hammer, normally designed to crack a percussion cap, now falls on a floating firing pin.

This is a novel system that works well. To unload the cartridge conversion cylinder, remove the conversion cylinder from the handgun, then the back plate, and then the cases shoved or shaken out. While not a fast system, it is simple and reliable.

CONVERSION CYLINDERS CONTINUED

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Pretty interesting design and very well machined. I found it interesting that the six-shot Colt 1860 Army takes a five-shot 45 Colt cylinder. Since the Colt Army uses a rebated cylinder similar in diameter at the rear to the .36 caliber Colt Navy revolver, a six-shot cylinder was out of the question. Yet, the lockwork operates just fine with the five-shot conversion cylinder in place. Cylinder Fixes All revolvers based on the Colt Single Action Army operate on the same principle.

The hammer is cocked and moved to the rear, locking in place until the trigger is pressed. A stud on the hammer will contact the rear of the cylinder bolt as the revolver is cocked. The cylinder locking bolt then drops downward and the cylinder is allowed to rotate. As the hammer continues its travel past the half cock position/half cock notch, the bolt is released and the bolt spring presses the bolt stop into position and the cylinder is locked tight.

When the trigger is pressed the hammer falls and the revolver fires. The cylinder must remain locked in place for accuracy, reliability, and safety. I think that a problem with many shooters is that they do not pull the hammer completely to the rear before lowering the hammer. If the hammer is brought only to the half cock notch the system doesn't properly operate. This also leads to the often-noted scoring of the cylinder by the bolt stop. Occasionally there are difficulties with conversion cylinders.

They are not big problems but must be addressed based on standard cylinder fitting techniques. One such difficulty came into my shop recently. The shooter had taken good notes on his problems, making the initial assessment much easier. He reported the ratchets on the conversion cylinder were different than the original cylinder. I agreed, but they seemed a proper fit. What

I found was that the hand in the revolver was just slightly too long to properly mate with the new conversion cylinder.

The result is a different angle or fulcrum. The old cylinder worked fine, but the new cylinder, when engaged as the shooter lowered the hammer without firing, wanted to move in the opposite direction than the normal rotation of the cylinder. There were several avenues to pursue toward a fix. If the hand was left as-is it would work fine with the original cylinder and mostly okay with the new one with a less-than-ideal fit.

If the new cylinder was intended to be the normal go-to cylinder I could modify the ratchets slightly to work with both. That seemed the preferred course, having two cylinders matched to the revolver. Another course could be to file the hand very slightly shorter. Of course, this demands careful work as very little effort will shorten the

RIFLES

Reader Forum

BY AMERICAN GUNSMITH EDITORS SEPTEMBER 2021

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A problem that I ran across many years ago fitting anew 45 ACP cyl- 90 Grain Service Rifle Bullets The 90 grain Very Low Drag bullets Joe Carlos has written about have been produced in some fashion since around 1998 for Match Rifle in use at High Power Rifle Across the Course competition. Around 2000 John Holliger of White Oak Precision paid Pac-Nor Barreling to produce a 1:6.5" twist button in the hopes that he could get them to shoot out of Service Rifle AR-15s.

The investment paid inder to a blackpowder Colt SAA frame was a bolt stop that was larger than the corresponding bolt cut in the cylinder. I didn't think much of it at the time, but in retrospect it probably should not have happened. The Colt's bolt stop was removed and polished. The bolt was simply too wide.

I later searched for oversize bolt stops and could not find one, although I suppose Colt production simply included larger bolt stops in some cases. off and early shooters like Jeff Rost started to post big scores at 600 and 1000 yards. In 2002, Chris Hatcher of the Army Marksmanship Unit shot the

first clean score at a Long Range (1,000 yards) match with the 90 grain JLK VLD from JLK Bullets at the Interservice matches.

John Scandale followed that up with a win at the Nationals that same year, taking the Porter Trophy at Camp Perry shooting JLK 90s. One experienced gunsmith felt the cylinder's wobble was a factor. Certainly food for thought. It may be the bolt is causing a problem rather than the hand so be certain to check this out before filing the hand. If the cylinder has free play, a shim may cure the problem. Power Custom makes good shims. If the hand is too short, fitting another is the best solution.

A stop gap that works for non-critical use is to remove the hand and peen it on an anvil. When it is properly done the hand is longer and will resume function. A good test is to remove the cylinder and slowly work the action while watching for movement in the bolt stop as the hammer is cocked and lowered. An experienced gunsmith told me that a cylinder that wobbles fails to hold the cases securely and the crimp may not

hold the bullet in the cartridge case. With this revolver we experienced just that problem.

Fitting the cylinder seems to have solved the issue. Only thorough testing with live fire will confirm. AG There were a cluster of us shooting the 90s around 1998 through the early 2000s, both Match and Service rifles. I had a ringside seat to the development of the 90 grain AR Service Rifle round and have two of the early 6.5 twist barrels that Holliger produced. One is set up with a strain pressure rig. We established early on that you can get good velocities out of a 20" barrel with sane pressures.

My recollection on the chronology of Sierra and Berger entering the fray is a bit different. I believe Sierra came first but not many used them because their BC was not great, and there was no benefit. Berger was later and by then most everyone I know had given up shooting 90s. I'm curious if there are/were any hard holders winning with the gain twist barrels? Most of the hard-guns I know are now shooting 308 Winchester again out of M110 or M14 for Long Range Service Rifle matches.

READER FORUM CONTINUED

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Can you quantify your success on target with the 90s? 600 or 1000 yard groups? Scores? Joe Carlos responds. Thanks for clearing up these dates for me! Early 90 grain Sierra Match Kings were prone to blowing up mid air but they're now dependable and have a ballistic coefficient of 0.563. It is factory pointed and is easy to get to shoot. I believe that bullet is loaded to AR-15 magazine length by Federal for the 224 Valkyrie.

I have also been successful in getting both the Sierra and Berger match 90s to shoot in the 22 Nosler at speeds about 150 feet per second higher than the 223 Remington. JLK Bullets no longer offers a 90 grain .224 bullet and the stated reason for them dropping it was lack of jackets for them. In early 2018 Sierra introduced a 95 grain .224 Match- King with an even higher ballistic coefficient of 0.600. There has never been a better time to try 90s, assuming you have a 1:6.5" twist barrel.

I am having great success with Bartlein gain twist 20" Service Rifle barrels that have a starting twist of 1:13 in front of the chamber, doubling to 1:6.5 at the muzzle. You asked about groups. When gain twist barrels come in my shop they first go through a very thorough break in, then are machine rest tested for ten-shot groups. Those groups are filed in a loose leaf binder and go to Perry with me. (Bldg. 910-A on Commercial Row) during the CMP National Matches.

This allows shooters can come in my shop and sit down with my binder and pick out their own sub-minute barrel. Likewise for complete uppers. Chris Furuya Supershot Cylinder I have an Iver Johnson Supershot Sealed Eight revolver chambered in 22 Long Rifle and am looking for a vendor that might help me find a cylinder for it. I have been in contact with Numrich, Jack First, and some others. Can you help me find some other outlets? From Mark Hollensen.

Try Popperts Gun Parts (Popperts Gun Parts. com, and Outback Gun Parts (OutbackGunParts.com, They may have some parts for it but there are not many parts left for that old revolver. From RK Campbell. Try Bob's Gun Shop (Gun-Parts.com, and Ocala Armory (Ocala-Armory. com, Colt New Line A friend brought a pre-1898 Colt New Line five-shot revolver chambered in 32 Rimfire. It is nick plated and in good condition with no rust or pitting. The problem is the cylinder stop will not release, freezing the cylinder rotation.

It seems to have all its internal parts and the springs are all there. I have taken the pistol apart three times and stoned all burrs and sharp edges away, and then cleaned it with solvent and lubed it with light gun oil. Do you have any suggestions or a gunsmith you can recommend that has dealt with this problem? John C. Wallace From Mark Hollensen. Without seeing the revolver and testing it, I would ask if the bolt releases (drops down when pulling the trigger) when the cylinder is out of the way?

If it does, then this appears to be a timing issue. In other words, the hand is trying to turn the cylinder too quickly and before the trigger can move enough to get the cylinder stop down enough to release the cylinder. Again, without function testing it, I can only assume that this may be the issue. Chuck Metzler Martini Henry Restoration Can you recommend a gunsmith who is particularly qualified on the Martini Henry, both in the original 577/450 Martini-Henry and converted 303 British?

Cc Gunsmithing Michael Stryjewski From Mark Hollensen. Without knowing more about your project, Turnbull Restoration Co. (Turnbull- Restoration.com, is a great choice for vintage rifles. AG

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