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EDITION

PRECISION ARMS WORKSHOP

AND THE AMERICAN GUNSMITH ARCHIVE

A TECHNICAL JOURNAL OF CRAFT, REPAIR & RESTORATION

022

ARCHIVE ISSUE NUMBER

INSIDE THE ARCHIVE

CORROSION BASICS FOR GUNSMITHS

4473 CLOUD • TOROS COPOLLA T4 • WINCHESTER MODEL 1885 • MILL POWER LIFT

ORIGINAL METHODS. MODERN ACCESS.

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DIGITAL ARCHIVE EDITION

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SAFETY & COMPLIANCE

4473 Cloud

BY AMERICAN GUNSMITH EDITORS FEBRUARY 2023

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4 473 Cloud is an ATF-approved form 4473 digital storage solution that utilizes encrypted, tamper-evident file formatting to ensure security for FFLs.

Travis Glover is VP of Business Development and Sales and has over 26 years experience in the firearm industry as a subject matter expert on ATF Compliance, including nearly a decade developing, implementing, and leading ATF Compliance at Cabela's. 4473 Cloud Even with a saved PDF copy, the printed 4473 is the official record and all future corrections or changes must be done on the paper copy as instructed on the 4473 itself.

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PEOPLE & COMPANIES

Toros Copolla T4

A look at the Toros Copolla T4 shotgun and parts interchangeability with the Benelli M4.

BY ROBERT K. CAMPBELL FEBRUARY 2023

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Original caption: Top: The author considers the Toros Copolla T4 one of his front line shotguns. well made of good material. The fit is good and the finish may not quite equal the Benelli but then the Toros T4 carries a price tag closer to \$800 rather than the Benelli's \$1,800. The Benelli M4 is often regarded as among the most reliable shotguns of all time. Superbly well made and reliable, the M4 was developed to meet U. S. military demands. The original Benelli shotguns used a reliable inertia drive.

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The Toros Copolla T4 shotgun is a recent introduction from a Turkish maker. The shotgun isn't anew design, only a recently introduced shotgun. Turkish makers have extensive experience in manufacturing shotguns. Over the years they have developed a strong working relationship with Beretta and Benelli, both respected and well established Italian manufacturers. The Stoeger line of shotguns and handguns is another example of firearms manufactured in Turkey. Turkish makers have jumped into the marketplace in a big way.

The Toros Copolla T4 is a straight up clone of the Benelli M4. The Benelli shotgun is a good example of "Big Rand Little M" as it excels at reliability and demands little maintenance. The T4 is a direct copy of the M4, down to the fact that all parts are interchangeable

according to the importer. We would find out after making aside by side comparison. The T4 is manufactured by Sarsilmaz Silah Saniyah and seems The front sight is interchangeable with Benelli sights and also the XS aftermarket sight.

The shotgun the Army and Marines wanted had to be gas operated as the inertia drive proved less reliable when optics and accessories were added. Benelli's patented Auto-Regulating Gas-Operated (ARGO) system is clean and reliable, making the M4 among the most reliable shotguns ever designed. The Toros Copolla T4 tested was imported by Aztec International Inc. doing business as Ocala Armory in Ocala, Florida. The T4 follows the Benelli M4 outline closely—perhaps exactly—and features ghost

TOROS COPOLLA T4 CONTINUED

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Original caption; Bottom: During the initial disassembly the barrel, barrel nut, and forend halves are removed. power loads including birdshot, field loads of all types, slugs, and buckshot. While our test sample is just one shotgun, the results are encouraging.

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ring sights identical to the Benelli. There is also a light rail for mounting optics. The shotgun has been tested thoroughly and so far seems as reliable as a machine can be. There have been no failures to feed, chamber, fire, or eject with full

In appearance the only thing truly different is the slightly enlarged trigger guard. The trigger action is lighter and crisper than the Benelli, which was an unexpected bonus. The shotgun is supplied with three choke tubes. The specifications are identical to the Benelli M4, being chambered for 2 3/4 and 3-inch 12

gauge shotshells, 5-shot magazine, 18.5" barrel, 14 3/8" length of pull, 40" overall length, 7.7 pounds and \$895 average retail price.

Lets look at the nuts and bolts break down of the Toros Copolla T4 and parts interchangeability with the Benelli M4. Disassembly is simple enough and straightforward. Be certain the magazine isn't loaded and the chamber is clear. Lock the bolt to the rear. Grasp the magazine cap and unscrew it. There are generous gripping surfaces making this quite easy and the cap is easily tightened as well.

Once tension is relieved on it, the forend is easily pulled apart and is two parts marked left and right with an arrow pointing toward the muzzle to ensure proper reassembly. With that removed, pull the barrel forward off of the shotgun. At this point we confirmed that the Toros T4 and Benelli M4 barrels interchange. With the barrel out of the receiver the bolt may be removed next. By twisting the bolt handle out and away the bolt may be pulled forward on its rails. A word on removing the bolt handle.

IT DOESN'T SCREW OUT. THERE IS AN INDENT IN THE BOLT AND THE BOLT HAN-

TOROS COPOLLA T4 CONTINUED

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Far dle is twisted and removed. While the Toros T4 was quite tight and demanded considerable effort on the first try, simply pull the bolt straight forward and out. At this point you may wish to remove the firing pin in order to clean the firing pin channel or replace the firing pin spring or firing pin. Depress the bolt together and pull out the locking head retaining pin. The firing pin and firing pin spring may be removed. These parts are also interchangeable with the Benelli M4.

Removing the trigger group is simple enough. Use the bolt handle to depress the trigger group retaining pin. The pin is captive

and presses out right to left. Press the shell carrier release and pull the trigger group down and out. Next, take a look at the heart of the shotgun the ARGO-type gas pistons. You will notice that the Toro T4 cover and pistons have some type of oxide coating while the Benelli M4 is stainless steel. Use the bolt handle to screw the operating piston covers out.

The gas pistons are then pulled out. The gas pistons interchange with each other on either shotgun. On close examination we were able to detect some differences between the Benelli M4 and Toros T4. The barrel nut is slightly larger on the Turkish shotgun. Not a

problem but a consideration with some aftermarket forends. We also confirmed the Toros Copolla accepts all Mobil/Benelli/Beretta-type choke tubes. We placed the trigger groups in either receiver.

The Benelli trigger group fit right into the Toros T4; no problem at all, a nice tight fit. However, the Toros T4 trigger group did not fit as well in the Benelli M4 receiver. The rear wing, tang, or extension of the Toros T4 trigger group was just slightly larger.

TOROS COPOLLA T4 CONTINUED

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Original caption: Bottom: The Toros Copolla T4 hasn't been cleaned at any point during the evaluation. Fouling was modest. ply snap into place. Carefully line the trigger group up and depress the shell carrier release as you move the trigger group into position. It is easy to press the trigger group too far into the receiver. Move slowly and line the trigger group pin hole up with the retention pin hole in the receiver.

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The lever with the red dot forward of the trigger is the firing pin decocker. I do not think I would have had any difficulty at all fitting the part, perhaps a pass of the file a time or two. Perhaps I could have forced the part with a bit of pressure but the fact remains the Benelli trigger group slid into the Toros receiver while the opposite was not true. This was the only issue of compatibility that I was able to determine.

Another caution, the trigger group on the Benelli design doesn't sim- The Benelli uses stainless steel components.

Moving to the rails and sights of the shotgun, these were looked over closely. It is important to be able to mount combat lights, lasers, red dots, and optics. I had previously mounted a shotgun-type scope from Tru Glo on the Toros for use in a shotgun slug evaluation. The rails and the screw geometry are identical in the Turkish and Italian shotguns to the smallest fraction I was able to measure. After more than a year of evaluation, the Toros Copolla T4 has proven reliable.

If the shotgun comes into the shop for work you may be confident aftermarket accessories designed for the Benelli M4 will fit the Toro

Copolla T4. An exception might be a particularly close fitting forend due to the slightly larger barrel nut, however, I believe that the dimensions are close enough for fitting to achieve a good fit. The trigger group will not quite fit the Benelli but would fit properly with minimal fitting. The Benelli trigger group, however, fits the Toros Copolla without any difficulty.

The Toros Copolla T4 by all indications in extensive testing seems a viable personal defense shotgun. AG

PEOPLE & COMPANIES

Winchester Model 1885

A how-to on renovating a Model 1885 Winchester rifle and adding a Schnabel tip to a custom restoration.

BY PAUL MAZAN FEBRUARY 2023

ORIGINAL PP. 7-10

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The purchase of the design rights to a then-new single shot rifle by a Winchester manager in 1883 was the beginning of a legendary partnership and the birth of the legend of John Moses Browning. When Thomas Bennett, Vice-President and General Manager of the Winchester Repeating Arms Company, traveled to Ogden, Utah and negotiated the purchase of Browning's single-shot rifle design destined to become the Winchester Model 1885 it was the first collaboration between the two icons.

Here is how I renovated a used and abused example. In 1883, a Winchester salesman discovered a used single shot rifle for sale. The barrel was marked "Browning Bros. Ogden, Utah U. S. A." and he was so intrigued with it that he sent it in to the Winchester factory. The folks at Winchester took one look at it and were so impressed

that Bennett himself was soon on a train heading out to Ogden determined to buy the rights to the rifle.

He met with an obscure inventor and gun-maker named John Browning, concluded a deal for the rifle, and was back on the train headed home the same day. It was the start of a business relationship that was to last for many years and produce some of the most iconic firearms ever invented. What became the Winchester Model 1885 single shot rifle was John Browning's first design. He was producing and selling it out of his shop before Winchester came calling.

The rifle was available in both High Wall and Low Wall configurations with the Low Wall chambered for the less powerful cartridges and the High Wall for the more powerful. In all, the rifle was chambered for over 30 calibers from the 22 Short to the 50/90 Sharps. I recently acquired a very well used and run-down Winchester 1885 Low Wall single shot rifle chambered in 25-

20 Single Shot that was in desperate need of a loving hand. Looking down the barrel was like looking down a sewer pipe.

There were dings and gouges in the metal, the bluing was gone, and the stock was split. In other words, it had been trashed. I ordered a replacement stock from Macon Gunstocks (Macon- GunStocks.com, and while waiting for the stock I made the decision to convert the gun from 25-20 Single Shot to 25- 20 Winchester because 25-20 Single Shot is obsolete and difficult to find brass and reloading dies for.

Once the barrel liner was installed it would have to be chambered anyway and a call to Dave Manson at Manson Precision Reamers (MansonReamers.com, had a to me the next day. I also ordered a .25 caliber barrel liner and drill from Brownells. The metal work was straightforward and we have covered it in detail previously: draw filing the receiver sides, spinning the barrel

WINCHESTER MODEL 1885 CONTINUED

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to remove the pitting, drilling the barrel and installing the liner, chambering the barrel, and rebluing was the order of the day. The one thing that made this project unique was that the gun came with the extractor missing. I managed to find one at Wyoming Armory (WyomingArmory.com, but it, of course, required fitting.

This turned out to be one of those time-consuming jobs that requires assembly and disassembly of the firearm over and over as you try to get the extractor exactly the correct length, width, and thickness to perfectly fit the extractor cut in the barrel. Once that is accomplished you still have the CM on the lower end to fit so the extractor and extracts the fired case. It is entirely a cut-and-try operation.

With the metal work completed I thought I would add a personal touch to the gun by creating a Schnabel tip on the forearm. The Schnabel or “beak” on the tip of a firearm’s forend has always been associated with European firearms in my mind, and it may well have originated there, but it has been embraced by American shooters for many years. Much like highly figured walnut, the Schnabel doesn’t really have any practical use except for perhaps the longest armed of us who I have heard call it a hand stop.

Personally, my arms are far too short to reach out where the Schnabel is on any firearm I own. However, if all you are looking for in a firearm is functionality rather than classic good looks, synthetic stocks are probably right down your Far alley. Personally, I like my guns to be unique and have some personality and beauty along with accuracy and reliability.

So, I thought I would show you how to add a little style to the design by adding a Schnabel tip to the forearm rather than just repairing and refinishing the stock. My first thought was to graft a larger piece of wood to the tip of the forearm but I rejected that idea just because I didn’t think the slim forend would balance well with a bulbous tip. Stock work is one place in gun work where mechanics meets artistry and pleasing the eye is as important as mechanical function.

I took my cues for the Schnabel design from a 1950s era Savage that had a tip I liked very much. I used a drafting circle template to determine the approximate radii of the tip in both the horizontal and vertical axis as well as the curve blending the tip back to the forearm. There are no hard and fast diameters to these curves but match-

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Original caption: Bottom: The forend is repaired by squaring off the area of the missing piece. A groove is filed around the end to start forming a Schnabel tip.

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The material will be removed from the ejector to fit the barrel. Always work on the cheaper part. ing the curves of an example

you like is an easy place to start. After sketching in the rough outline of the tip, the next step is to file a groove all the way around the

three

WINCHESTER MODEL 1885 CONTINUED

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sides of the forearm just behind the tip and isolating it from the rest of the forearm. Now you get to show your skill and artistic ability in the actual sculpting of the tip. Keep your first attempts classic and simple. Get a feel for the blending of the curves and the undercut of the very tip. It takes some time, patience, and trial and error. The center of the vertical arc should be the bottom of the barrel channel. The curve then continues up to the top of the forend and smoothly down to the bottom of the hook.

It all comes down to uninterrupted curves that blend together and meet at the point of the hook. The coves on the left and right sides of the hook are the hardest part of the project for me. On your first attempt, it is probably best to start with wood carving tools. Then, as you get close to your final Schnabel contours, change to sanding using

small bits of sandpaper backed with something like a baby spoon. This is the tip we will try to copy.

Try to keep the edges sharp and resist the temptation to “blend” the edges. The final part of the woodwork before finishing is to taper the entire forearm from where it meets the receiver to the base of the Schnabel on all sides of the forend. I use a straight edge to be positive I have a straight taper from the receiver to the base of the Schnabel. All should be smooth curves and straight lines.

Since this is more art than science it is not necessary that your finished Schnabel look like mine, Savage’s, or anyone else’s. It is only necessary that it pleases you or your customer. It goes without saying that you should keep your sculpting within the realm of good taste and artistry, I have seen

Schnabels take the form of certain body parts; while it might provide a good laugh among the guys at deer camp it is never appreciated at any shoot where there are women and children attending.

It also devalues the gun as few people will want to buy something they have to hide from the wife and kids. With the forend complete I turned to the buttstock and removed the nails, pieced it together, and glued it back to some semblance of its former glory. It was a fix that I expect will last through my lifetime, but it certainly wasn’t pretty. All the work was completed by the time the replacement buttstock arrived which was fitted and finished to complete the project.

The final result is a refurbished classic Winchester 1885 Low Wall in a currently-available caliber with a personal touch. AG

FROM THE ARCHIVE

Corrosion Basics for Gunsmiths

Firearm corrosion can be—and often is—self-inflicted by gun owners. Here’s what to know regarding how corrosion happens and how to avoid it on

BY BRIAN R. SMITH FEBRUARY 2023

ORIGINAL PP. 11-16



Right: “You can buff that out, right?” A badly corroded firearm demanding attention.

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Worldwide, corrosion and the steps to mitigate it account for an estimated \$400 billion cost to society each year. Vehicles, bridges, buildings, railcars, factories, communication towers, and firearms all fall victim to rust. It’s entropy at work, the natural process of things at a high energy state decaying to a lower energy state, which Mother Nature prefers.

We as firearms owners, enthusiasts, and those engaged in the gunsmithing trade have a keen interest in maintaining our weapons and those of our customers in their as-manufactured, corrosion-free condition, and many owners follow proper procedures in care of their guns. Some owners unknowingly ask for trouble and then wonder why their firearms rust.

Corrosion, otherwise known as oxidation, is an electrochemical reaction in which a minimum of three components are required: An anode, being the metal that is prone to corrode; a corrosive chemical agent called an electrolyte, such as plain water or a salt water solution containing chloride ions that causes a metal to rust; and oxygen to do the, well, oxidizing. Remove any one of these ingredients and corrodible things simply don’t corrode, period.

An example of controlled, desirable corrosion is the electrochemical reaction that takes place in a carbon-zinc battery. The battery is an “A badly corroded firearm demanding attention. electrochemical cell, just like aluminum and stainless steel would be, but carbon and zinc generate a higher voltage (potential) than an aluminum and stainless steel battery and lasts far longer.

Another corrosion process is galvanic corrosion in which two dissimilar metals in the presence of an electrolyte cause corrosion of the more active (corrodible) of the two metals. The most common electrolyte is water, including freshwater, seawater, acids, and alkalis. Even overnight dew condensing on that hammer left beside an outdoor project is an effective electrolyte.

When a galvanic couple forms, one of the dissimilar metals in the couple becomes the anode and corrodes faster than it would alone, while the other becomes the cathode and generally does not corrode, or if corrosion occurs it is in a localized area forming one or more pits. An example of galvanic corrosion is the corrosion of aluminum rivets joining either stainless steel or carbon steel sheet metal, a practice that is not recommended as the anodic aluminum rivets will corrode and the joint will fail.

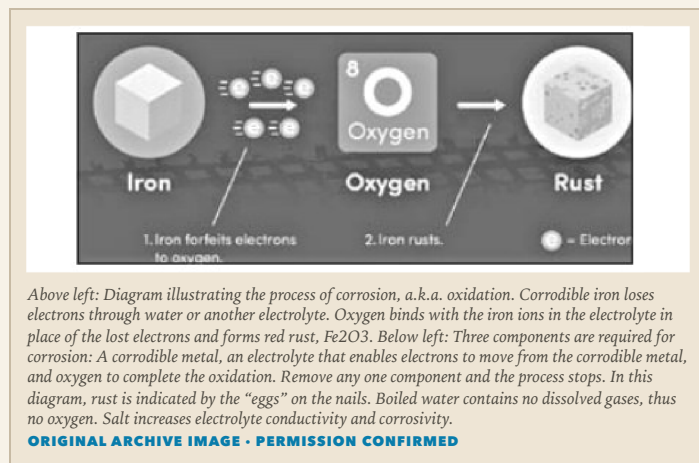
Another example is a do-it-yourselfer who is “getting tired of the bolts rusting” on a vehicle or piece of yard or snow removal equipment and replacing them with stainless steel fasteners. Instead of the stainless fasteners rusting, the anodic carbon steel sheet metal they hold together corrodes, and quickly. When joining carbon steel components, it is recommended to use zinc plated, or better yet, zinc-rich coated fasteners than stainless fasteners in those applications.

In both basic or galvanic corrosion, the active or corrodible metal combines with oxygen from the atmosphere to form the metal oxide, more commonly known as rust. In the case of iron and steel, the red or orange oxide is Fe_2O_3 , which is two iron atoms and three oxygen atoms that makes up the common iron or steel rust with which everyone is familiar. Iron and steel can also develop another kind of rust, Fe_3O_4 , which is known as black rust or magnetite. This is the rust that constitutes rust bluing.

Black rust is a moderately-performing barrier to oxygen transfer, and thus helps to prevent red rust from forming on firearms as the gun is already “rusty” with black rust. It’s why early gunmakers used rust bluing to finish metal bits—corrosion protection. The more active metals, such as magnesium, zinc, and aluminum also develop “rust”—white rust. An

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k.a. oxidation. Corrodible iron loses electrons through water or another electrolyte. Oxygen binds with the iron ions in the electrolyte in place of the lost electrons and forms red rust, Fe_2O_3 . Remove any one component and the process stops. In this diagram, rust is indicated by the “eggs” on the nails. Boiled water contains no dissolved gases, thus no oxygen.

Salt increases electrolyte conductivity and corrosivity. example of this corrosion is an aluminum vehicle wheel that exhibits fluffy, white, or light gray deposits under peeling clear, silver, gray, or black powder coating films. Fasteners, being zinc electroplated or coated with high-solids metallic zinc particles in a binder to provide corrosion protection, also form white rust.

In the presence of an electrolyte, the anodic zinc combines with oxygen to form white zinc oxide, preferentially to the cathodic carbon steel basis metal. Also present are zinc hydroxides and zinc carbonates, insoluble compounds that act as a barrier to further corrosive electrolyte attack. Since zinc is more galvanically active than steel, and relatively inexpensive, zinc plating and coating is widely used to protect steel in commercial and industrial use.

But zinc would not work for firearms because it is so reactive, is not mechanically robust, and is not aesthetically pleasing. Magnesium and magnesium alloys also form white rust—as anyone who has owned a lawn mower with a cast magnesium mower deck can attest, the underside of the magnesium deck reacts with acids in the cut grass and the action of bacteria and fungus to

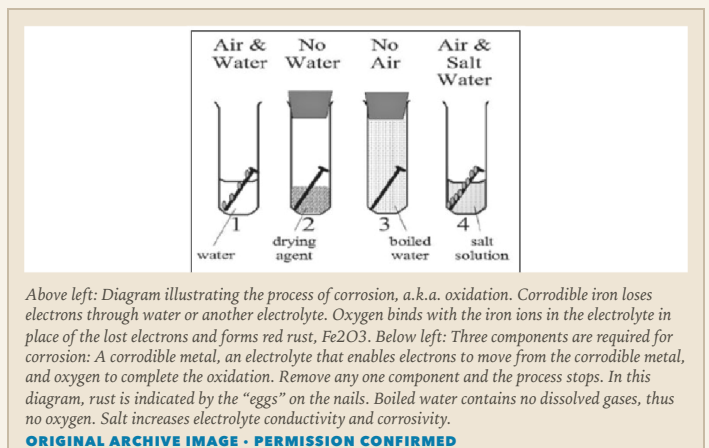
form powdery, white magnesium oxide if not washed away routinely. Like zinc, magnesium is not for guns.

Aluminum readily forms aluminum oxide on its surface in open air, and if the aluminum oxide is removed by chemical or mechanical means, the surface starts to form more aluminum oxide immediately, within minutes. This is why aluminum is popular and widely used as an unfinished architectural material. Anodizing is the controlled electrochemical process of forming aluminum oxide on the surface of aluminum.

Anodizing is an effective corrosion prevention mechanism for aluminum; the layer of anodizing is electrically non-conductive and blocks the electrochemical corrosive attack from an electrolyte, and also blocks the basis metal from oxygen in the atmosphere. In the firearms world, alloy handgun frames and AR upper and lower receivers are “hard” anodized and dyed black, silver, or other colors (e.g., Charter Arms revolvers).

Galvanic Series To understand this more in depth, look at the galvanic series of common metals, with the most active metals (readily corrodible, or anodic) at the top, and the most noble metals (least corrodible, or cathodic) at the bottom. Generally, the closer together dissimilar metals are on this galvanic series, the less probability of corrosion.

A common practice of using metals adjacent or close on the galvanic series is the use of zinc plated or zinc-rich coated fasteners to join carbon steel or aluminum parts, as mentioned previously. The zinc will corrode preferentially before the steel fastener substrate does, because the zinc is the more ac-



tive (anodic) metal. Notice that the stainless steels, nickel, Inconel, and Hastelloy-C alloys appear twice on the galvanic series, with the parenthetical suffixes of active and passive.

An active alloy is one where free iron particles from machine tool bits, shaping rollers, carbon steel grinding dust contamination, or other ferrous fabrication equipment are present on the surface. In the case of an active stainless steel in the presence of an electrolyte, the microscopic free iron particles corrode and form discreet pits of galvanic corrosion in the stainless steel. These free iron particles initiate corrosion and concentrate it in the area immediately around the iron particle.

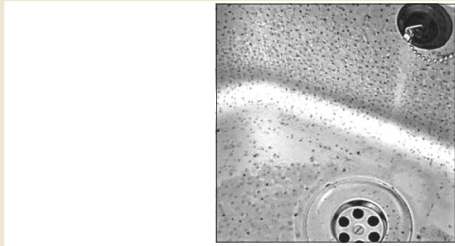
The corroding iron particle overcomes the ability of the chromium oxide on the surface of the stainless steel to resist corrosion, and a corrosion pit forms in the stainless steel. Recall that galvanic corrosion involves two dissimilar metals in contact with an electrolyte. This free iron pit corrosion can be problematic to a stainless steel article.

After all fabrication operations are completed, some manufacturers of stainless steel products submerge them in a strong nitric, nitric/sulfuric, or citric acid solution to “pickle” (dissolve) the free iron and thus “passivate” the surface of the stainless steel, making the surface passive to free iron corrosive attack. For example, stainless steel products used in food preparation are customarily passivated.

Again, passive stainless and other alloys are much further down the galvanic series, meaning that they are less prone to corrosion.

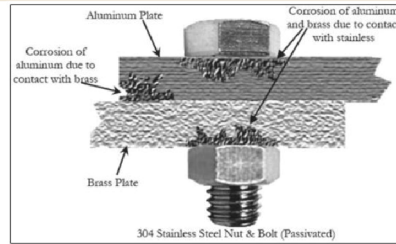
CORROSION BASICS FOR GUNSMITHS CONTINUED

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Far left: Yes, stainless steel will rust. This does not mean that this sink is made from a “poor grade of stainless steel,” rather, the wrong grade of stainless for the intended use and likely not passivated to remove free iron. Left: The bolted joint shows three dissimilar metal corrosion mechanisms at work, all examples of galvanic corrosion: First, the aluminum sheet corroding under the stainless steel bolt head. Second, the brass sheet corroding under the SS nut. Third, the aluminum sheet in contact with the brass sheet corroding where exposed to air and humidity. The more noble stainless steel is not corroding and is causing rapid corrosion of the two more active metals.

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In firearm manufacture and gunsmithing, machining of stainless steel firearm components is a given part of the process. Some firearm manufacturers and gunsmiths incorporate the process of passivation of stainless firearm components following machining operations. A technical discussion of the stainless firearm passivation process is outside the scope of this article, and there is much information on passivation processes on the Internet.

I positively cringe when someone posts a recommendation in a firearm-related Interwebz forum or DIY video to use steel wool to polish out scratches in a stainless steel handgun or rifle.

Those who take steel wool to stainless steel are making the surface of the stainless steel much more active and prone

1100 5 Cadmium 6 Aluminum 2024-T4 (copper-containing Al alloy) 7 Steel, Malleable Iron 8 Cast Iron 9 410 Stainless Steel (active) 10 304 Stainless Steel (active) 11 316 Stainless Steel (active) 12 Lead/Tin Solder to corrosion.

Should the surface polished with steel wool come in contact with an electrolyte—even humidity—the stainless steel will rust again, and more readily! Never use steel wool on stainless steel! There are plenty of non-metallic abrasives that can be used, including abrasive-containing polymer non-woven meshes (e.g., 3M Scotch-Brite) in a variety of grit sizes as well as old fashioned silicon carbide wet/ dry sandpaper up to superfinishing 4000 grit for high polishing.

These abrasives do not promote corrosion, providing they were not previously used on iron or steel. 13 Lead 14 Tin 15 Nickel (active) 16 Inconel nickel-chromium alloys (active) 17 Hastelloy C (active) 18 Brasses 19 Copper 20 Bronzes 21 Copper-Nickel Alloys 22 410 Stainless Steel (passive) 23 Monel nickel-copper alloys 24 Silver Solder 25 Nickel (passive) 26 Inconel nickel-chromium alloys (passive) 27 Chromium-Iron (passive) 28 304 Stainless Steel (passive) 29 316 Stainless Steel (passive) 30 Hastelloy C (passive) 31 Silver 32 Titanium 33 Palladium 34 Graphite 35 Gold /

Platinum Another caution regarding stainless steel firearms is to remove them from your work area where you routinely grind carbon steel.

The grinding dust is rich in steel and iron oxide. If that grinding dust falls on a stainless steel firearm, the more minute particles will become trapped in polishing marks in the stainless steel, setting up future corrosion trouble by activating the stainless surface. Wiping or blowing off ferrous grinding dust is ineffective, due to dust particle size and slight magnetization of the dust or the stainless steel firearm components.

A reminder: Most stainless steels used in firearms are martensitic, because those SS alloys are generally easier to machine. Speaking of machinability, high machinability steels generally contain molybdenum disulfide, and sulfur is another corrosion promoter. High machinability steels readily corrode and need to be protected.

If you use rubberized abrasive bits in a Dremel or Foredom tool for polishing work on stainless steel and carbon steel firearms, it is highly recommended that you maintain two segregated sets of these polishing bits, one for stainless work and another for the carbon steel work so that fine, free iron particles em-

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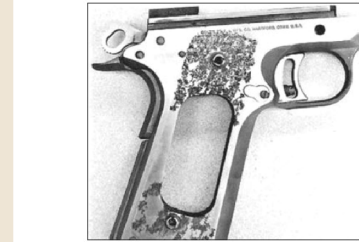
Left: Light rust on firearms is often the result of humidity condensing on the cooler metal surface when the metal is long overdue for an oiling. Light surface rust can be removed using bronze wool or a credit card and a penetrating oil such as Kroil. Bronze wool and credit card plastic are softer than firearm bluing and will not harm bluing as long as the rusty oil slurry is wiped off and not rubbed around. Contrary to what is often published, 0000 steel wool WILL remove or thin bluing.

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Left: Investment casting is a common method used to produce frames. Owners have been reporting occurrences of pit corrosion under grip frames. Keep in mind that castings are porous unless the porosity is sealed by vacuum impregnation of a methacrylate resin, an expensive process. The alternative is to warm the frame and repeatedly apply a proven corrosion inhibiting product to fill up the porosity much the way oil fills the pores of an Oilite bronze bushing.

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The same applies to having two sets of abrasive polishing cloths or papers—keep them separate, or if need be, downgrade polishing materials from use on stainless to carbon steel only and never back. Another dissimilar metal situation with potential for corrosion is set up when an aluminum alloy, carbon steel, or stainless steel firearm is brought in contact with graphite. Looking at the galvanic series, graphite is more noble than titanium but more active than gold or platinum.

Graphite is a particular crystalline structure of carbon, just like carbon black or diamond are also just carbon atoms with different crystal structures. Graphite is a Pitting corrosion to a stainless steel handgun frame, likely caused by contact with either rubber or carbon fiber reinforced grip panels that had absorbed moisture or due to the handgun being

stored in a vehicle or under some other high humidity conditions. popular dry lubricant; the purer it is, the more electrically conductive it becomes.

A graphite-containing dry or wet lubricant when used on aluminum alloy, carbon steel, and stainless steel (either passive or active) will cause those metals to form corrosion pits under the right circumstances with the right electrolyte. To avoid a potential corrosion situation, NEVER use graphite on firearms! Carbon itself in some forms can promote corrosion. There are many firearm accessory products made of reinforced carbon fiber, such as grips, mounts, brackets, etc.

Despite all of the excellent properties of carbon fiber reinforced (CFR) components, there can be issues with using CFR articles and metals together. The carbon fibers in CFRs cause this material to be highly electrically conductive. Therefore, when a more active metal is physically and thus electrically connected to a CFR article, that metal component is more susceptible to galvanic corrosion, examples of which are carbon steel or unpassivated stainless steel.

This situation becomes worse when a large surface area of a carbon fiber reinforced component like a grip plate is coupled to small and anodic carbon steel grip screws. Those screws will develop corrosion quickly in the presence of moisture in any form unless protected with a corrosion-inhibiting product such as Corrosion X, Eezox, Cortec Bullfrog, or WD-40 Specialist Long-Term Corrosion Inhibitor, among others.

When in contact with a carbon fiber composite article aluminum and unpassivated stainless steel are likely to be prone to galvanic corrosion as well. Galvanic corrosion with carbon fiber components has been an issue for decades, but there is no real universal solution to the problem, aside from providing some sort of non-conductive barrier between the CFR article and the adjoining Owners have been reporting occurrences of pit corrosion under grip frames.

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Left: Results of a home study of maintenance fluid corrosion resistance performance from the Interwebz; the spots and dark areas on the bare steel coupons are rust. Such studies are fraught with procedural issues that can invalidate the results, including suspending samples above other samples as in the photo, where the corrosive liquid can drip on samples below; using a hand spray bottle to apply a corrosive electrolyte, such spray bottles are not consistent applicators of the fluid sprayed; and uneven or inconsistent application of the maintenance fluid under test, leading to false failures of products applied thinner than others. Let the observer beware!

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In the case of grip panels, there are companies that offer thin polymer sheet isolators in the shape of grip panels to physically block the contact of CFR grip panels with the grip frame. In the absence of a polymer isolator, firearms with carbon fiber grips, stocks, and other accessories should be disassembled on a regular basis and the fasteners and metal surfaces in contact with the CFR items should be protected with a corrosion-inhibiting product as mentioned above.

Corrosion-inhibiting products generally work by conveying barrier protection to the corrosion-susceptible metal. This can be as simple as a thin layer of a hydrophobic material such as a grease-based product. The more sophisticated products block oxygen transfer by

means of a molecule-thin oxygen barrier consisting of one of a number of proprietary ingredients. If oxygen cannot contact the more anodic (corrosion-prone) metal, then that metal can't corrode.

Similar oxygen-blocking technology is that used in vapor corrosion inhibiting (VCI) paper and polymer films, such as those made by Cortec and Daubert-Cromwell. An example of VCI paper known to many firearms enthusiasts is the light brown paper that Smith & Wesson handguns were once wrapped in, inside their boxes or plastic cases. VCI products are impregnated with an oxygen-blocking compound that in the case of paper is impregnated with a solvent.

For polymer VCI products such as films and bags, the oxygen blocking agent is usually thinly coated to the dull side of the polymer film. VCI-containing polymer film products are typically tinted a color, such as blue, green, or yellow, indicating the type of corrosion inhibitor, the intended use of the film or bag, or the relative "strength" of the inhibitor. Today, new firearms are frequently packed in a VCI bag at the factory. The problem with volatile corrosion inhibitor products is, well, their volatility.

Unless kept in a tightly-sealed bag, the active ingredients dissipate. VCI products need to be replaced on a regular basis; for brown VCI paper, that's when it no longer feels damp to the touch, indicating the solvent carrier has evaporated and dispersed. Another potential source for often-seen corrosion of a handgun grip frame beneath rubber grips. The grip frame can be either blued carbon steel, aluminum, or stainless steel.

Any of these materials can develop corrosion from the rubber itself or the rubber in conjunction with a lubricant or firearm care product that either degrades the rubber or contains water or water-based compounds that can act as an electrolyte. For example, Ballistol is a well-known product used in gun care, and one of its selling points is that it readily absorbs water and mixes with water. Ballistol contains mineral oil and some butyl alcohol which is soluble in both oil and water.

The butyl alcohol acts as an emulsifier for any water with which Ballistol comes in contact. In my opinion, that is not an advantage. Rubber and wood are somewhat porous and can absorb and trap moisture from the air or from a product like Ballistol which will act as the electrolyte that can cause corrosion. Rubber grips should be removed periodically and washed with a detergent and allowed to dry thoroughly, and the grip frames should be treated with a coating of a corrosion-inhibiting product as mentioned above.

Wood grips used to be finished on the inside surfaces as well as the outside, however, today as a cost-saving measure the wood grips that I've seen are sealed only on the outside. Wood grips on new guns should be removed and their inner surfaces sealed with a few coats of lacquer or shellac to prevent moisture absorption. Another cringe-worthy practice advocated by firearm forum participants is using automotive or industrial maintenance fluids for firearm care.

Many times I've read contributions of forum members stating that they lubricate their firearms with a leading brand of synthetic engine oil and "have never had a problem." They should modify their statements to include the word "yet" because problems will arise eventually from multi-purposing products intended for a much different service.

FROM THE ORIGINAL PAGE

Staying with engine oil for the moment, that product customarily contains additives that are designed to attract and keep fine particulate matter in suspension, and to absorb the moisture that condenses out of the air in the crankcase ventilation systems of engines, so that when the engine warms up next time the absorbed moisture can evaporate out of the oil. Engine oil being engine oil and doing what it is designed

THIS DIGITAL ARCHIVE PRESERVES THE RECOVERABLE SOURCE TEXT.

CORROSION BASICS FOR GUNSMITHS CONTINUED

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to, I'm not certain that I want dirt particles suspended in a moisturegathering lubricant in my firearms, let alone those of others. Moisture gets absorbed in motor oil used to lube a firearm but never has the opportunity to have that moisture evaporate; guns don't attain 195 degrees Fahrenheit for lengths of time. If you're wired to be cheap and collect your "gun oil" from what eventually drips out of an upturned quart bottle or five gallon jug, maybe it's worth the risk to you, but not to me.

Back in the 1980s, the practice of coating bullets with molybdenum disulfide was popularized by proponents who claimed higher velocities and enhanced accuracy. Some used commercial products intended for bullet lubrication, others "found" Mo S2-containing products at work and used them. Moly's popularity dropped off when it was found to build up in rifling and cause a drop in accuracy.

A second observation was made: Rifling seemed to become corroded as evidenced by rusty orange deposits or stains on cleaning patches. Sulfur just being sulfur and absorbing water vapor from the air forms an acid. Recommendation: Use gun lubricants and other firearm and reloading products designed for their intended use. Corrosion of firearms inside gun safes has been attributed to the use of imported dry-wall sheeting as the fireproof insulation material in construction.

Formaldehyde and other chemicals and high levels of iron pyrites, found naturally in gypsum manufactured in China or elsewhere using raw Chinese gypsum, have been alleged to cause corrosion of firearms. Certain bacteria that feed on iron pyrites generate vapor byproducts that can be corrosive to steel in an enclosed space.

Some safe manufacturers emphasize that they only use domestic drywall, other manufacturers of gun safes emphasize that non-carpeted steel-only safes offer the best corrosion protection because gypsum and

moistureabsorbing carpeting is avoided altogether. I cannot comment one way or the other because of lack of personal experience or controlled standardized testing results.

It is recommended that some means of heat and/or desiccation be employed inside a safe to ensure that the temperature of enclosed firearms stays well above the dew point of the safe location and interior. Use of desiccation reduces the amount of water vapor (humidity) in the safe interior atmosphere, particularly in humid summer months.

The colorchanging silica gel desiccators give a visual indication of their saturation and loss of efficacy, and some of them can be regenerated by oven baking at a recommended temperature for several hours. One long acquaintance of mine didn't want to spend the money on silica gel desiccators so he recalled the deliquescent properties of calcium chloride and put containers of it in his two gun safes.

Chlorides, be they sodium, potassium, calcium, or magnesium are extremely efficient promoters of corrosion in humid environments! Right after the first June, July, and August with calcium chloride in his safes he called, asking about removing rust from his guns. Don't be that (cheap) guy!

Speaking of humidity, dew point, and condensation, a reminder is made for gunsmiths and their customers to refrain from immediately uncasing firearms that have spent time inside a vehicle interior or trunk during cooler months and especially wintertime. Uncasing a cold firearm in a humid environment can and will result in a microscopically thin layer of moisture condensing on the firearm surface.

Usually the residual oil on the metal surface, or bluing, anodizing, or the chromium layer on the surface of stainless steel will effectively block oxygen transfer, but I have personally seen blued firearms that developed fine rust in a matter of hours or overnight from being very cold and then

introduced into a humid environment. Let the cased firearms acclimate for several hours or overnight before bringing them out, and apply oil or a corrosion inhibitor to their metal bits frequently.

Readers may have seen corrosion test videos on the Interwebz where the video producers compare the anti-corrosive performance of various maintenance fluids. The betterproduced of these videos go to great lengths to describe the methodology employed for the test, in an effort to imply some measure of validity.

While these videos may demonstrate some degree of relative corrosion inhibition performance using the materials and methodologies as tested, it is recommended that viewers consider these videos to be anecdotal information at best.

In order to perform truly valid comparative studies using sodium chloride as the electrolyte, one would use standardized corrosion exposure equipment constructed in accordance with ASTM B117, ISO 9227, or similar standard practices using 5% pure sodium chloride, and not iodized table salt which adds to the salt's corrosivity. Those so-called 5% Neutral pH Salt Fog test standards also require precise control of the exposure zone temperature and fog atomizer pressure, and for control of the fog condensation rate.

Uniform application of the tested products to standardized steel test panels is also required for test validity. Such a study is outside the scope of this article and could well be the subject of its own future article. Suffice to say that Interwebz videos of performance testing of corrosion inhibiting products should be taken with a grain of salt (sorry!). An article such as this one can only scratch the surface of the subject.

Corrosion is one of those topics where a lot of knowledge of the subject can avoid significant cost, a little knowledge can be slightly costly, and no knowledge whatsoever can be incomparably expensive. AG

MACHINING

Mill Power Lift

Get rid of the crank! This power conversion effortlessly lifts and lowers your mill head.

BY CHARLIE BRIGGS FEBRUARY 2023

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For those of you doing work with a milling machine in your shops, I have something here that will drastically reduce the effort we often go through, sometimes on a daily basis. I have tried to write it in such away as to help the “electrically savvy” as well as those who might not be familiar with rectifiers. My mill, a model JMD-18 by Jet, was considered a rather topos-of-the-line for a Chinese manual mill, but it is probably similar to, if not identical to, those made by Grizzly and others.

Mine, sitting on and bolted to its base, is almost seven feet tall and the uppermost quarter of it, the “head”, weighs close to 400 pounds.

With some effort, after loosening two large bolts on the right side of the mill head with a wrench resembling a tire tool/lug wrench, one can raise and lower the head to adjust for shorter or taller projects by using the large and heavy cast iron crank engaged in a rack and pinion on the left side of the mill (not to be confused with the spindle handles, located on the right side of the mill which simply operates the Zaxis, moving the chuck or collet up or down).

Larger and/or very expensive mills often utilize either hydraulics or a substantial gear motor to do this job or use a powered “knee” design to raise and lower the bed instead of the crank, but I doubt if many of us are lucky enough to have one of these.

Eleven years ago I suffered a very severe neck, back, and shoulder injury. As I have gotten older, fighting the crank has become more and more of a chore, often causing me to choose other, sometimes inferior, options.

So, like I did on my 7" x 19" tool room lathe almost twenty years ago (American Gunsmith, December 2004), I modified it! In a nutshell, I found a low cost and readily-available gear motor I thought capable of doing the job and then modified and adapted it to my mill in place of the crank. Hopefully, with the creativity and insight of most gunsmiths, you can see what I've done here and make any necessary changes for your mill.

Incidentally, a buddy of mine asked me if I could similarly power the feeds moving the Xand/or Y axes of the mill table. I told him that I thought my choice of gear motor certainly had the power to do the job, but I didn't think it could stop precisely enough for milling. There are numerous videos on You Tube for adding power feeds to milling machines, but I think they fall a little short on motor selection. And, of course, you'd have to be able to vary the power supply voltage so as to control the feed speed.

Perhaps a power supply incorporating an SCR tied to a windshield wiper motor from a large truck would work? If one of you readers is able to tackle a project like this, I think it would make an interesting

and valuable article for this magazine. The heart of my project is the motor and controls from a \$56 Badland 12 volt winch with a 2,500pound capacity which is often on sale at Harbor Freight.

Now call me crazy for choosing a 12 volt direct current motor, thus requiring a 12 volt power supply, but this means you have a smaller and lighter motor hung off the side of your mill and it's easily reversible for adjusting up and down. Most alternating current motors are quite difficult to reverse, if at all.

A starter motor for a motorcycle/jet ski/snowmobile would probably work as well, but in my experience adapting the business end of a starter motor to the mill would have been far more difficult than modifying the reel of a winch. For the required 12 volt high-amperage DC power supply, I gutted my old automotive battery charger. Details to follow.

There are numerous alternatives power supplies on You Tube, including extensively modifying “switching” computer power supplies (beyond me) or modifying a power transformer from a microwave oven, which should work very well but I didn't have a microwave to scrap! For the gear motor, the Harbor Freight winch package also includes a very nice wireless remote control, a relay and circuit breaker, and a rugged frame with

MILL POWER LIFT CONTINUED

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associated components that all came in handy. Making The Lift Here's how I did it. First, I removed the cable from the winch reel, cutting it off flush at the spool using a cutoff wheel in my Dremel tool. I had a different project for putting that now-unused cable to use. Then, I removed the motor from the frame. That was easy as it involved just two screws. However, removing the reel from the frame was not so easy!

First, I removed the sheet metal shield inside the frame held in place with two small machine screws. Then, using a large punch (about 3/8") and a medium-heavy weight ballpeen hammer, I drove the front of the reel backwards and out of the bushing-lined frame. It took some care and a bit of determination, but The internally-splined, motor end is at right. The six-inch rule beside it gives one an idea of the size of the motor. after a few minutes the reel and the frame were separated.

Once I removed the aluminum alloy reel, I sawed off the flanges at each end with a band saw, sawing parallel to the reel axis, so as not to damage the full length of the central shaft or spool. This could also be done using an appropriately sized hole saw if available, using the mill or a drill press, or even a hacksaw. The idea here is to convert the reel to a shaft or coupling which we will use to eventually connect the winch motor to the mill where the crank had been.

I carefully sawed off the flanges, apiece at a time, and then smoothed both ends of the remaining shaft in my lathe. Far The large flanges at each end were cut off to make the central shaft. Note the splined hole in the center. A belt sander or even a file would have worked

as well. Next, after taking careful measurements I determined I would need to use my lathe to bore out a portion of the front end of the reel shaft to mate with the diameter of the mill/crank shaft.

The motor end of the reel shaft has female splines to fit male splines going to the motor, so you want to leave it alone. Naturally, I had to ensure that in boring what would become the mill end of the shaft I didn't damage the castin splines at the motor end of the shaft.

Attentive readers will notice small irregularities in the finished surface of the shaft.

I noticed them too, however, machining them away for cosmetic purposes would thin the shaft and the foot-pounds of torque required to deliver to the mill is unknown. Even if I went to the trouble of measuring the effort, how do we know what a "2,500 pound" Chinese winch is really capable of? I chose to leave it ugly and stronger. It can't be seen anyway, as it's masked by the motor's frame.

Other than drilling and tapping the shaft for set screws, one for the splined portion and the other for the mill shaft, this completed the coupling. Note that the finished length of this new shaft also determines the spacing between the motor and the body of the mill. At the same time this determines the locations for new mounting holes in the frame for the soon to be relocated motor. Now to modify the motor frame in order to attach both frame and motor to the mill.

The frame, as is, has a one-inch hole in the outermost end. For my mill, this had to be enlarged to accommodate a large 1.5" boss on the side of the mill which

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enclosed the bearings for the crank. I first tried a cheap, never used Harbor Freight hole saw in the mill. It was the perfect size but had dubious metallurgy. Not surprisingly, it gave up about 75% through the job. That frame is tough! Whatever alloy they used to make it would make an incredibly good hole saw. Anyway, about that time my mill spindle gave up as well.

However, after a couple of phone calls with some very patient This is where the crank's (now the lift motor's) gears attach so as to engage the teeth of the rack. and wonderful people at Jet's customer service facility (JPW Industries, JPWindustries.com, MMCwil- I was able to get the mill back to work. I then finished the winch frame with a milling cutter, then an abrasive stone in an air-powered die grinder.

A quality bimetal or HSS hole saw here with the correct diameter would have saved a lot of work, and also probably the phone calls to MMC Williams as well. Before getting to the winch motor installed into the modified frame, this is probably a good

time to go over how the frame attached to the mill body. The aforementioned boss is attached to the main casting of the mill by four large machine screws, which turned out to be 1/4" x 20 thread.

This amazed me as I would have thought a Chinese machine would use metric screws or even some other thread. Anyway, studying the geometry of my four proposed attachment points (the drive shaft, the round portion of the boss, and the now longer top two 1/4" x 20 screws through the boss) I thought this arrangement would be strong enough to handle the counter-rotational torque between the winch motor and the rack and pinion on the mill—or, to be more accurate, the pinion.

Obviously, this still leaves us to deal with gravity tugging straight down on the motor, but I figured I could deal with that later if necessary by using an angled strut underneath, however, it proved to not be needed. When scrapping my battery charger to build the new power supply, I saved the power cord, the on-off switch, and the

transformer, and bought anew rectifier \$2.50 on e Bay. I assembled these parts into an old aluminum box I had saved from another project together with a small muffin fan for cooling.

Lastly, I needed a pilot light to remind me to turn the power off when I got the mill head to the desired height. I had one in my "junk box" but it turned out to need six volts, not twelve. Fortunately, there was an unused six volt tap on the transformer that sufficed. Again, if you are using a microwave transformer or some other low voltage source, this would be an easy addition.

Note the output wires from the transformer go to diagonally opposite terminals on the little rectifier, and the output wires originate at the other two diagonally opposite terminals. One of these is positive (+), and the other is negative (-). Conveniently, the positive terminal was well marked by the manufacturer. Even though the rectifier is rated for 50 amps, I added a little aluminum heat

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sink from my junk box under it as a little insurance policy. If you choose another motor/power supply combination, I have included a wiring diagram for reversing most any DC motor (for “Up” and “Down”) using a Double Pole, Double Throw (DPDT) switch from e Bay, Ace Hardware, or wherever. Be certain, however, that your switch and wiring is rated for the amperage of your motor. Next, I had to determine where to locate the electrical relay (sole. The power supply is at top right with the motor on the left.

The relay is underneath the power supply, on the left, and the remote is high and to the right of the power supply, hanging on a magnetic hook. The two shorter lugs are for the 12 Volt AC input. Note the positive (+) output terminal at the front left. Its negative (-) “partner” is in back, on the right. noid) for the motor and where to mount the power supply.

The relay is a simple DPDT device, which upon receiving a radio signal from the remote (to go up or down) switches or reverses the heavy amperage current from the power supply to the motor. This is used be-

cause a little switch operated directly by the wireless remote could never handle the motor amperage by itself. I chose to mount the power supply on top of a piece of 2.5x3" aluminum angle with the relay underneath and used existing bolts on the mill to attach the aluminum angle. Now to mount the power supply.

Rather than drilling holes through the floor of the power supply and the aluminum angle, I chose to combine gravity with hook and loop fastener. Gravity, meaning the heavy weight of the assembled power supply, compresses Velcro on the back and sides of the supply. This was much simpler than drilling the floor of the supply for bolts to secure it and made subsequent movement for maintenance or whatever much easier.

Reattaching the boss and the aluminum angle motor/power supply assembly with 1/2" longer 1/4" x 24 bolts completed the project. It works great! I hung the little up/down remote on a magnet/hook near the right side of the power supply. Turn the power supply on, use the remote to position the mill head up or down, then turn

off the power supply. Done! Oh, what project did I put that 30 feet of brand-new, leftover highstrength cable to use?

Well, it was election time and caring about the Second Amendment as I do, I had a “Keep America Great” sign in the front yard... until it was stolen! I replaced it, only this time I welded one end of the cable to the metal frame of the sign and padlocked the other end to a nearby tree, leaving about twelve feet of slack in between. A couple nights later, my wife and I returned home from dinner with a friend. The sign was lying in the driveway with its cable still attached to the tree!

I suggested we check our security cameras. Sure enough, there was a great video of a college-age female and would-be thief running off with the sign... until she ran out of cable! I’ll bet her rotator cuff was sore for a week or two, or her right arm is now noticeably longer than the left! The sign remained in our yard for the rest of the month, undisturbed, until I removed it after the election. For questions about this project, feel free to contact me at AG

PEOPLE & COMPANIES

All Choked Up

An overview of shotgun choke use and maintenance.

BY KENNETH FINLEY FEBRUARY 2023

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Ve I written before about chokes and the evolution of choke tubes as a system for increasing the versatility of shotguns. As a quick recap, by back boring a cylinder bore barrel and threading it, the shooter can insert thin tubes that allow the shooter to use the choke best suited to the purpose. Winchester perfected the screw-in choke tube system as the Winchoke in 1970. This system became the parent of all the choke tube systems in use today.

Which choke you use is a matter of individual shooter preference and the choice of shotgun, barrel length, and shotshell for the upcoming event. There are a few very important points to understand about choke tubes. If you have a shotgun bored for choke tubes, never shoot it without a tube installed. If shooting very heavy shot—say, #4 through #00—I recommend an open choke. Never shoot a slug through any choke other than a cylinder bore tube.

I know from the sad experience of several customers that you will regret it, as in you'll likely have to replace the barrel. After this summer I have a new caveat. Once again, this past summer I was privileged to introduce a couple of hundred shooters to the shotgun sports through Scouting's summer camp program.

Scouting BSA Shooting Sports experts have decided that the Shotgun Merit badge should be taught using semiautomatic shotguns in 20 gauge, the theory being that the recoil-reducing properties of the semi-auto action would be a benefit to beginning shooters. The camp where I was teaching had been gifted with a set of Benelli M2 semiautomatic shotguns, and I must say they are a very nice piece of equipment. The shotgun armory to which I had access had a selection of M2 and venerable Remington 870 pump shotguns.

My teaching process is after an extended safety briefing and fitting each shooter with comfortable hearing and eye protection, I start each student with five rounds so that I can assess their abilities and liabilities. Following the policy, I started each scout on the Benelli shotguns with one-on-one coaching. Generally, it takes three or four boxes of shotshells to begin hitting consistently enough to shoot to qualify. This year, that didn't seem to be working.

The shotguns weren't all equipped with the same chokes, with some having Modified chokes and others having Improved or Skeet chokes. It did not seem to matter. What did seem to matter was switching the shooter to one of the Remington 870 pump shotguns. Many qualified very quickly leaving me puzzled as to why. Another requirement for the shotgun merit badge is cleaning

ALL CHOKED UP CONTINUED

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shotguns. Each class cleans one each of the pump and semi-auto shotguns. I clamp the shotgun in a vise pointed in a safe direction and have each student pull a Hoppe's Boresnake through the barrel from the chamber end. After all of the students had tried that, I examined the barrel. Then, on the same barrel and with the choke tube still installed, I have the students use a brass bore brush and my old favorite solvent, Hoppe's #9.

They are amazed at the crud that comes from the scrubbing, even after the multiple passes with the bore snake. After that experience, I turn them loose on cleaning shotguns. Of eight shotguns in the camp armory, seven showed similar fouling. One of the scouts wanted a closer look at a Benelli choke tube and I pulled it. He asked if it was okay to clean it. It turned out he got more than he

bargained for. After a great deal of scrubbing, he asked if I would look at some deposits in the tube.

The material was firmly encrusted to the interior of the choke and it resisted removal. After soaking for two hours in Hoppe's I was able to remove the deposit. Upon inserting the clean choke tube back into the barrel, I found the inner diameter of the barrel was slightly smaller than the inner diameter of the choke tube, leaving a ledge. While it didn't impede the passage of the wad on its way out the muzzle, it did appear to allow a buildup of debris.

The next day was check out day and I had no class, so I pulled all the Benelli choke tubes and soaked them in Hoppe's. I had both Modified and Skeet choke tubes in the solution. The Hoppe's solution didn't let me down. This kind of build up is not what you want to find, but I found it in every shotgun.

To be fair, I pulled the choke tubes from the Remington 870 shotguns and found much the same thing, but not nearly as bad.

Apparently, the slight bore diameter mismatch between barrel and choke tube has a greater impact than I imagined it would have. As heavily as these shotguns are used in the summer, I have no idea how many rounds it took for this buildup to occur but it gives me new caution for those using choke tubes: After every use, take the chokes out and clean them separately. Do not just rely on a bore snake or similar quick pull-through cleaner to clean choke tube-equipped barrels.

The Benelli is an expensive, quality shotgun. If a problem occurs with them, it will in others that aren't as well made. When you get a choke tube-equipped shotgun into your shop, make it standard procedure to remove the choke and give it a good soak as a routine customer service. AG

PISTOLS

Reader Forum

BY AMERICAN GUNSMITH EDITORS FEBRUARY 2023

ORIGINAL PP. 23-24

Glock Safety Installation I was disappointed to find that the Learn Gunsmithing, The Troubleshooting Method book I received with my subscription did not include information on the P35 Hi Power, Glock, or CZ Witness pistols. I'm particularly interested in installing a safety on a Glock pistol, preferably without having to spend \$100 on a jig to accomplish the job. Thanks for subscribing.

Learn Gunsmithing, The Troubleshooting Method is intended as a primer provided to all new subscribers with additional and new gunsmithing topics to be added on a monthly in basis here as a single book can't cover every conceivable firearm topic. There are at least two options for adding a manual safety to a Glock that require no modification. BH Spring Solutions (BHspringSolutions.com, offers their Tactical Safety System for Glock (TSSG) pistols.

This adds a thumb-actuated safety on the slide by replacing the existing backplate. The safety can also be locked with the included padlock as a secure storage option. A second option is a Striker Control Device (also known as the "Glock Gadget") that also replaces the backplate and is thumb actuated to suspend the striker while holstering. Langdon Tactical (LangdonTactical.com, offers a popular option.

A 1911-like thumb safety requires modification of the frame and doing so it best handled by using a jig typically available for \$80-\$100. For a shop owner offering this as a service, it's a good investment. For a one-off project, it's probably best to farm the work out. D&L

Sports (DLsports.com, dlsportscustom@gmail.com), Ten-Ring Precision (Ten-Ring.com, contact information omitted in this digital edition), and Cominolli Custom (Cominolli.com, jcomioffer this service.

Throwback Gun Ads We posted a number of throwback advertisements from the 1950s and 1960s before the 1968 Gun Control Act passed and this has proven popular. If you'd like to see this collection, visit youtu.be/k4EKJ52oYGk AmericanGunsmith.info/?p=4076 or Short Url.at/bkmr T Marlin 25MN I first learned machining from my father who was in Patton's armies in WW2, both in exile in England and in Europe. He was one of the guys that did the 100 mile, 48 hour run to Bastogne.

I started putting this to professional use machining parts for helicopters and jet engines in the mid-1980s, learning from many old guys who knew all the tricks. L. Walters Landisburg, PA I'm doing a bolt rebuild on a Marlin 25MN and need to compress the mainspring. Similar to what Charlie Briggs did in "J. C. Higgins 101.1/Savage 94" (June 2022) I've already purchased long-nosed locking pliers from Harbor Freight for the tool.

As for the screwdriver mentioned in the same article, I'd make a super short "L" driver by soldering a tip into a 1/4-inch box end wrench to fit the tight spot. I've attached pictures of a mainspring bushing I cut for the Marlin 25MN repair. I also make my own oil for gun work. Email me if you're interested. Paul "Face" Krawic Exeter, ME Facial Firearms

READER FORUM CONTINUED

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Gary Yee Sniper Book From author Gary Yee. I've submitted my fifth designer book which is a compendium of the best of all WW2 sniping manuals. This companion volume to World War II Snipers: The Men, Their Guns, Their Story is comprised of the training manuals used by the various combatants of the war. Drawing from the material collected to prepare World War II Snipers, it gives the readers insights into the training of a World War II sniper.

One included manual reproduced in its entirety is the sometimes mentioned but never seen 1933 Soviet Sniper Manual along with the Soviet 1933 Course of Fire for Sniper Training which has never been released before in English. Excerpts from British, American, German Wehrmacht and SS, as well as Finnish material is in there. There's a chapter dedicated to camouflage and others on tactics and lessons learned the hard way.

Finally, the book is finished with a chapter on equipment available to the sniper at that time and how to use it, including the use of early scopes such as the Warner-Swasey prismatic scope from the World War I era. This volume would be useful to collectors, museum directors, conservators, curators, and WW2 re-enactors and researchers. Used Project Gun Sources I'm retiring soon and my first two years of retirement are planned to be spent attending an in-residence gunsmithing school.

Most of these schools require students to acquire a small inventory of firearms for projects. What are good sources of used, abused, or broken rifles, shotguns, and handguns? Any and all information on used firearm acquisition sources would be most welcome. Please email any suggestions. Pete Le Grand Thanks for subscribing.

Starting online, check GunBroker.com, SimpsonLTD.com, ClassicFirearms.com, ViennaArsenal.com, and Cash My- Guns.com are good places to start.

BestGuns.net, GunsAmerica.com, Guns.com, ImpactGuns.com, Buds- GunShop.com, Replica Guns Swords. com, and Cabelas.com have sections listing broken and used guns. On the local front, check with pawn shops, gun shows, flea markets, estate sales, gunsmiths, and gun shops and ask for broken or unrepairs firearms. Independentlyowned operations are ideal. They may have used guns not ready for sale that haven't been repaired yet or would prove too costly to fix for a profit.

Specify that you're looking for gunsmith projects and that any of their bad trades would be ideal as a fixer upper or sources of spare parts. Also, customers at local independent shops may be willing to part with a broken firearm rather than pay to have it fixed. Let the shop owners know this as well. Their trash may be ideal for your school projects. Contact local law enforcement agencies and see if they are allowed to auction their evidence guns to a dealer.

If so, contact the winner of the auction and deal on the "basket cases". Consider finding a government buyback program location and set up nearby with an offer to purchase at slightly more than the buyback price. Finally, ask the school you decide to attend as they may have an inventory of unfinished project guns or similar. One student attending the Colorado School of Trades reported the school runs a repair gun shop and always had plenty of different firearms to work on. AG

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