

Metal Finishing

An extremely short article to start the
gunsmith on his way to finishing and
creating fine firearms

**A compilation of notes and handed-down instructions of over 30 years
By
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Metal Finishes

(As handed down and copied from old notes)

First, a warning to all would be gunsmiths and individuals using this process. The chemicals and solutions used in this procedure are corrosive, toxic, and in some cases, hot! Many pose a hazard for inhalation when used in this manner! Use all necessary safety precautions whenever handling solutions or parts. Safety glasses, rubber apron, rubber gloves and adequate ventilation or respirator are an integral part of this procedure and shouldn't be bypassed. Use these procedures and formulas at your own risk, and perform all mixing procedures SLOWLY!!! Some of these recipes are over 150 years old and folks back then weren't as safety conscious as they could've been. Since I can't be responsible for the actions, inactions, or outright foolishness of some folks, I can't take responsibility for the misuse of this information!

Second, this article is not meant to be a treatise on hardening procedures. Case hardening without destruction of the part is a very unforgiving process. To utilize most steel hardening processes, temperature regulation and timing are crucial, and in many cases, the hobby gunsmith doesn't have the technology to carry this out.

With that said, let me also mention something about refinishing old guns. Unless the piece has to be completely rebuilt, has no historic value or collectibility factor, don't refinish, wash, sand or re-blue (or brown for that matter) any old gun. The patina (I've had some uneducated folks call it "dirt") found on aging firearms lends to the history and value of the piece. Many times, the original finish is found (discolored perhaps) just under the first layer of people grease and dust that accumulates with years. Scraping, sanding, staining and even re-varnishing a piece may take it from collectable to jokable within minutes. Please leave the old ones alone, our history and heritage deserves to be preserved.

Now, on to the processes!

Heat Bluing

Heat bluing provides a pale blue color with minimal surface penetration. While this may be the oldest form of metal finishing, it is also the least resilient. Polish all pieces with at least 600 grit and DO NOT handle with the bare hands after degreasing.

Lay the finely polished steel parts on a bed of sand in a steel tray. Gently warm the tray from below (don't allow direct flame contact with the part to be blued). Heat until part achieves the desired shade of blue, air cool (don't quench), Buff finish by hand with soft cotton or wool fabric, then oil or wax to preserve color.

Charcoal Bluing

Charcoal bluing provides that wet, inky black color of fine antique revolvers and shotgun receivers. This oxidized finish, while not deep, can be spectacular, especially on older and softer steels. Care must be taken to not overheat the parts, and continue the process at least one step beyond the desired shade of blue (as the part cools, the color will fade significantly) and individual parts will heat faster or slower depending upon their mass. Therefore, one timed sequence will not be appropriate for all pieces being blued. A little experimentation is required.

Polish all parts to a high gloss. Carefully degrease the parts and avoid contact with the skin (clean/dry cotton gloves work well for this). Attach steel wires to all parts, there can be no handling of the parts once the process has begun (the “people grease” really screws up a finish, not to mention the extreme heat of the parts themselves!).

Fill a tray deep enough to fully cover the part to be blued with charcoal pellets (about the size of a pea) and place the tray on a heat source. Bring the heat up and let the charcoal start burning (not all the way red, just started to burn). When the charcoal has begun to burn, bury the part in the charcoal “peas” and keep heating for 3 to 5 minutes. Remove the part from the charcoal (the wire comes in handy here) and rub it down with soft cotton (cotton batting or soft cotton bandaging) that has been dipped in lime (Calcium Oxide) powder.

Return the piece to the charcoal, and after another 3 to 5 minutes repeat the process. Continue this sequence until a dark, rich, inky blue has been obtained, and let the part cool in the air (do not quench) before applying a coat of oil. The resulting finish will appear glassy and wet, much like the color of wet ink.

Aluminum Black

This solution is VERY toxic! Take all safety precautions and do not allow the solution to come into contact with skin or eyes, and only apply it to the metal outdoors in a ventilated area.

Mix:

1 oz. White Arsenic

1 oz. Iron Sulphate

12 ozs. Hydrochloric Acid

12 ozs. Distilled Water

Scour the aluminum and then wash in weak caustic soda (Sodium Hydroxide) solution to etch the part. Immediately immerse in, or apply the slightly warmed blacking solution. Dry off and lacquer.

Silvering

DANGER!!! Mercury is very toxic! Only perform these procedures (ALL procedures) in well-ventilated areas.

Mix:

Dissolve a few drops of metallic mercury in nitric acid (about 5 times as much acid as mercury by volume). When the mercury has dissolved, add it to an equal volume of 5% silver nitrate solution.

Rub this solution on the surface of brass or copper to develop a bright silvery film. Protect immediately with a coat of lacquer or the film will evaporate.

Blackening Silver

Rub the silver item with silver nitrate until black. Wash and dry with warm water.

Blackening Brass

DANGER!!! Mercuric chloride is EXTREMELY toxic! Absolutely avoid inhaling vapors or skin contact with this solution.

Mix:

1 oz. Mercuric Chloride

1 pint Vinegar

Apply to clean, dry and degreased brass with a clean swab. When the part turns the desired color, wash and polish.

Blackening Copper

BEWARE!!! Nitric acid is... well acid! Not only will it eat the hide off of you, but also the vapors will permanently damage your lungs. I think that just about sums up the reasons for safety...

Dip the part in pure Nitric Acid and heat to a dull red. Cool and wash off, then apply oil or lacquer to protect the finish.

Antique Bronze Green for Brass

Copper Sulphate is a skin absorbed poison. Wear rubber gloves, apron, and eye protection when mixing and applying.

Mix:

1 pint vinegar

1/2 oz. Copper Sulphate

1 oz. Table Salt

1 oz. Ammonium Chloride

Swab the mixture liberally on the brass, wipe off the excess, and let dry. Repeat this procedure every 24 hours until the desired shade of green is achieved. This may take as many as 3 or 4 coats.

Rust Bluing Formula & Procedures

There is nothing quite as pretty as a satin smooth rust blued firearm! Modern hot salt bath bluing methods and the various parkerizing processes tend to be lacking when it comes to the custom finish found with a rust blue. Custom rifles, shotguns, and pistols with modern and “convenient” finishes don’t show the pride of construction that should be present in any fine firearm. The deep, lustrous blue achieved with a little extra time and elbow grease is a fitting end to a careful construction process, and is never missed when gun experts evaluate a fine gun. Besides, the hot water rust bluing system is the only one that allows the gunsmith to put a new finish on an old soft soldered shotgun barrel without disassembling the ribs and tubes!

Remember that the finish you achieve is only as good as the prep work you put into your gun, so take your time and polish, polish, and polish some more! When handling polished or degreased parts, the use of cotton gloves will prevent the transfer of people grease to your hard work! Use care and don’t leave your fingerprints behind!

Another area of concern is the bore of your gun. The bore and chamber should be thoroughly packed with grease and the muzzle and breech must be tightly plugged before starting the degreasing. I like to use hardwood dowels (maple, birch, alder, poplar, etc.) that are whittled to fit the chamber and muzzle of the barrel tightly enough that I have to tap them in with a wooden mallet (I can’t express how important it is to tap these plugs in very gently...). If they are left a little long (depending on the length of your tanks of course) they make great handles and hanger points so I don’t end up with the fingerprint condition mentioned above. If you have any suspicion that the plugs have leaked bluing or etching solution into your barrel, you must stop immediately, clean the bore and chamber of the gun, rinse with clean hot water and re-grease and plug the bore before continuing.

This process relies on the corrosive action of the bluing solution, and the heat of the hot water rinse to speed the rusting process. Anyone that has used a cold browning process and a sweatbox knows how many days (or weeks!) are involved in achieving that dark plum brown color sought after for replica arms. But, through the use of boiling water and a heated bluing solution, the oxidation reaction is speeded up to hours instead of weeks! This process does, however, have its faults! Remember, small or thin parts will heat more rapidly than heavy, thick parts, so more time for heating should be allowed for barrels and receivers. Conversely, small parts lose heat more rapidly, and in order for your bluing process to look even, you may have to apply more “coats” of solution (or process steps?) to smaller parts to achieve the same depth of color. Use wire hangers or small parts baskets to handle the screws and small parts in and out of the boiling tank. Remember that fingerprints show on these too!

Because rust bluing is also dependent upon the surface hardness of the steel to be blued, I've included info on a solution for bluing hard steels (modern vanadium receivers and hardened actions) and also for the softer steels (such as those encountered in .22 rifle barrels). Make up both solutions and store them in a light proof bottle in a cool dark place (they last WAY longer if you do this, and keep them tightly capped too!). Remember to store them away from anything you don't want to accidentally become etched. I forgot a bottle once that got left on my table saw, and the pit it left when the vapors contacted that saw table are enough to make me sick every time I see it...

Well, like I said earlier, be safe, wear your safety equipment, take your time, take pride in your work and enjoy your new “Hot Water Rust Blued” finish. With a little care and patience, you'll have a finish that'll be the envy of all your shooting partners!

Supplies needed:

One mild steel (or stainless) tank long enough, and deep enough, for the biggest part to be blued. This tank must have some sort of burner assembly in order to boil the solution you are working with during the different phases of the job. In a pinch, you can use the kitchen stove, but if you say I said it wouldn't hurt anything to your wife or significant other, I'll call you a liar! Remember that you'll be using caustic solutions that will vaporize when heated, and hurt or harm everything they come in contact with... Maybe you should go outdoors after all!

Degreasing solution:

This solution is corrosive and toxic

1/2 cup oakite per gallon of water (tank size plays a big part here). If Oakite is unavailable, a weak solution of sodium hydroxide (pH 10-12) will suffice.

Etching solution:

Once again, Nitric Acid is a strong acid that's also toxic by inhalation

1 part technical grade nitric acid to 7 parts distilled water (distilled water costs a couple bucks, but the purity makes it worth it).

Bluing solution:

ALL of the following chemicals are toxic and corrosive. BE CAREFUL!

1/4 ounce Sodium Nitrate

1/4 ounce Potassium Nitrate

1/2 ounce Mercuric Chloride

1/2 ounce Potassium Chlorate

10 ounces distilled water (hard steels)

Or:

14 ounces distilled water (softer steels)

Clean cotton or wool swabs

Small jar and hanging apparatus for bluing solution (keep it in the boiling water tank in order to keep the solution the same temp as the parts being blued)

FINE steel wool (00 or 000 grade)

Clean cotton cloth (wash the sizing out before you use it)

Rig oil, or your personal preference for oiling the parts at the end of the process.

The Procedure:

Sand and polish all metal parts until they have no visible scratches on the surfaces to be blued. I don't personally use buffing wheels because they tend to round corners and remove lettering too easily. Using progressively finer sand paper to 600 grit wet or dry seems to do a superior job for me and the extra time I take doing this process by hand pays off in spades later. Remember to back up your paper with a flat object whenever you're working on flat surfaces, and it doesn't hurt to sand round objects in a "shoe shine" fashion as long as lettering and shouldered areas are protected from over-sanding. Following polishing, grease and plug the barrel as described before, lay out all of your materials, prepare the oakite (or Hydroxide) bath, bring it to a boil and boil all of the parts for 20 minutes, rinsing when done. Drain your tank, rinse it well, fill it with fresh water and boil all parts for 10 minutes to insure removal of all of the degreasing solution.

Etch all non-sliding parts by swabbing etching solution on them with a cotton or wool swab and return to the boiling tank for 10 minutes. This process should be repeated at least 2 times in order to achieve a uniform dull grey color (removes any final sanding swirl marks and provides a surface for the bluing agent to “bite” into later). Following the final etching cycle, return the parts to the boiling tank and reheat until the part is too hot for you to touch. This is also the time for you to hang your jar of bluing solution into the tank in order to heat it prior to applying it. The bluing solution **MUST** be the same temperature as the part to be blued for this process to work effectively.

Working with one part at a time, remove and coat the part with bluing solution using a clean swab, returning it to the boiling tank as soon as you have coated it with bluing solution. Repeat this step 2 or 3 times and after the last coat in this step, remove the part and card off the rust with the fine steel wool, returning the part to the tank for reheating when done. Remember that the heat is of primary importance in this process and allow plenty of time for the part to reheat in between these steps.

Continue swabbing the part, returning it to the tank for reheating, removing the part and carding off the rust, and returning the part for reheating through at least 8 cycles, or until the color of blue is just slightly lighter than what you want to achieve.

Repeat the process immediately above but substitute burnishing with clean cotton cloth instead of carding with steel wool for at least 3 more cycles or until the color of blue is to your liking.

Return the part to the boiling water 1 more time, reheat until you can't handle the part bare handed, and immediately oil or grease the part insuring that all water has evaporated and oil has displaced it. For the barrel, remove the plugs, remove the grease from the bore, regrease with clean RIG (or your choice of gun grease) and swab the bore to remove excess grease build-up.

When you're done, reassemble your firearm, pat yourself on the back for a job well done, and admire a truly fine piece of steel and wood with a deep blue glow. Your extra effort has put a classic finish on a fine firearm!