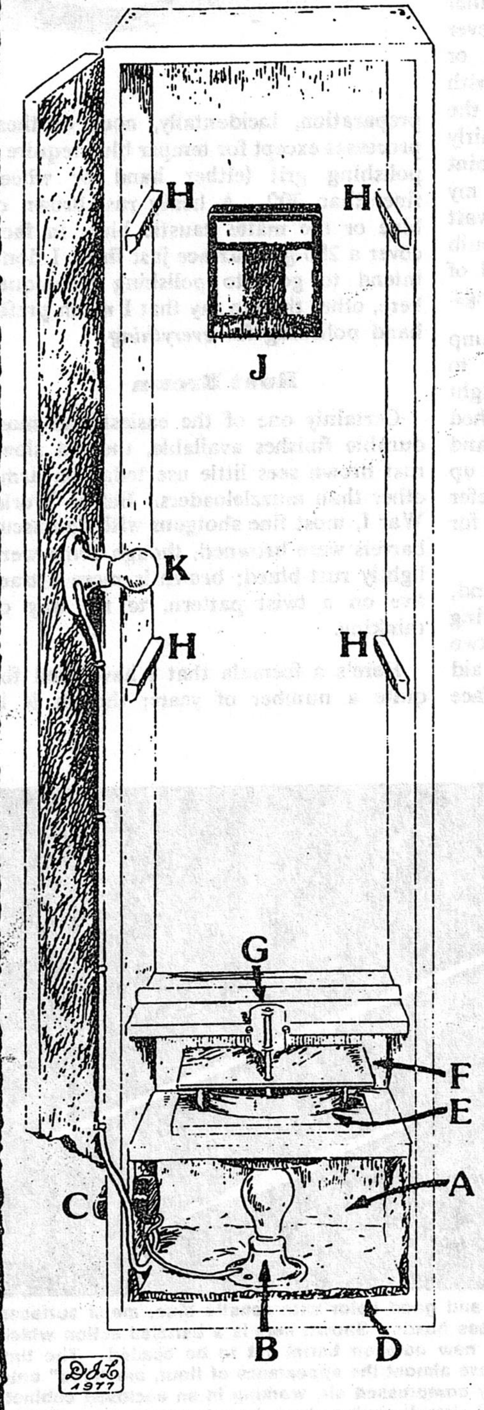
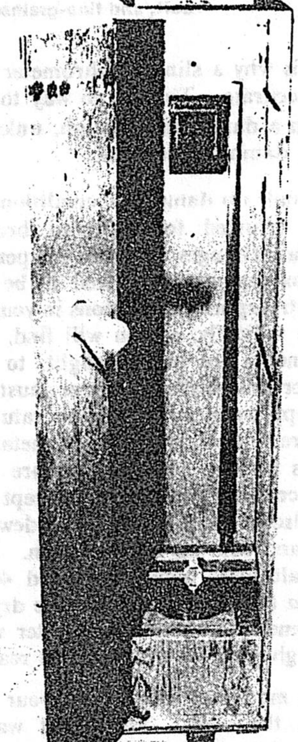
The BIVINS DAMP BOX

Mk. II





This is Bivins' damp box, which he uses for all rust bluing and browning. The box is constructed of 3/4-inch exterior grade plywood, glued and nailed at the joints. The bottom chamber [A] which is totally enclosed, conceals a single 150-watt bulb in a ceramic socket [B] resting on the floor of the box; the bulb is controlled by a dimmer [C] with a control shaft protruding from the side of the case, and the entire lower heat chamber is lined with asbestos and heavy aluminum foil [D] to prevent heat damage. Placed in a tightly fitting hole in the top of the heat chamber is a medium-sized stainless saucepan [E] filled with water, with two-thirds of the top covered with a piece of sheet brass [F], a meat thermometer [G] reads water temperature, usually set at 140-160 degrees. Barrels and/or barreled actions rest upon the shelf just above the pot, and rests [H] are nailed near mid-point and top of the upper chamber to receive partitioned plywood shelves shown on top of the damp box in the photo for finishing small parts. A dry bulb/wet bulb hygrometer [I] keeps tabs on damp box humidity, and the lightbulb [J] on the door provides both illumination and extra heat; Bivins alternates between 25 and 40-watt bulbs, depending upon the heat needed. Though this box measures 15x15x66 inches, a smaller unit could be used if only breechloaders were to be finished. In use, the water pot should almost touch the light bulb heat source, and the pot should be kept filled. Shelving should be at least four inches shallower than the depth of the box to permit free air circulation. Screen-door hooks keep the door shut tightly.

our erudite readers have insights into such things.

In addition to rust browning and fire-blues, another finish popular from a very early period was case-hardening. Early gunsmiths saved both time and money by fabricating working mechanisms, particularly gunlocks, from soft iron and simply carburizing the surfaces by pack-hardening in charred leather, bone black, and other carbon-bearing substances. This is what old gunsmiths' accounts mean when one finds the entry "steeling a frizzen;" it meant casehardening, or converting the surface iron to steel by the addition of carbon. Such surface-carburized parts were glass-hard on the surface by virtue of having been quenched in cold water, yet .010-.020 below the surface, the part was still soft steel or iron. . .thereby providing a part that was both malleable and hard. This is a very desirable characteristic in my mind, and even with the fine through-hardening tool steels of today, I still much prefer casehardened mild steel for use in fine lock components. All springs, of course, must be through-hardening steel.

Casehardening will, to a good degree, resist atmospheric oxidation, and it was popular among early gunsmiths to leave the locks of fine fowlers and rifles bright. At some point, however, someone discovered that mottled colors could be brought to a casehardened finish by "tampering" with the water which the parts were quenched in when they were dumped from the iron box in which they were pack-hardened in the forge. Someone no doubt noted that as the water in the quenching or "slack" tub became dirty from use, subtle colors began to appear upon the finished gun metal rather than the usual silvery-gray of plain casehardening. Potassium nitrate dissolved in the quench, it was soon discovered, provided brilliant mottling to the surface, especially when the quench tub was aerated by some means. A vigorous stream of bubbles heightened the colors and the patterns they made; what was taking place was simply an instantaneous introduction of oxygen of varying strength to the metal as it was being rapidly cooled, providing the entire spectrum of oxide temper colors, frozen in incredible patterns by cold water. How early color hardening was used, I cannot say, though Lynton McKenzie told me recently that he had seen brilliant color case on the locks of a pair of ca. 1730 French holster pistols. Generally, color case wasn't particularly popular much before 1800, judging from surviving samples of guns in fine condition.

Though casehardening, and even obtaining good colors, isn't really difficult, we won't go into the process here for the reason that it isn't a finish very practical for the custom smith who doesn't have expensive precision heat-treating equipment. Casehardening large parts such as receivers invites warpage unless hardening temperatures are held within a critical range, so this finish, in most shops, is best confined to small parts.

These are the basic working finishes for the gunsmith, all of them with the exception of caustic blue known to one degree or another for centuries, so let's have a look at specifics.

Atmospheric controls are vital to the efficient application of either slow-rust browns or blues. Two years ago, in *Rifle* 36, I discussed the use of the dampbox, in which I used a thermostatic hotplate to heat water to provide a high humidity level inside a sealed chamber, regardless of the ambient humidity of the atmosphere. A damp box is a great necessity in order to provide constant humidity conditions, since you can't do much rusting when the moisture content of the air drops much below 60 percent, and a baroque mess develops if the humidity rises much above 90 percent. Both heat and humidity controls are important; I control the air temperature of the main chamber of my damp box with varying wattages of light bulbs. The more efficient heat source I now use for the water is simply a single 150-watt lightbulb which is controlled by an inexpensive dimmer. See Dave LeGate's sketch and the attendant explanation for details. My box is large to accommodate long muzzleloading barrels; the gunsmith who only has to deal with breechloaders could well do with a smaller box.

In my rig, I have found that a water temperature range (I measure this with a meat thermometer) of 140-160 degrees and an upper chamber temperature of 90 degrees or so will provide the 80 to 85 percent humidity needed for optimum conditions for most browning and bluing solutions. Each formula, of course, tends to have a humidity level where it works best, hence the need for a dry-bulb wet-bulb hygrometer (cost approximately $20) to keep tabs on the conditions in your box. The wet bulb must be fanned before taking readings for best accuracy, which is why a sling psychrometer is the most accurate. There's no way to use a sling in a damp box, though, unless you have a damnably big box.

Bivins found Rick Schrieber's browning solution to be the best commercially produced for both rust browning and rust bluing. Bivins says it produces a very fast, soft, and fine-grained oxide.

Not only do damp box conditions need to be adjusted for different browning formulas; changes in water temperatures and box temperatures need to be made when atmospheric conditions in your shop change radically, as you will find. Such adjustments are usually slight, to either speed or slow rusting. Water must never even approach boiling temperature, or moisture will condense on the metal, with hideous results. Air temperature in the upper compartment must be kept fairly high, also to avoid reaching the dew point inside and causing condensation. In my box I alternate between 25 and 40-watt bulbs in the top for control; the dry-bulb thermometer on your hygrometer will of course give you air temperature readings.

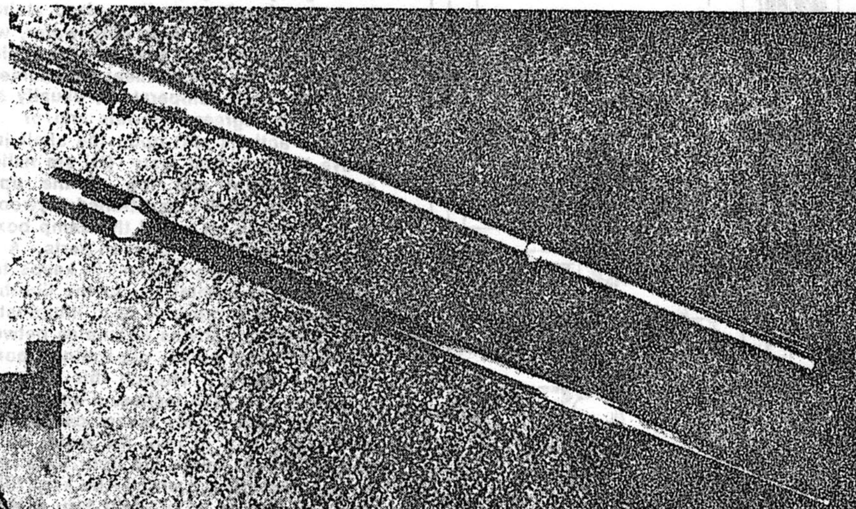
As a matter of safety, bolt your damp box to the wall. You don't want to stumble into it in the dark some night and knock your lovingly hand-polished Hoffman Mauser action off the hooks and into the drink. . .unless you like to stay up until three ayem re-polishing. I prefer thorn branches and snow banks for pleasure.

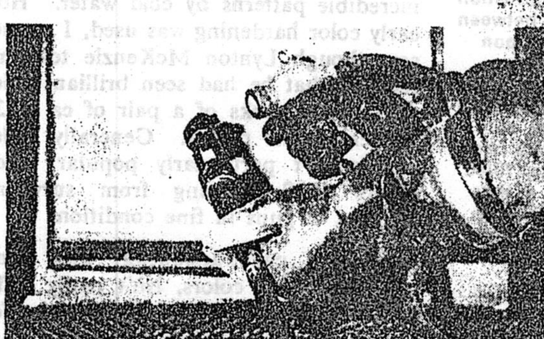
With atmospheric conditions in hand, let's have a look at six different finishing processes appropriate for fine guns, two of which will be carried out with the aid of the damp box. Regarding surface preparation, incidentally, none of these processes except for temper blue require a polishing grit (either hand or wheel) finer than 300. A heavy rust brown or blue or the matte caustic blue, in fact, cover a 280-grit surface just fine. I don't intend to go into polishing techniques here, other than to say that I much prefer hand polishing for *everything*.

Rust Brown

Certainly one of the easiest and most durable finishes available, the old slow-rust brown sees little use today on arms other than muzzleloaders. Before World War I, most fine shotguns with damascus barrels were browned, though some were lightly rust-blued; brown is more attractive on a twist pattern, to my way of thinking.

Here's a formula that I have used for quite a number of years; though it is





To produce an excellent finish and good color with caustic blue, metal surfaces can be impact-finished with glass beads. Shown here is a barreled action which has been beaded, alongside a new octagon barrel yet to be beaded. The tiny spherical glass beads, which have almost the appearance of flour, are "fired" onto parts surfaces at high speed by compressed air, working in an enclosed cabinet. Some auto shops and almost all aircraft engine shops have bead blasters. Photos by Joe Balickie.

associated with Harper's Ferry Arsenal during the mid 19th Century, it no doubt was derived from virtually identical formulas present in the 18th Century:

Browning Solution, US Ordnance Manual 1841

5 oz. ethyl alcohol
5 fl. oz. ferric chloride tincture
1.7 oz. (48.2 grams) mercuric chloride
5 oz. ethyl nitrite, 4 percent alcoholic solution
4 oz. (113.4 grams) copper sulfate
2.5 fl. oz. nitric acid, 70 percent
104 fl. oz. distilled water

This formula makes a gallon, and of course can be cut in proportion if a smaller quantity is desired. One problem ingredient in recent years has been the ethyl nitrite solution, called "sweet spirits of nitre" in the early days, and used as a pharmaceutical up until a decade or so ago. It has gone out of use, and few firms will now synthesize it since it is unstable, so if you are not able to locate it I believe that it can be replaced with an equal volume of ethyl alcohol with no harm to the formula. The 1841 Ordnance solution will give an excellent dark reddish-brown color to just about any alloy of steel, usually requiring six or seven applications spaced four to six hours apart; it's all right to leave parts in the damp box overnight with this brown. Like most browning solutions, it should be kept in a brown glass bottle or an opaque plastic jug. It's poisonous as the very devil, largely thanks to the mercuric chloride.

With the ordnance formula, a medium to heavy oxide suitable for most muzzleloading work can be obtained by carding between coats with 4/0 steel wool, and you'd best degrease the wool. Much of it seems to be saturated with oil these days, and I for one would like to see someone produce steel wool for gunsmiths that has no oil in it. If anyone knows of any, please write! Parts must of course be degreased before application of the brown. I simply clean parts with toluol (a basic solvent in lacquer thinner) and then go over them again with methanol (wood alcohol) to remove any residue from the thinner. Avoid touching the parts after they're degreased, though the ethyl alcohol in this brown will remove trace amounts of oils. It's also a good idea to run a dry patch down the bore of a barrel that is to be browned, to prevent oil from creeping to the outside; I protect bores from rusting in the damp box by simply swabbing them with a patch soaked in Sherwin-Williams A66 V3 varnish sealer, the stock finish I discussed in *Rifle* 47. This can be removed easily with lacquer thinner after the browning is finished.

If a finer-grain brown is desired, you can card between coats with a wire wheel, using an .004 wire diameter brush, obtainable from Frank Mittermeier in New York. Decreasing the rusting time to three hours per session will also produce a finer grain, and this solution can also be cut as much as 20 percent with distilled water if desirable. For use on damascus steel, it should be cut considerably. I can't say how much since I haven't tried it on damascus.

To stop the browning salts, either wash the parts in hot soapy water, as I do, or wash with a water and baking-soda mixture. A good final finish results from waxing the parts with Johnson's Paste Floor Wax. For best results, melt a little wax and stir in a little burnt umber universal tinting color first, or you will be left with white spots when the wax hardens. *Do not* be tempted to boil *any* browned parts to stop the rusting action unless you want the parts to turn a matte black. This is at times a good technique for aging when restoring an antique, but it ain't so hot for new work. I wouldn't even soak parts in hot water for more than a very brief period.

The greatest drawback to the Ordnance formula, and to many other old browning solutions, is that it contains mercury salts. Mercury poisoning is one of the most insidious maladies on the books. It's very difficult to diagnose, and, like lead poisoning, it's cumulative. I have become very concerned with this due to the fact that I use large quantities of brown, and I don't fancy becoming senile before I'm forty. For the past couple of years I have been hearing about a solution marketed by Rick Schrieber, whose fine gunsmithing work was featured in *Rifle* 48. Rick is a chemist, well prepared to devise excellent finishes, and some while back he began to market a product he calls "Barrel Brown & Degreaser." The "degreaser" comes from the fact that it apparently contains a detergent, and a strong one at that. I tested this feature, basically being a dubious fellow, and found that it would cut right through a generous smear of oil and immediately begin to brown the metal. . .certainly a boon to the gunsmith, since with this brown there is little need to worry about touching parts during the browning process. Also, this brown is *very* fast indeed; I found that I can finish parts in the damp box in only four applications, spaced three hours apart, and the resulting brown is very fine-grain, with an excellent plum color. Longer rusting periods or less carding will build up the oxide if a heavier coat is needed. Like the Ordnance brown, Schrieber's solution needs 80 percent-plus humidity to work most efficiently, though I found that it would produce a very fine rust at a moisture level not much over 60 percent. Equally as important, this solution contains no mercury, and is not even toxic enough to even warrant a "poison" disclaimer on the label. Rick tells me that the principle corrosive is ferric chloride, and there is a trace of acid present. I've tried a good number of browning solutions over the years, and Schrieber's brown is the very best I have used to date, if my tests with it so far are any indication. I immediately ordered a gallon, and have no intention of using any other solution in the future unless this brown balks at some particular alloy, which I don't expect it to. I've used it now on 12L14 (low-carbon leaded barrel steel), 4140, and A-2, and it browned all with equal ease.

Rick sells this in 2.5-ounce bottles through various dealers such as Golden Age Arms Co. in Delaware, Ohio; he will not sell these small bottles direct. Due to my prodding, he now has available bulk quantities, quarts retailing at $26.80 and gallons at $87.70, and he will sell these bulk quantities directly to bonafide gunsmiths and dealers *only*, and the discounts are liberal. For the hobby gunsmith, the 2½-ounce bottle retails for $2.75 and will brown four rifles. Schrieber's address is: Laurel Mountain Forge, Box 272, Clawson, Mich. 48017. Use the directions he supplies with each bottle.

Fast Brown

Fast browns, applied by heating the metal until the solution will just barely sizzle when it is swabbed on, are useful for finishing small parts since repeated handling of the parts while slow-browning is avoided. Generally speaking, however, fast browns are less desirable as a finish, since they are less durable and do not always provide as good a color on some alloys as rust brown. I have found that the best color with fast browns is usually obtained when a part is polished; using such a brown on a part with a foundry sandblasted finish can result in a greenish-gray. For best results, parts which have been fast-browned should be left to rust for six or eight hours; this improves surface texture, color, and durability. With a damp box, the parts can be left as little as four hours, but it's best to have the parts directly under the upper-chamber light bulb to prevent any condensation around the powerful browning salts present on the metal.

The standard fast brown of the industry is Birchwood Casey's "Plum Brown," an excellent product which has been around for years. You may rely on their instructions for good results in most cases, with the addition of the extra rusting mentioned above. Avoid excessive heat when using this brown, or you will have a surface buildup of a foamy, yellowish oxide. This, however, is easily removed with a clean swab and more solution, and it must be removed before parts are put into the damp box, if you do decide to "age" the brown.

For those who would like to mix their own, the following formula will give the same results and color as Plum Brown, and it may be used exactly the same way:

Fast Brown

600 gr. Potassium nitrate
400 gr. Bichloride of mercury
500 gr. Potassium chlorate
150 gr. Ferric chloride
150 gr. Sodium nitrate
80 gr. Cupric chloride
900 CC Distilled water

Heat this solution to 140 degrees F., stirring slowly, and let it cool to room temperature. The formula I have calls for the addition of 90 CC of the same ethyl nitrite solution (after cooling) mentioned in the Ordnance formula, but if this isn't easily obtainable, then I believe you can substitute ethyl alcohol in the same quantity with equal results. Also, I don't believe the cupric chloride is particularly needed. This chemical, known as "blue vitriol" in the old days, usually serves as nothing more than a stain. This is needed in a slow-rust solution so that you can see where you've applied solution to bare metal, but I doubt its importance in a fast brown formula. Both this formula and Casey's contain mercury, so avoid both the fumes *and* dust from carding parts. I should mention at this point that making up your own finish solutions is no longer exactly inexpensive, since some of the ingredients have become dear. Check with a drugstore that has been in business for quite some while, and you'll likely find what you need.

Rust Blue

Certainly the finest finish available for fine custom sporting guns, the rust blue, though a little time-consuming, is one of the easiest finishes to use. It is also an appropriate finish on some muzzleloaders of the mid 19th Century and later. I have here in my office a fine little offhand percussion slug rifle by Joseph Tonks of Boston, sporting a beautiful rust-blued barrel.

As I mentioned, virtually every old browning solution will also blue, though some are more efficient than others. I have found that the 1841 Ordnance formula works well, though it should be diluted 15 percent or so with distilled water. An old standby was the simple formula used by A.O. Niedner's shop:

Niedner's Rust Blue

2.5 fl. oz. Nitric acid
2 fl. oz. Hydrochloric acid
1 oz. Nails (clean)
30 fl. oz. Distilled water

To concoct this very strong solution, mix the acids slowly in a stoneware or heavy glass container, preferably outdoors, and add the nails, allowing them to dissolve. The acid solution may then be added *slowly* to the water.

Niedner's formula also works quite well as a rust brown, though for either browning or bluing it seems a little more sensitive to humidity changes than the 1841 Ordnance formula. Proceed with rust bluing just as you do with browning, including degreasing as mentioned before, and be certain that you have a good uniform coat of varnish sealer in bores, chambers, or other action parts to prevent rusting after boiling. The varnish will hold up nicely in boiling water after it has hardened, but don't expect it to stay on the metal if you dunk the parts in a cleaner such as Brownell's efficient Dicro-Clean! I prefer to use the toluol/methanol method of degreasing, though you must take more care to remove oil from screw holes and "hidden" areas.

When rust bluing, parts are best left in the damp box for no more than three to four hours at a time. . .never overnight. After a rusting session, pop the parts into boiling water for three or four minutes, shake off the excess water, and let them dry. The water must be clear of minerals to avoid a spotted finish, so you must use either distilled water, or, as Jerry Fisher does, rainwater. I have also found that condensate water from an air conditioning system works equally well, but of course it's only available in the summer. If you catch rainwater from your roof, let it rain long enough for dust to be washed away before you put out your barrel.

The boiling apparatus need be nothing more elaborate than a 16-gauge sheet-iron box with the corners welded up, eight inches wide and eight inches high. My box is 45 inches long for muzzleloading use, but a much shorter one can be made for breechloaders. I boil the water on an old range top, with the tank sitting across the two largest burners. A gas burner is much quicker, but not really needed unless you do a volume of rust bluing.

After boiling, parts must be carded, and it's best done with a motor-driven wire brush with .004 wire diameter, as mentioned before. The parts should be carded heavily to remove all traces of ferrous oxide; try to card long parts such as barrelled actions parallel to the part, since cross-carding will show in the blue. Areas inaccessible to the wire brush, such as the inside of a trigger guard, can be carded with 00 steel wool, but you'd best rub *hard*. A good blue can be obtained with no more than five or six applications, boiling, and cardings, but if you like a heavy buildup, as many as eight or ten applications can be used. Preliminary testing with Schrieber's brown mentioned above indicates that it will deposit an excellent fine-grained blue on 4140 steel in four applications, though again further applications are needed for those who like a heavy matte finish. I prefer a fine-grained rust blue since it can be used over engraving without obliterating detail, and it can be used more easily to duplicate old factory finishes, which are usually fine-grained. In any event, use Schrieber's product just as you would Niedner's blue or the 1841 formula.

After the final boiling and carding, rust blue only needs oiling, and it's ready to give you twice the service of a polished caustic blue.

Fast Blue

Fast blue relates to rust blue just as fast brown does to a rust brown, and, as a matter of fact, I suspect that any of the formulas which will brown hot metal will also blue the same metal. I do know that Plum Brown works as an excellent fast blue, using the process described below. Like fast browns, fast blues are not as durable as slow-rust oxides, since the coating is much thinner and the chemical bond with the metal not as strong. However, the appearance is exactly like a fine-grained rust blue. The old standby formula is Clyde Baker's, if you wish to mix your own:

Baker's Express Blue

1/4 oz. Sodium nitrate
1/4 oz. Potassium nitrate
1/2 oz. Bichloride of mercury
1/2 oz. Potassium chlorate
10 fl. oz. Distilled water

This makes a small quantity of blue. Mix the dry ingredients, but do not grind! Potassium chlorate is highly unstable and can detonate under friction. Pour the chemicals into warm water, stir, and let cool. Baker called for the addition of 1/2 oz. of ethyl nitrite, but it's not necessary.

In using the fast blues, parts are simply put into your stove-top tank and boiled vigorously, after of course appropriate degreasing and bore protection. The use of varnish sealer as a bore protecter here is a boon, for if you use plugs in the barrel, trapped air will expand and may cause the plugs to leak.

A small jar of bluing solution is also put into the tank of boiling water (distilled or rainwater), preferably hung on a wire, and allowed to come up to tank temperature. Bluing is carried out by simply pulling out the parts, shaking off the water, swabbing on the blue in fast, long strokes, and returning the parts to the tank for a couple of minutes. They are then removed, shaken off. and carded just as with rust bluing. As with fast browning, the metal must be hot enough for the solution to dry on the metal instantly, or you will get no blue. I find it an advantage to light a propane blowtorch and set it next to the tank of boiling water. I remove a part, give it a couple of slow passes with the torch, then swab on the solution. This is a virtual necessity for small parts, and it helps with larger parts as well.

Four to six applications of Plum Brown or Baker's formula will produce an excellent blue, needing only oiling after the final carding. An entire rifle can be blued in not much more than two hours this way, but I'm not too fond of standing around with my snout in a cloud of steam, so I much prefer rust blue. Harry Pope liked the fast process, though I don't know what formula he used. He did manage to ruin an eye when a tiny bit of solution boiled up and spat out of the jar in the tank, so take care with this stuff.

With both rust blues and fast blues, some alloys and some casehardened surfaces resist taking a good finish easily. When casehardening is present, it's a good idea to put all the parts in boiling water, remove them, and swab them with a 5 percent solution of nitric acid. Boil the parts again briefly, and if they are to be rust blued, let them cool. Proceed with them hot if you are using fast blue. In any event, this very mild etch will lightly frost the surface and give the oxides a "foot."

Temper Blue

As I mentioned before, heat-induced oxides were the primary source of blue for firearms much before the 1800's. A temper blue can be very durable if means can be found to "soak" the part at the temperature at which deep blue occurs. A heating medium is a virtual necessity for this, since heating in an open flame results in a "flash" color that has little surface depth.

Temper blues can be used for large parts such as barrels and actions, if the alloys used have been heat-treated at a temperature *higher* than 600 degrees. Winchester formerly temper-blued the nickle-steel receivers of lever-action rifles, obtaining such a depth of oxide that when it comes off it "flakes" almost like plating, resulting in the familiar appearance of many pre-war Winchester receivers with the finish partially gone. Barrels may also be temper-blued, as I mentioned earlier, but if a heating medium is used a barrel should be heated to 400 degrees or so with a torch before plunging it into the heat bath to avoid possible warpage.

In modern parlance, temper bluing is most convenient for small parts such as screws. "Fire" blued screws showing on a set of silvered, casehardened shotgun sidelocks are the height of London elegance. Needless to say, any part that is to be temper blued should receive a brilliant polish for best effect and color.

Molten lead and other agents can be used to provide a uniform temper blue on parts, but the most convenient agent I have found is common potassium nitrate, which melts at approximately 640 degrees Fahrenheit. Winchester used this chemical for heat bluing in the 19th and early 20th Centuries; a description of its use, written out in a fine Spencerian hand, may be found in Madis' *The Winchester Book*, entitled "Oxidation of Steel and Iron by Nitre." The fellows at Winchester added a bit of peroxide of manganese (a tenth to a twentieth in weight of the amount of nitre used). I don't know what the purpose of the manganese was, and haven't tried it, but I suspect that it may lower the melting point of the potassium nitrate.

When nitre is melted, it's clear as water, and you can simply suspend the polished and degreased part in the stuff on wires, pulling it out when the desired color is reached. Boil the parts afterwards in water to remove the nitre, but take care not to allow even the smallest drop of water to fall into molten nitre, or you will be spattered and burned.

For melting the nitre, I use a smallish 1/8-inch sheet steel box long enough to accept a longrifle guard (about 11 inches) and about four inches wide. Six pounds of nitre is enough to do most work in this box, and I have a lid for the box for use while melting the chemical. It likes to "erupt" through the hard "shell" on top when the bottom has melted, so a lid is advisable.

Different alloys have different temper-color characteristics. Mild steel is the easiest to blue, and can almost be dropped in the tank and left there, while tool and spring steel must be watched closely and pulled out when they near the right color.

Caustic Blue

We come now to the use of that evil stuff which requires all manner of tanks, burners, and alchemic wizardry. . .hot caustic blue. I have no intention of going into this process; it's covered well enough in various books. What I'd like to discuss is the *preparation* of metal that will cause caustic blue to have much the same appearance, if not the durability, of rust blue. Several years ago some custom gunsmiths began experimenting with glass-beading on custom rifles. I don't know who first tried this, but I first saw it on one of Clayton Nelson's fine rifles. Thinking I was looking at a first-class rust-blue, I inquired about the formula, and Clayton just laughed and said that I was looking at a caustic blue over a glass-beaded surface.

Many of the caustic blues that are virtually black to the eye seem to magically become a "true blue" when applied to a beaded finish. I suspect the reason for this is that the minute surface pitting caused by the tiny glass beads shot against the metal at high pressure causes light rays to be reflected off the surface differently, causing the oxide to appear more blue than on a highly polished surface. This may well be the reason also why rust blue is "bluer," since a matte finish is present. In any event, the beaded finish is a timely solution to the gunsmith who wants to reduce finishing work to a minimum, yet produce a finish that has the right color, durability, and luster so desired. . .much in contrast to the space-age glitter of mirror polish, which to some of us is abominable. Beading reduces polishing time to almost zero, and it will remove old finishes and minor scratches.

Joe Balickie has been using this finish exclusively for several years, and I called him a while back for full details. Joe uses equipment at a firm near his shop, Potters Industries, Inc. (Southeast Division, Box 298, Apex, North Carolina 27502). Potters is a large firm specializing in industrial metal finishes, and they apparently were pioneers in the manufacture of glass beads. Joe tells me that Potters is willing to carry out bead blasting for gunsmiths at *very* reasonable rates; contact Frank L. Dray, Potters' regional sales manager, at the address above.

Very briefly, glass-beading provides an excellent surface finish for firearms due to the fact that spherical beads can be regulated through particle size and intensity of application to provide any finish from a bright satin to a deep matte. Other materials used for "blasted" surfaces, such as sand, have angular particles that impart a less-bright surface, even when particle size is small, and angular particles have a tendency to remove pieces of a surface, which beading does not. In other words, areas that have critical tolerances won't be hurt by beading. Further, the beads leave no imbedded particles in metal, and they may be recycled repeatedly. Bead particles range in size from 990,000 to the pound to 864,000,000 to the pound, and are fired on a surface through a compressor-fed "gun" just as sandblasting is done. The operation is carried out in a fully enclosed booth; Joe uses Potters' size AD beads for his work, which I suspect is a medium mesh size. Beads are aimed at the surface at an angle of 45-60 degrees for optimum results.

Since glass beading is fast and inexpensive, and since it makes the use of caustic blue the visual equal of slower, more traditional finishes, it seems to me an ideal production method for manufacturers as well. Certainly, the same effect could be obtained with a 5 percent etch of nitric or muriatic acid, but a great deal more trouble would have to be taken masking areas where this surface finish wouldn't be wanted. Also, acid removes surface, rather than peening it as glass beads do. Beads would be more easily controlled, especially on a critical surface, such as where engraving might be present. In any event, beading, along with the use of caustic blue, seems to be the only really satisfactory firearms finish where speed is a necessity, and it's one of the *few* instances where increased speed and lower cost don't result in a lesser finished product.

There you have it. . .a simplified discussion of six primary finishes useful to the custom gunsmith. With these, I see no real reason to seek other processes. None of these call for strange incantations or medieval witchery to make them work, and they all give a finished surface consistent with what should be considered appropriate on the very finest of guns, custom-made or otherwise. Some of these certainly involve a little more work, but that time spent is more than justified. As for myself, I'd very much like to see more gunsmiths and arms manufacturers making use of these tried finishes. . .and, if they did, perhaps those mirror-finish blues and white-line spacers would sink back into whatever Gehenna they lay in two decades ago, back when guns looked like *guns*.

John Bivins