Restoring Antique Firearms

ONE SUBJECT that I have avoided writing about, despite a number of inquiries, is the restoration of antique firearms. I have sidled away from the topic for several reasons, the foremost of which is that it is such a damnably complex subject that it takes all of the concentration of a skillful professional to do the work responsibly. In treating a subject that may deal with the care of arms that range from petronels of the sixteenth century to Parkers of the twentieth, one quickly realizes that even a very heavy tome on the subject could not possibly illuminate every aspect of the work.

I don't think that it would be an exaggeration to suggest that a firearms conservator — to be able to treat every material that firearms have been made from, and to understand all of the processes in the technology of the trade over the centuries — would have to develop something like two hundred fifty very specialized skills. Very few people on this earth confidently approach every aspect of firearms restoration, from replacing missing engraved ivory on a baroque wheellock to color-hardening the receiver of a Stevens 44. There *are* a few such renaissance men, in fact, but most of us should face the hard facts — and leave to the professionals any critical work that isn't familiar to us.

Fine firearms are not the place to experiment, for quality work is very much a document of its maker and its time, regardless of the century, and therefore deserves all the respect that

To illustrate some of the restoration techniques that he explains in this series of articles, John shows his own work on this much-abused rifle, made in the western Piedmont region of North Carolina by gunmaker John Eagle, who dated it January 14, 1836.

John Bivins

Restoring Antique Firearms

...continued

FOR CLASSROOM USE ONLY

IN THE FIRST part of this series (*Rifle* 88), I listed some of the ground rules of arms restoration and gave an account of taking apart a rather bedraggled Carolina rifle, leaving it in pieces at the end of that account. I brought together a history of the rifle's use, based upon the evidence that I found on the rifle alone — a very real demonstration of the fact that all objects of antiquity are documents that can speak to us quite readily if we but listen. This old fellow's vernacular, in fact, must include more than a few groans from its past treatment.

After removing the lock, barrel, guard, and set triggers, I began systematically dismantling all of the secondary elements — parts that had been added to the rifle after it was made. The rifle had suffered through four hard lives, and the evidence of each was intact. The barrel had been shortened — twice — at the breech, and a new tang had been added. After removing the barrel and giving it a light outside cleaning by scraping it with pieces of brass, I removed the drum — taking no special care with it, since it would be replaced.

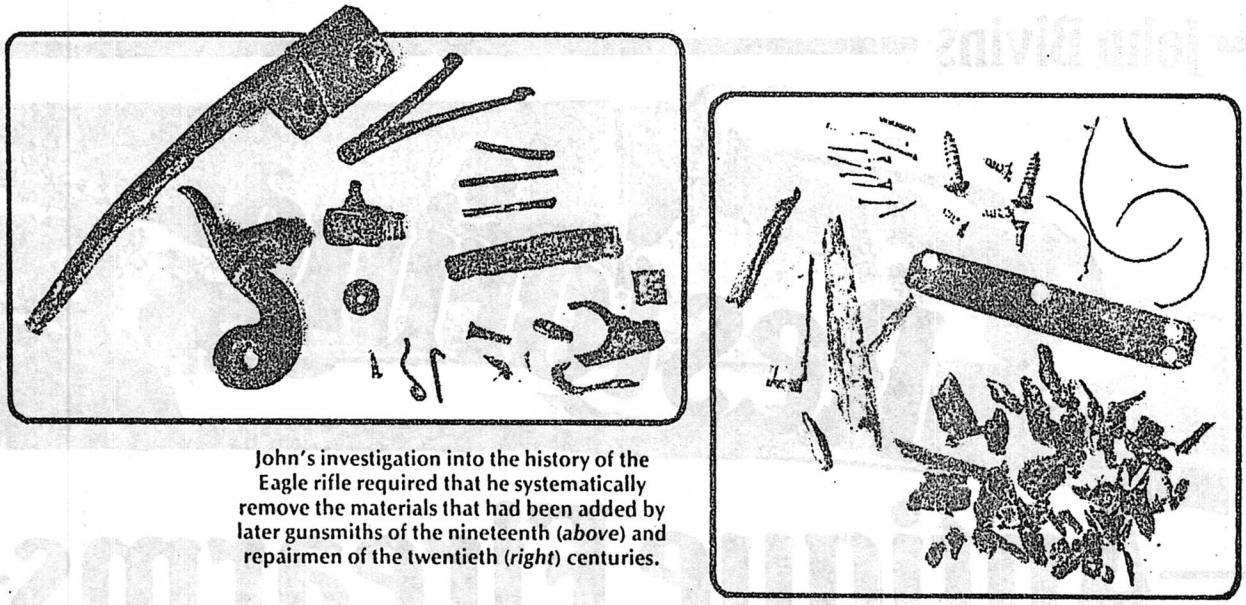
If a flint rifle is to be left in the percussion ignition that it has been converted to, or if the piece was originally percussion, there should be no attempt to remove its drum until the barrel has been stood on its tang and given a good dose of penetrating oil, down the muzzle and in the nipple if it isn't clogged. If the rifle is loaded, it will need quite a large dose of penetrating oil to soak through the load, to the drum, and I would count on a week of soaking. The drum should always be removed before the breech plug, since plugs were often notched, allowing the threaded shank of the drum to intrude somewhat — rather effectively locking the breech plug in place, though that wasn't the gunmaker's intent.

To remove a drum that is to be saved, I use a small pair of Vise Grips with the teeth blunted and the jaws ground with a bit of a hollow to fit around the drum. I wrap the drum in eighth-inch-thick sheet lead and clamp the Vise Grips on with the tips of the jaws just at the base of the nipple. You don't want to exert any force against the nipple — it would likely shear off — and don't lock the Vise Grips down so tight that they cut the sheet lead and skin the drum. I remove the nipple first, if it isn't frozen — but if any one part of a long rifle is likely to be stuck fast, it's the nipple. Prolonged soaking, with the drum off the rifle, usually loosens it.

If the drum refuses to turn, even after further soaking with penetrating oil, it can almost invariably be loosened with thermal shock — *heat,* that is. Again, *be sure that the piece isn't loaded!* A chap not far from here found-out by the hard way that a Civil War musket barrel that he was welding a tang tip onto had been stuffed with three loads, probably in the heat of battle. All three Minié balls slammed through the cab of his pick-up, since he had the thing lying on the tail gate.

Loosening heavily corroded threaded parts with heat sounds like something brutal, but it need not harm the part if it's done right. To loosen a drum, the breech of the barrel must be heated very rapidly, all around the drum, with a large tip on the oxyacetylene torch. Anything else would heat the mass too slowly, and if the surface temperature rises much above 385 degrees or so, that fine brown patina on the barrel begins to turn a hideous bright red. This isn't heat color but a chemical alteration of the oxides on the surface of the metal — and to remove it later, you'd just about have to go to bare metal.

Since this must be avoided at all costs, move in fast with the torch, play it rapidly around the breech for five to eight seconds, and move it away. The heat expands the mass of the barrel, loosening its grip on the shank of the drum and — at the same time — breaks-down the accumulated "varnish" left in the joint by oils that have deteriorated



John's investigation into the history of the Eagle rifle required that he systematically remove the materials that had been added by later gunsmiths of the nineteenth (*above*) and repairmen of the twentieth (*right*) centuries.

and oxidized. One such treatment is usually enough; but if it *still* doesn't move, I let the thing cool, dose it again with penetrating oil, and let it sit for another spell before I repeat the process.

Breech plugs that refuse to move can be treated in the same way. Don't be tempted to use much force in trying to loosen them, for it's all too possible to wring a plug off. Use a breech-plug wrench to fully grip the tapering faces of the lug behind the thread shank, with a strip of 0.040-inch-thick brass formed around the lug before you fit the wrench to it. If you have no wrench that fits properly, it's possible to clamp the lug in the jaws of a vise (lined with heavy sheet brass or — better — quarter-inch-thick sheet lead) and then to turn the barrel. Sheet brass 0.060 inch thick should be formed around the flats, with a heavy Crescent wrench used on the side flats from beneath the barrel, and someone must support the muzzle unless you have a telescoping rest to hold it up.

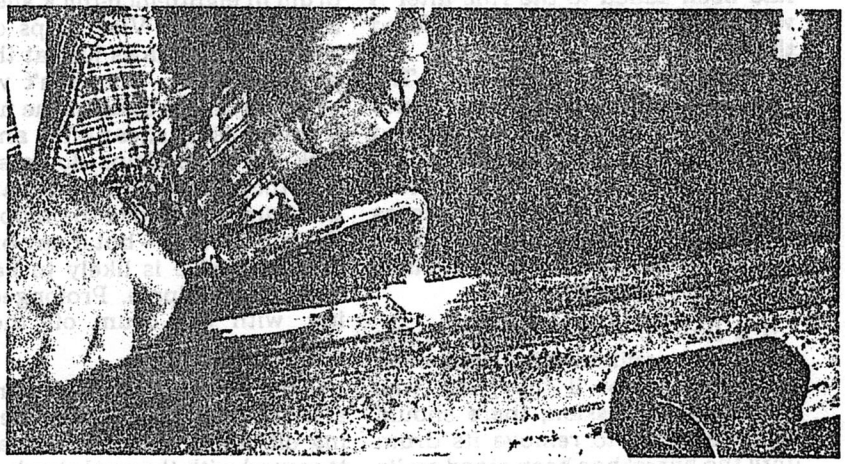
I *always* remove the breech plug and scour the bore out with 00 steel wool and CRC. Many old muzzleloaders have dirt-dauber nests, scrap paper, and all manner of other things that absorb moisture shoved down their bores — certainly not in the least contributing to the long-term conservation of the bores. For scouring, a bronze brush of an appropriate size, pinned to a hickory rod and then wrapped with steel wool, is quite effective.

On this particular rifle, I elected to simply remove the breech plug with a hacksaw — a rather ghastly method indeed. The breech had been heavily pitted by fulminate residue from percussion caps and would have required a good deal of surface welding to bring it back to its original dimensions. Since eight and three quarters inches of the breech was *already* missing, I opted to cut just enough away to get back to clean metal, since I planned to return the barrel to its original length.

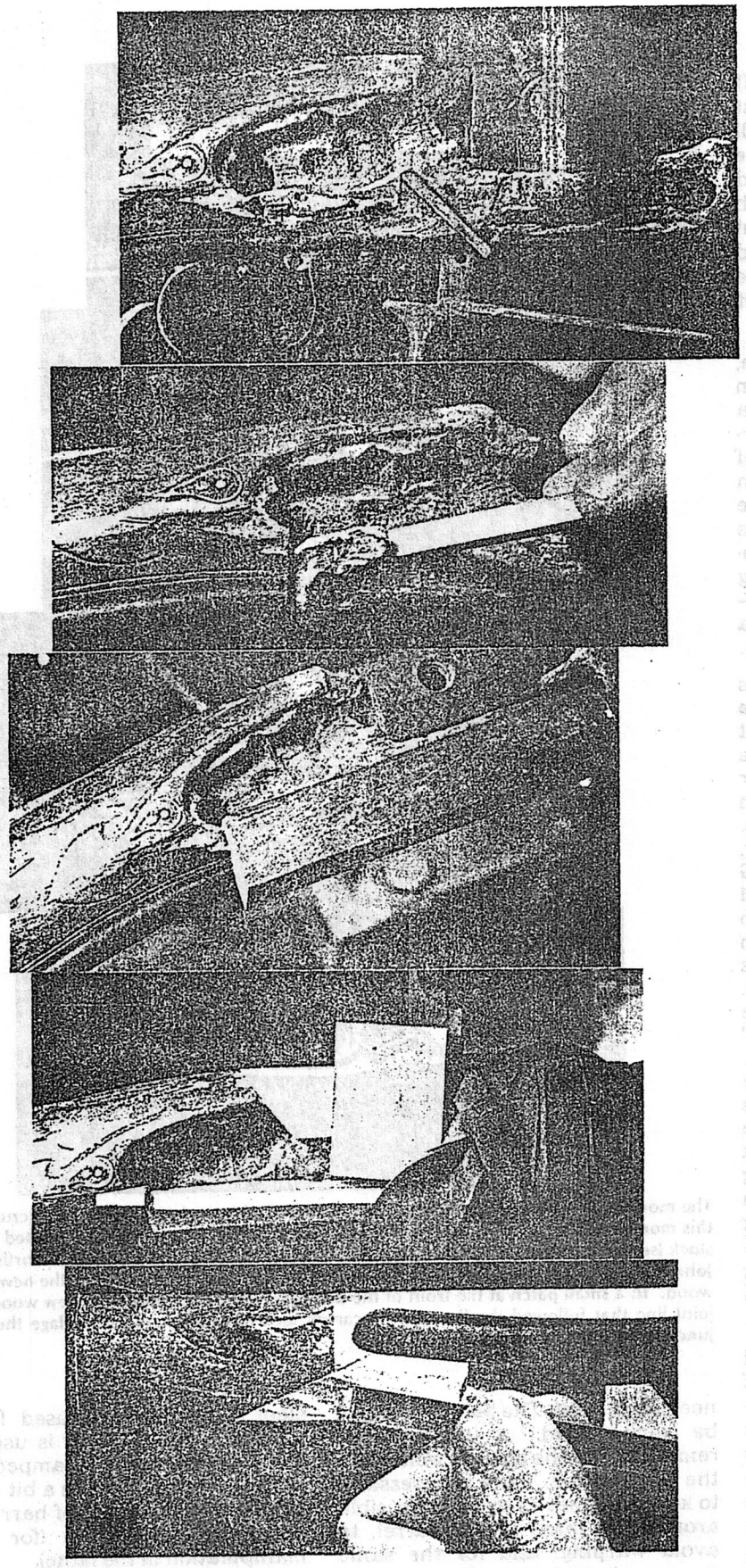
More on that anon — but I must say here that such a drastic measure quite obviously would *not* be used on a barrel that wasn't to be "stretched" back to length, nor should such a thing be done if the surfaces of the breech are in good condition.

So I plucked-off the offending breech, along with sundry other nineteenth-century impedimenta such as the blacksmith-wrought percussion hammer, the drum, the mainspring from a double-barrel shotgun, pieces of iron wire that had bound an old stock fracture, wooden pins that had helped to hold a longitudinal split together, a woodscrew that had been fitted to the rear of the worn-out lock mortise, a variety of scraps of leather shim, with their tiny wooden pegs, that had been used to reposition the lock in its crushed mortise, and a long strip of leather that had been placed under the barrel to take-up the gap left when the barrel was cut off (the original breech of the tapered barrel was almost three sixteenths of an inch larger).

The real garbage that had to be discarded was part of an early-twentieth-century "face job." The brass plate with its attendant collec-



Since the restored barrel would support the stock while John worked on its restoration, the twice-shortened barrel had to be brought back to its original length — with a section of another barrel carefully welded to the breech end, then dressed-down to final dimensions.



With all of the original parts and later cover-up materials removed from the stock with great care, extensive damage to the stock mortise (*top*) was all too evident. The repair of this damage began (*second*) with the painstaking removal of all unsalvageable wood and the inlaying of new wood (*middle*). A temporary filler block in the lock mortise kept the inlaid pieces of new wood from slipping while all was clamped together with wrappings of inner-tube rubber until the adhesive hardened. Then John trimmed the patches down with a quarter-round gouge (*bottom*).

tion of assorted woodscrews had casually hidden the facsimile of the Carlsbad Caverns that had once been the stock below the lock mortise. The copper wire and small army of wire sprigs had been added to hold the fractured wood together, though the sprigs had caused a number of additional splits. Several fragments of wood simply fell out of the stock when I took the gun down. A pile of dark stuff was part of the hard brown wax that someone had most cunningly applied to every interstice on the rifle.

I photographed all of this junk and then threw it out except for the scraps of wood, the hammer, the drum, the mainspring, and the breech.

I generally elect to undertake the worst part of a job first; if I can get that part past me, the rest seems ever so much easier. On the John Eagle rifle, the worst was the ungodly mess around the lock mortise. As I mentioned in part one, no such work should be done on the stock of a long rifle with the barrel out, since the stock is otherwise exceedingly fragile. To better support and strengthen the stock without straining anything, I felt that it would be better to lengthen the barrel first, so that the barrel inlet would be completely filled, allowing no possibility of twisting the buttstock slightly while I was working on it.

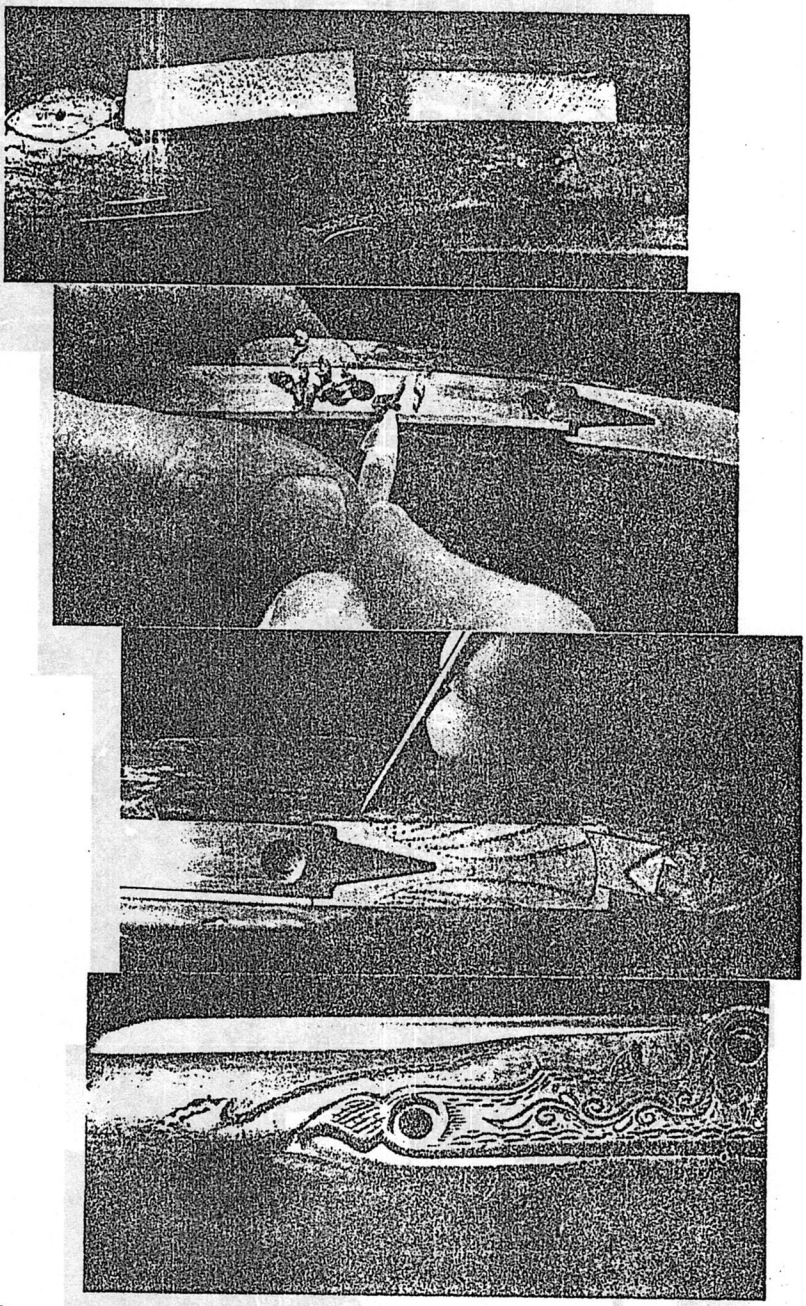
Many long rifles have been cut off, and there is a variety of pros and cons of returning them to their original lengths. It is not a simple or an inexpensive job, and it entails considerable realteration of a rifle — which should be considered very carefully, particularly if the piece is otherwise in fine condition and has been shortened but an inch or two. Radical shortening, as in the case of the Eagle rifle, frequently removed significant elements such as forestock inlays, thimbles, and the like, making the rifle ungainly in appearance. Even so, I would rather see a long rifle left as an awkward carbine than see an indifferent job of lengthening both barrel and wood; a poor job of "stretching" is irresponsible and ultimately far more costly in terms of the damage that it does to the rifle.

I determined the original length of the Eagle barrel very readily by matching-up the unused pin lugs and even empty lug dovetails with the original barrel-pin holes in the stock. To prepare a barrel for

stretching, I file the breech end off clean and bevel that face about three sixteenths of an inch all around to accept the weld. On the Eagle rifle, I simply cut the corroded breech off. For piecing-in such bobbed-off barrels, I have a closetful of odds and ends of old barrels, and with any luck, I can usually manage to find a piece of the right size to fit a cut-off breech or muzzle.

With the barrel of the Eagle rifle, however, I didn't manage such an easy solution and had to resort to a piece of new barrel. From measuring both the height and the width of the barrel inlet at the breech (with the lock in place), I knew that the original width of the breech was 0.960 inch, so I used a piece of one-inch barrel to replace the missing eight and three quarters inches — actually, after I'd cut a section off, a total of ten and three eighths inches.

While I try to find a bore that is as close as possible to the size of the original, I don't make any great attempt to match the original size exactly. Returning barrels to their original lengths, as far as I'm concerned, is a matter of cosmetics. By using a mandrel for centering, welding clear to the bore with a TIG welder, and then reboring and rerifling, it is entirely possible to have a stretched barrel that is both safe and accurate to shoot, if it's properly straightened and proofed. Many original barrels, in fact, were made in segments and then "jump" welded into a continuous barrel. Such welding methods certainly were no better — and likely not as good — as modern gas-envelope techniques are. However, I am not one who advocates shooting original long rifles. Most of them can not be used without expecting attrition in one form or another, so I do not restore barrels to shooting condition except in very special instances.



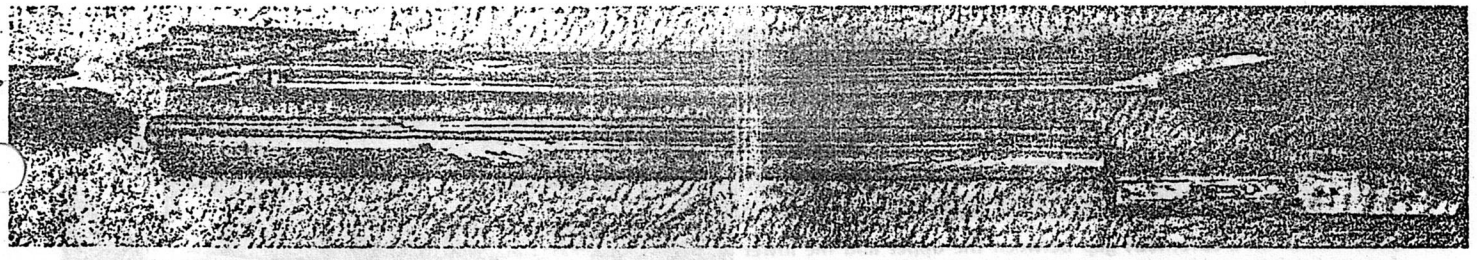
The mortise for the original tang had been enlarged with the later addition of a crude tang; this mortise had to be filled with wood (*top*) before the new tang could be inletted into the stock (*second*), with a shim set in place to fill the extra width of the enlarged mortise. Then John extended the veining pattern from the remaining original carving onto the newly inlaid wood. In a small patch at the front of the side plate (*bottom*), John fitted new wood with a joint line that followed the lines of the carved lock mouldings, to camouflage the line of juncture between new wood and old.

The piece of barrel can be welded in place by any of a variety of methods. I've done it with oxyacetylene, arc, and TIG, and I much prefer the TIG because of the quality of the weld and the localization of the heat — especially when some feature such as a signature is near a weld joint. On the Eagle rifle, fellow gunmaker and top metalsmith Mike Ehinger of Stedman, North Carolina, gas-welded the barrel flawlessly.

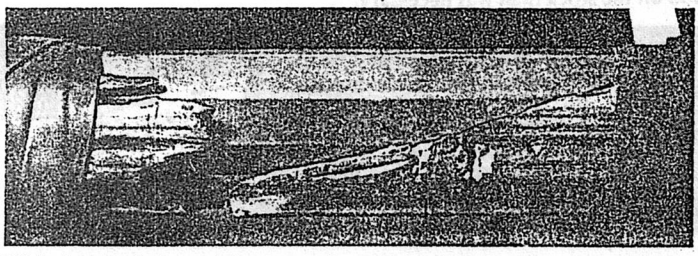
An easy way to mate-up the two parts is to clamp them in a piece of angle iron, shimming where they need alignment. The barrel can then be tack-welded in two places, removed from the jig, and welded all the way around. Care is necessary, to keep the heat as even as possible around the mass of the barrel, to avoid warping; and for the same reason, a hot joint should not be laid on a cool surface. If the barrel does warp, however, it's no great shakes to straighten a soft wrought-iron barrel, using a large C-clamp and a pair of steel blocks underneath.

Other things to be aware of: mild steel rod should be used for the welding, and if an arc is used, the ground should *not* be clamped to the barrel. Further, to save a bit of fuss, breech the new piece of barrel stub before welding it on (for easier manipulation in the lathe).

To provide enough metal to recreate the largest dimension of a tapering barrel, the new piece is usually larger than the original section at the joint. *Filing* a good bit of metal off — over three sixteenths of an inch in the case of the Eagle —



The ravages of time and crude "repairs" had shattered the upper forestock.



With the two halves of the upper forestock rejoined, John strapped it to the lengthened barrel in its correct position.

is about as amusing to me as gobbling cold chitterlings, so I availed myself of friend Dru Hedgecock's three-inch horizontal belt sander – finishing the job with files. With a new breech plug installed (with the correct shorter tang), I was ready to proceed. I placed the barrel in the inlet and wrapped it forward and aft with one-inch strips of inner-tube rubber. The fitting of the missing pin lugs would await restoration of the missing fore-end.

Beginning the woodwork on this rifle involved excising stock wood that couldn't be incorporated into a joint with new material. Joints are a matter all unto themselves. To be effective, and hidden from the eye, the joint between new wood and old must be tight. Butt joints are the easiest to fit, particularly on the compound curves of gunstocks, but they are also the easiest to detect. Rather than to risk an indifferent joint in a tricky place – such as under the lock of the Eagle – I use butt joints. If the figure of the wood or the degree of patination don't allow me to hide a butt joint perfectly, I break up the visible pattern of the joint by veneering over the completed joint with small, irregular – even zig-zag – pieces that fool the eye by robbing the joint of its linear appearance.

This is seldom necessary in an area that is heavily patinated, such as the missing area under the lock of the Eagle rifle. Consequently, I cut-away only enough unsound screw-hole-riddled wood at that point to permit a clean, square juncture for the new wood that is to be added.

Whenever I can, I use old wood for such repairs – not because it has some mystical quality of age or particular coloration but because really old wood tends to be "deader" than new wood and less inclined to move around later. For this patch, I used a piece of straight-grained maple cut from a scrap of mid-nineteenth-century bed post. It is critical that such patches have their grain structure aligned to precisely match that of the stock. To ensure that all of the new additions to this stock – which eventually amounted to some twenty-four new pieces in a variety of sizes – matched the grain flow of the wood, I spent a bit of time studying just how the blank for this stock had been sawn. The easiest way to determine the exact lay-out of the grain is to remove the butt plate and lightly clean its inlet – this is what I did with the Eagle rifle, making a sketch of the angle of the growth rings before I put the butt plate back on.

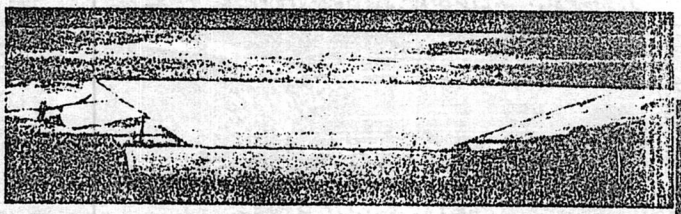
With the new piece tightly fitted in place – but not wedged, since brittle stock wood can not stand such stress – I was ready to attach the piece permanently. The adhesives that are to be used in all restoration and conservation deserve a good deal of thought. Because of the nature of handling stress on the stock, and often imperfect joints because of oil-contaminated wood, epoxy unfortunately is the only really effective adhesive for use in restoring firearms. I used the word *unfortunately* because of the fact that it is always considered desirable to make any restoration work *reversible,* for reasons that should be obvious.

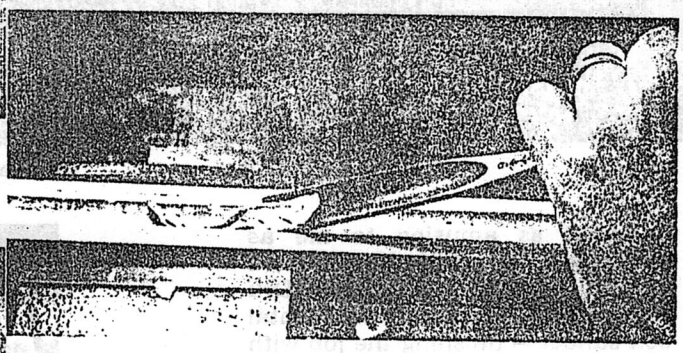
Many epoxies are indeed reversible – but only after prolonged soaking in chemicals that would certainly destroy the finish anywhere near a joint. Responsible cabinet makers use reversible adhesives such as hide glue, which is soluble in water, when they refit joints or replace elements on furniture. I haven't found an easily reversible adhesive that has the strength that gunstock joints need, but this doesn't mean that epoxy is a panacea. When we use it, we much be confident that we're attaching pieces of wood that we can live with later – if we discover that the new patch is incorrectly shaped or finished, it may have to be cut away.

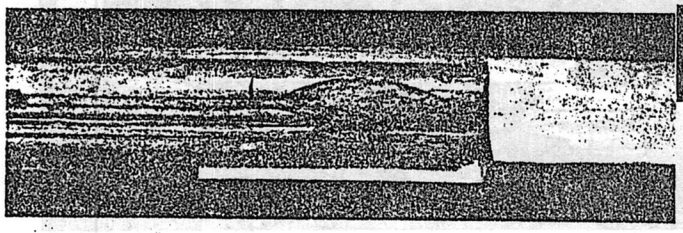
An alternative to removing epoxied joints, however, might be found in a product called *bond-cured epoxy dissolver* (Conservation Materials, Ltd; Box 2884; Sparks, Nevada 89431). This product requires soaking the joint. It might be considered a boon if one encounters a "redo" job that was *first* treated by some idiot whose idea of stock restoration was to fill entire voids with colored epoxy.

Consider, if you will, that a wood-stocked firearm – even one that is in perfect condition – is a very unnatural system. Nature didn't intend for us to attach unyielding metal alloys to organic materials that continually move with atmospheric changes. Stocks therefore split, inlays are rejected like cut-rate liver transplants, and curious gaps develop in embarrassing places. All that we can try to do is to minimize the natural distortion of such a system – not *add to it* with further material differentials that may cause even further damage. In short: keep the use of epoxy to a minimum in restoration work. Never give-in to the temptation to use it to fill large voids or as a bedding compound.

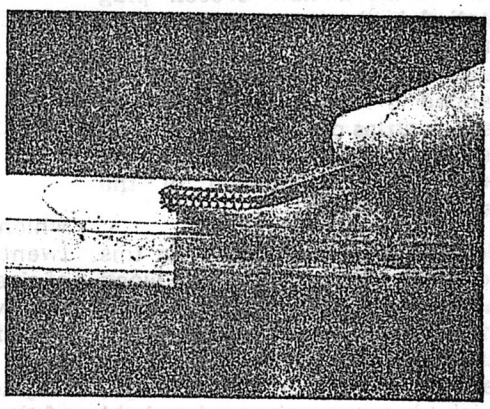
Before I glue such a joint, I often apply a coat of shellac to the original stock wood next to the joint, to prevent epoxy from adhering anywhere *except* the joint. Several coats of liquid floor wax are just as good, providing a better and less messy release agent than most of







John had to fill a cavernous gap between the upper and the lower forestock (*above*) and replace a missing ten-inch section (*right*) with new wood. Using a ship-lap joint (*below*) avoided cutting more old wood off the stock than was necessary.



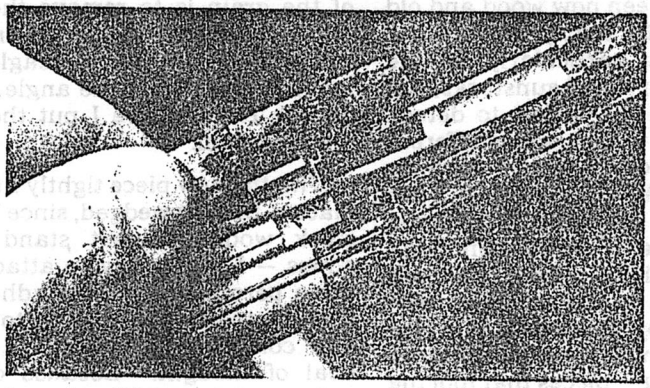
With the mass of the forestock restored, John's next step was to run the moulding on it.

the commercial films. I coat all surfaces of the joint, both new and old, with a thin coat of epoxy spread on with a palette knife. I use gel-type adhesives such as the Acraglas gel sold by Brownell's, since I don't want the stuff running out of the joint.

Don't be tempted to use a five-minute epoxy for anything other than a temporary joint; they haven't the strength of the twenty-four-hour epoxies. The epoxy that I use the most is a twenty-four-hour a-and-b epoxy manufactured by the Smooth-On Corporation of New Jersey; they call it *EA-40* and sell it in convenient tubes. I color it with Brownell's reddish-brown epoxy colorant as needed.

There are few places on a gun stock that allow the use of clamps, and I find that strips of inner-tube rubber hold most repairs in place while the adhesive sets and cures. I first wrap the entire area with waxed paper to prevent leaving great gouts of rubber on the stock when I remove the bands (somehow, "vulcanized curly maple" isn't appealing). Waxed paper is also useful inside inlets. When I add a missing piece of forestock, I simply wrap one thickness of it around the barrel, which is an even more effective means than floor wax for preventing unwanted adhesion.

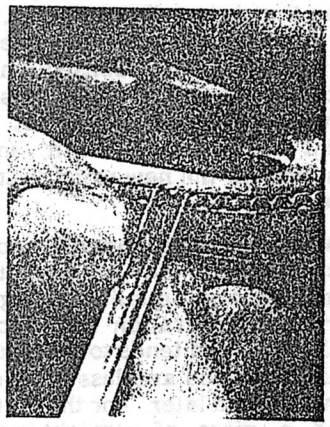
In shaping-down a new in-fill of wood, one must be exceedingly careful to pick up the contours of the stock correctly. I often do the rough shaping with a pattern maker's rasp, but it doesn't do at all to get near the original stock surfaces in any way. All of the final shaping-down is best done with edged tools. I most frequently use quarter-round gouges and finish the cuts with a carving knife.



Several small fragments of the original forestock wood could not be reused in their old locations, but some were usable — and useful — as inlaid patches in other locations on the stock.

The large patch under the lock of the Eagle rifle actually ran right in to the trigger inlet, which required that the triggers be taken-down and the plate reinlet before I could complete the final shaping. I don't shape new wood down to a metal part with anything other than light paring cuts of the knife, removing the metal for the final leveling of the surface.

No sanding should be done with metal that might be abraded left in place, and grit paper shouldn't be allowed to intrude onto the original



Where he had added new wood, John had to recut the lock mouldings. Here, he uses a ninety-degree parting tool to cut Eagle's unusual notched border.

(Continued on page 48)

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(Continued from page 31)

surfaces of the stock beyond just what little is required to feather the joint.

Most long rifles show — to one extent or another — a certain amount of wood damage and loss around the lock mortise. The worst place is just behind the breech, right behind the pan or drum; as I mentioned in the first part of this article, fungus rot caused this damage. In the old days, shooters depended more on oil than on assiduous cleaning with soapy water, as we do now, for preventing corrosion. After shooting, they wiped the rifle out with oil and tow, then often stood the rifle in a corner instead of hanging it up. Oil crept out of the vent or nipple and soaked the end grain of the stock wood next to the lock, encouraging the growth of mold and the eventual destruction of the wood fibers.

We all know the sickly white, crumbling wood that has been damaged in this way. In some cases, this "dry" rot may be trimmed slightly to produce a sound surface that will accept the adherence of a new piece of wood; but some times, the rot is so extensive that the wood must be consolidated before the restorer can add a patch. I have used water-thin marine epoxies that were designed to consolidate insect-infested or rotted wood, but I don't feel any too comfortable about adding such a mass of hard epoxy to a stock.

A better alternative is another product that Conservation Materials, Ltd sells, called *B-72* — an acryloid in pellets, which is dissolved in toluene. It can be reversed by soaking in the same chemical. Since it is more plastic than epoxy, it should not be allowed to build-up on the surface of a joint, where it would create a poor interface with the harder adhesive. Rather, it should be soaked into the wood — not left on it — so that the epoxy bonds well with the wood at the surface.

I didn't have to use a consolidant on the Eagle rifle; instead, I fitted a wedge-shaped piece of wood behind the breech and clamped it in place. I also added new wood above the nose of the lock. To prevent the new pieces from slipping while they were strapped in place, I cut a temporary filler block to fit between the new breech wood and the front pieces.

The lengthening of a tang provides us with one of the most difficult of repairs to hide, particularly since that area of the stock is usually a lighter color than the rest of the stock, because of wear. The tang of the Eagle rifle had been lengthened about an inch and a half, and the new tang was slightly wider than the old one had been. I established the original length from the pattern of the shell carving, the presence of an unused wood-screw hole, and comparison with another rifle that Eagle had made.

I filled the main portion of the secondary or later tang mortise with old wood, matching the grain structure carefully. This, incidentally, took two tries and a good four hours of fussing. I then reinletted the new tang into the stock and with a shim filled the gap left from the wider tang.

Fill-ins of wood can usually fool the eye and hide the joints better if the joint lines curve rather than running straight. I could have made such a joint with the tang mortise by cutting into the shell carving atop the wrist, following the curving veins of the shell. That would have destroyed some original evidence, however. It's preferable to have a new patch visible rather than to obliterate original "fabric," particularly on artistic elements such as carving. However, there are often opportunities to use the outlines of less-important carved features to hide a joint. For example, a patch was necessary at the front of the side plate on this rifle, and I made most of the joint correspond with the line of the lock moulding; the joint is nearly invisible.

I reestablished the punched-in veining of the shell carving on the new wood after the tang patches were shaped-down. Where heavy wear on a stock has obliterated carving, we should not be in the least tempted to recut the missing elements or to "improve" the remaining carving in any way. Some years ago, a customer became more than a little irate over the fact that I had replaced a missing section of stock just behind the lock and then recut the moulding lines just as they had been on the heavily damaged section. Those lines didn't match the opposite side of the stock, but that was the way that the gunmaker had cut them originally. It wasn't for me to correct his mistake, since the very fact that the old-timer had made such a booboo tells us something about how he worked.

The greatest damage to long rifles may often be found on the upper forestock, which is far and away the most fragile portion of the stock. Many stocks were broken in the past by simple removal of the barrel, while others broke or cracked because of poor inletting. If wood isn't supported against the oblique flats of the barrel, it is more than likely to split if the stock is inadvertently hit against a tree — which is bloody easy to do when one is ranging through the woods with a five-foot rifle.

Some stocks came apart because the gunmaker allowed no tolerance for shrinkage or expansion, failing to fit properly slotted lugs for pins or making pin or wedge mortises in the stock long enough to permit movement of the stock. I recently

repaired a silver-mounted flintlock rifle that had been broken through the forestock for that very reason, and the fracture likely occurred not many years after the rifle was made. To refit the separated parts of the forestock, I had to remove a full three thirty-seconds of an inch of wood from the forward ends of the lug mortises and a like amount from the slots in the wedge lugs. Now that should teach us a little something about stocking a new rifle.

The upper forestock of the Eagle rifle was an unholy mess — one of those things that you stare at in dismay, wondering whether to throw the whole thing out and add new wood full-length. Original fabric, though, is precious. I could have added a new forestock in probably half the time that it took me to repair what was left, but that would have been irresponsible indeed. Instead, I removed the wire and wooden pins from the stock and separated all of the pieces. I first cleaned them all with toluene to remove wax and other residues and then washed the old hide glue off all of the fracture joints with plain water. I laid the sorry mess out in its proper order and examined all of it to see what could be saved.

At the rear, one section about three inches long could not be used, since its multiple fractures had occurred so long ago that the joints were badly distorted and could not be refitted. Further, the piece looked like Swiss cheese by virtue of the wire that had been used to "sew" the joints together. What I was left with was a sixteen-inch section of forestock in two pieces; this section had four other smaller shattered remains at the muzzle end, one of which could not be replaced. I saved the unusable sections of forestock for a different application later.

After wrapping the barrel with waxed paper, I positioned the remaining forestock section on the barrel in its original position (determined by the pin holes), epoxied the joint, and wrapped the entire thing tightly with inner-tube rubber. After the joint had hardened and the excess epoxy had been removed, I added the three small pieces at the front and at the same time epoxied four longitudinal splits.

Epoxy can be worked into such cracks with 0.001-inch shim stock, or it can be simply blown in under low pressure from an air gun. To pull the joint tight, it's frequently necessary to lay strips of scrap wood along the upper edge of the forestock, at the side flat of the barrel, so that the rubber band pulls down firmly on the side of the stock when it's wrapped. The surface of the stock should be covered with waxed paper first, obviously.

With the remaining section of the forestock made again one piece, a sizable gap remained between that section and the lower fore-end. A good bit more wood was missing from one side of the stock than from the other — and not wanting to replace more than was necessary, I filled the void in three phases: first just below the upper line of the forestock moulding, then on each side of the stock. The lower piece oriented the stock correctly while I made the more difficult side patches, using angular scarf joints.

With the remnants of the original forestock once again pieced back to the lower forestock, over ten inches of upper forestock at the muzzle end remained to be replaced. To match the figure in the original wood, I was forced to spend some time pawing through a large box of remnants of stock blanks, which I save just for such purposes. The figure in this stock wasn't easy to match — it was weak and patchy, and its fiddleback angled slightly forward. I found a piece that matched both the figure and the tangential cut of the stock's grain pattern. After inletting the new piece, I installed it with a sort of a ship-lapped butt joint, both to reduce the cutting of the original wood and to allow a larger and stronger glue joint.

In this particular instance, the fact that the joint would not be contiguous all of the way around the stock would also help to hide the joint. If the joint had been straight across the stock, I would have made it a scarf joint to increase the area of the surface for the adhesive. Although I have used metal pins in such joints in the past, current conservation practice rules against them.

With the ramrod groove run to depth, I shaped the new wood down, then inletted the original nose cap — the nail holes in its sides filled with brass plugs held in place with low-flow silver solder — and riveted it in place with soft copper pins. I then ran the forestock moulding, using a "long jointer" single checkering tool first and then a double-line bordering tool. It's generally my practice to cut such a border as if I'm finishing a brand-new rifle, even though the remaining original mouldings are badly worn and battered. After I achieve the correct

Aside from typical use and abuse, the Eagle rifle had been subjected to both early and recent jackleg work: crude conversion to percussion and a very untidy sheet of brass to cover missing wood, for example.

we can give it. This means that we should learn to understand when it is best to leave something alone rather than to compromise any unique quality that it may have. If we do that, we will have robbed not only ourselves but also students of firearms for many generations to come.

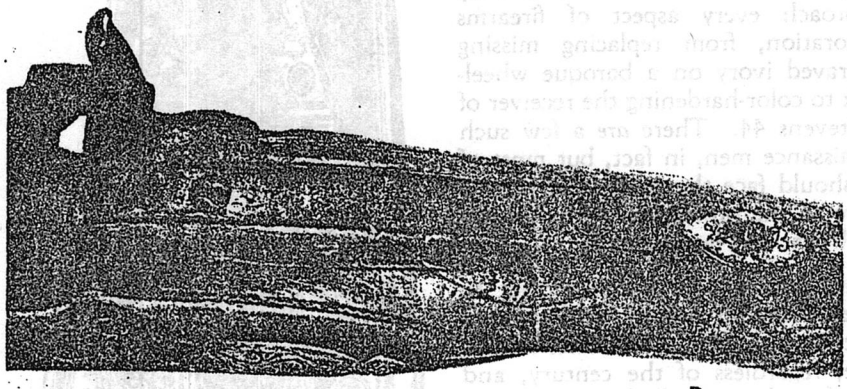
We often use the term *conservation* to mean *restoration*, but the two words are not always interchangeable. In its most current sense, *conservation* often signifies special treatment for stability. Conservation may also include the replacement of missing parts, but usually in a minor sense; the essence of that particular discipline is taken to mean the preservation of a firearm in the state that it was found in, with an eye to halting or removing harmful factors such as oxidation.

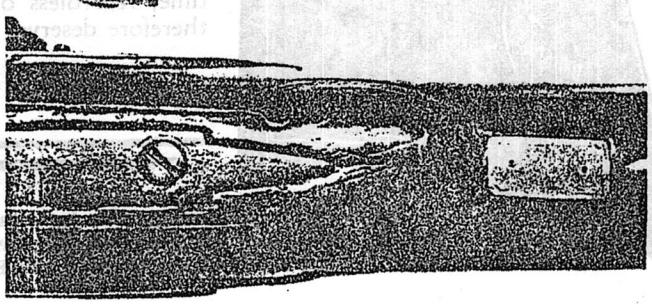
Restoration, however, may take an entirely different approach: it may involve the replacement of missing major parts and even returning every surface of the piece — the *fabric* of the thing, as museum people say — to its original gleaming state. *Responsible* restoration should engender a good deal of earnest soul searching in anyone doing the work. If an arms restorationist doesn't question himself at every turn, worrying about correct procedures and feeling halfway a fool, then sooner or later, he is as like as not to damage irrevocably a priceless statement of someone else's fine work. As Aesop said, familiarity breeds contempt. A certain humility is part and parcel of the competent restorationist's working manner — to put it just as bluntly.

While conservation is very much a part of restoration, that aspect of the trade is easier to understand — since it embraces, for the most part, a set of tried and proven procedures. So does a great deal of restoration work; but in many instances, even the experts are sharply divided over what might be considered the most responsible way to treat a good piece. Consider, for example, two very different types of antique arms, the British muzzle-loading sporting rifle and the American long rifle. When such rifles were new, there were very basic differences in the way that they were made and finished.

The British piece, whether it was from the hallowed alleys of Fleet Street or from one of the better shops in Birmingham, was a symphony of exquisite inletting, metal fit and finish, fine engraving, and superb finishes — including color case-hardening and fire blue. Most such rifles were returned to their makers periodically for them to refinish those delicate surfaces, and those surfaces were kept crisp.

On the other hand, American rifles were produced for the most part by small shops — often, by one man and his apprentice or journeyman. Both the demand for arms and the lack of specialization here before the nineteenth century prevented most American shops from attaining the level of finish in their work that was common in London. To be brutally frank, American rifles -- if we consider





After its barrel had been shortened not once but twice, Eagle's rifle was rebreeched, with a long tang cutting right through the carving (*above*), in stark contrast with its original appearance, which was probably like this other rifle (*right*) from the same gunmaking "school." Similar work helps to provide information on missing elements, but the restorationist usually must depend on the evidence that he finds only on the piece being restored.

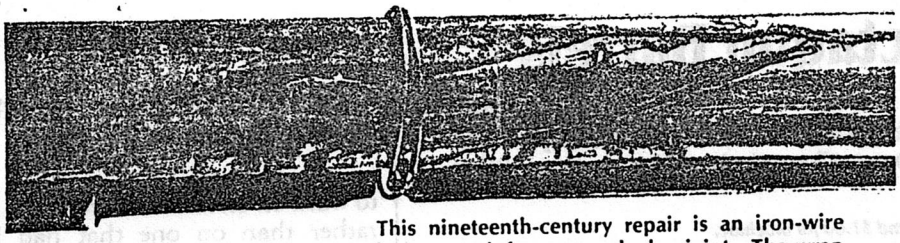
form of moulding, I *then* wear and batter the thing down — but that's a matter for the third part of this article.

Butt joints can be hidden readily by veneering over them with small, irregularly shaped pieces of wood. I did some of that on this stock, and that's where the shattered scraps of wood that I'd saved came into useful play. Matching both grains structure and figuration perfectly, they could be sawn into small plugs to cover joints or to add wood where it was missing, obviously matching the stock far better than wood from another source. When small patches must be made, or joints veneered over, and the wood is highly figured, it's often next to impossible to match the figure with a "foreign" piece of wood. I often make no attempt to do so, but instead use a perfectly plain piece as an in-fill, planning to grain it artificially to match later.

Upper fore-ends that have been badly shattered and then rebuilt often need more stiffening than the glue joints themselves can provide. To strengthen the stock without causing problems later, a stock liner that is compatible with the natural state of the stock can be added. After cleaning the entire barrel inlet with methanol, I saturate a piece of heavy all-linen drapery material with Franklin's hide glue (available from Woodcraft Supply; Woburn, Massachusetts) and fit it into the forestock full-length. The fabric should be cut to cover the three bottom flats of the barrel only, and it must be pierced ahead of time to clear the barrel lugs. I paint a full-strength coating of glue in the inlet first. The glue to saturate the linen should be thinned a little with water.

I set the fabric in place, wrap the barrel with waxed paper, and push it into the inlet. It's wise, of course, to try that fabric in the inlet *before* dousing the whole business with glue. If the barrel was nicely inletted originally, it may admit no more than the thickness of sheeting linen. In any event, this technique stiffens a pretty wretched forestock considerably yet is easily removable by "painting" the fabric with water. This is most assuredly *not* the place to use epoxy.

In the next installment, I'll treat the finishing and the "distressing" of all this new wood, at the same time taking a hard look at just what the early stock finishes were really like. I'll also go on to matters of metalwork and the curious aging of the metal.



This nineteenth-century repair is an iron-wire lacing to reinforce a weak glue joint. The wrap of copper wire and the loss of wood are signs of twentieth-century damage and repair.

them solely as gunmakers' art — were generally indifferently made. Lock mortises were often sloppy, with cavernous sear holes, and barrel inlets in the majority were cut round for most of the length of the stock, having been inletted to fit the octagon only at the breech and the muzzle. As much as I love those long and graceful pieces, I have a good deal more respect for our modern gunmakers who care more about quality work, even where it doesn't show.

To return to my wandering point, however, the antique long rifle as it has survived until today has quite a different appearance from that of its British cousin. It likely never had brilliant temper-blued steel furniture but rather mellow cast brass, and never received tender refurbishing at the hands of its maker. Rather, even though it likely saw a great deal more use than a British piece did, about the only maintenance that it got was the replacement of worn parts and perhaps alteration by conversion to percussion or even having its long barrel cut down to suit shifting styles or uses.

I am continually amazed at the overwhelming evidence of long and hard use on American muzzle-loaders, the wear showing not only just carrying scars and such but evidence of what must have been thousands of shots, in some instances. Some are quite literally worn-out, with locks as loose as a graveyard gate and silver inlays worn quite through. Americans were hard on their arms — and some still are, although the arms aren't getting any less expensive.

Obviously, one must look at the restoration of different types of arms from the viewpoint that best serves the piece at hand. If a fine London flintlock had spent two lifetimes on the American frontier, we would be prepared to accept all of the deep patination and generous surface damage that documented the history of that piece, just as we must with most American rifles. We would work to preserve the mellowness of age. If the same piece, however, had remained in England since the eighteenth century and had been cared-for in a fastidious manner, we might become concerned with matters of restoring missing areas of original finish or even removing light pitting from and otherwise gleaming case-hardened breech. In the latter instance, we might become more concerned with preserving or even restoring every aspect of its original appearance. With a used-up frontier fowler or even a well worn American long rifle, taking such a tack would be the ruination of the thing.

In this article and in the next two after it, I'd like to examine briefly the variety of techniques that are used in the course of one restoration job on an American rifle. My intent is not to try to make restorationists of any number of readers but to bring up some weighty matters that all of us must consider, whether we are thinking about having an early lock reconverted to flint or dreaming about having the brilliant case colors renewed on a prewar Purdey double. I'll touch on procedure and techniques of repair, replacement, and restoration of finish, on both wood and metal, including techniques for aging where aging is appropriate.

Obviously, if the subject truly demands a huge volume for anything approaching full coverage, I haven't the space here for more than an introduction to the restorationists' art. All the matters of intricate welding techniques, methods of working and decorating the many media encountered on firearms, and the like would fill a very large book — and even then, such a work would best be written by half a dozen experts rather than by one gunstocker who has happened to fix a number of old guns on the side over the years.

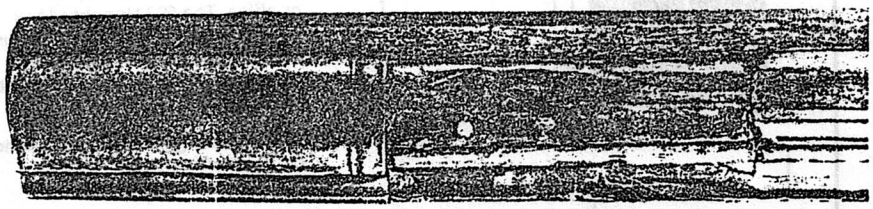
The firearm that is the subject of this treatise is a flintlock that happened to have been made about fifty miles from where I live, in Cabarrus County, North Carolina. Though it is loaded with competent — if a little florid — relief carving, good silver inlays, engraved brass furniture, and a long, handsome patch box, this poor rifle had seen about all the ravagement that it could stand and still have merit. And merit it indeed has, even to the extent of being a museum-grade piece, for carved Carolina rifles are quite rare.

None of the major art on the rifle had been damaged, and it is proudly signed on the box lid *made by J Eagle*. John Eagle made that rifle early in his career: a silver comb inlay bears the date of January 14, 1836, and John Eagle — son of gunsmith George Eagle — was born in 1813.

Old John wouldn't have liked to see this specimen of his work. After two major nineteenth-century alterations of something less than gunsmith quality, the thing must have been given to some kiddies to play Daniel Boone with. It had been in the same family since it was made, but it looked so bad that one member of the family came within an ace of giving it to a moving-van man as a tip for his work, since the fellow wanted something to hang over his mantel.

The saving grace of the piece was that it hadn't been "restored" by some well-meaning bloke working with a whizzing Dremel tool and a tube of Plastic Wood or epoxy. What had happened to the rifle was bad enough, but an arms restorationist would prefer

(Continued on page 42)



Since the barrel of the Eagle rifle had been shortened twice, there is no finish to the forestock molding, which runs abruptly to the cap — always a sign that a rifle has been shortened.

Restoring Antique Firearms

(Continued from page 29)

to work on an absolute wreck of a gun, rather than on one that had been spiffy until it was "improved" along the way by some sport who thought that it would be ever so nice to sand all the dark grime off and draw-file the barrel — or maybe by someone who *wanted* to do the right thing but had read the wrong book.

There is one book on the market — which I shall not name — that makes my teeth grind, for in one chapter, the poor sod who wrote the thing teaches us how to "restore" a pretty decent eighteenth-century French pocket pistol. A sizable piece of wood was missing from one side of the tang, which the fellow replaced — but he was concerned that the other side, which was still intact, was relief-carved. And the solution? Yes: cut the carving off so that the patched side would match. Needless to say, we should consider such things ghastly enough to nauseate a buzzard off a gut wagon.

A project like the Eagle rifle — or any other important conservation or restoration job — starts not with tools but with the eyes and the camera. The work at hand here is *evidence* — evidence of the techniques and skill of the gunmaker, evidence of how the piece appeared originally, and evidence of how it got into the state that we now see it in, which may represent some considerable alteration.

One piece of evidence, in fact, tells us something about the use of antique arms, especially American muzzle-loading rifles, and that evidence is in the fact that many of them are *still loaded*. After all, when a fox was in the hen house, a farmer didn't want to reach for an uncharged piece. And since black powder doesn't materially deteriorate unless it is contaminated by something, it is quite possible to set-off an old charge. I've done so, several times, *after* I'd pulled the load. Check the piece first, and if it is loaded, kill the charge with penetrating oil, with the idea of removing it later (and don't forget).

Responsible work on a historical arm calls for a thorough examination of the piece, inch by inch, and a detailed set of notes about the state of the firearm. After examination should come thorough photographic recording of its details. We must feel the heavy responsibility of documenting every-

thing that we do to a piece — and at the same time showing what we *haven't* done. Aside from full-length shots, shots of both sides of the butt stock and of its top and bottom, also necessary are shots of areas that obviously need work. Though I can't talk about photographic procedures here (that article should be done by our excellent editor, the Richard Avedon of the gun world), I will mention a couple of things briefly. Record photography should be shot on relatively slow black-and-white film such as Plus-X, with diffused floods or skylight rather than direct specular light, for better control of shadowing to record details. A thirty-five-millimeter camera is all right, but if you have access to a 2¼x2¼ or 2¼x2¾ camera, use that instead.

After the "before" photography, disassemble the piece and photograph its individual parts as needed. I also complete my preliminary notes as I disassemble the arm. During the course of restoration work, I don't necessarily photograph the work unless I'm using some procedure that would be difficult to describe in my final written report.

I also photograph the completed work. I file all of the notes, the final report, the negatives, and the prints in the customer's file, and provide prints if the customer wants to pay the expense. The written report is part of the job, and work for museums is routinely submitted with full photography for the museum's accession files.

If all of this sounds fussy, stop and think of all the implications of doing anything to alter the condition — bad or good — of an expensive arm. If you have your cap set for a Parker A-1 Special, have found both the gun *and* a wheelbarrow full of doubloons, you would want to know just what had been done to that fine thing before you dump your gold at the vendor's feet. Had the elaborate grip checkering been ruined, then later veneered-over and recut? You can bet your last bleeding buck that everything that we do to an old gun alters its value in some way, and not always to its betterment — especially if someone is suspicious about what was done and why. I've seen the reputations of some really fine antique guns destroyed in the market place by scuttlebutt from some individual who mistakenly thought that the piece had been faked in some way.

The cardinal rule of conservation and restoration on all objects of antiquity and art — be they by Rodin or Remington — is *Do no more to the piece than is necessary* to make it stable and presentable, considering the variables that I've already mentioned. Dismantling an American rifle is the first place where we begin to apply that rule. Absolutely nothing should be removed beyond what is necessary to preserve and repair the piece.

Pins were almost invariably made with a taper, and they are usually rusted fast, often because of the nitric acid used as a base stain. Wood screws were usually hand-cut — in fact, all of them were, before the early nineteenth century — and they may not want to retighten in the wood after being removed, because of rust, deteriorated wood, and a fast helix cut in the threads.

While metal parts do oxidize in places that you can't see, that fact isn't enough reason for me to even think of stripping-off ramrod thimbles, patch boxes, toe plates, and the like *unless* some repair of such elements is warranted. Original pins were often round-headed, the heads protruding slightly above the surface; a hollowed punch should be made for them, and they should be driven out toward their large ends. Screw slots were usually cut with a V, and they must be carefully cleaned-out — and screwdriver tips filed to fit them precisely.

Any such fasteners that have to be removed should be numbered and taped to a piece of cardboard, with the correct orientation of each pin duly noted so that they can be returned to their original location and orientation without exchange or damage.

Wood screws that are frozen in place with rust — a particular offender of this sort is the screw that holds the rear of a set-trigger plate — may be loosened by making a "screwdriver" of flat stock that fits the screw slot, perhaps four inches long. Holding the home-made bit with a pair of pliers, heat it above the tip with a torch until you have it just below a very dull red. Allow it to cool slightly and push it firmly into the slot, repeating the procedure several times. Don't ever be tempted to dose the screw with penetrating oil, for that should be used only on fasteners with metal-to-metal fit, and even then very sparingly. More is not better, for you don't want that junk on finishes and in the wood.

When you're working on an antique firearm that doesn't have screws that are either of steel or case-hardened, be aware that you can't cold-work wrought iron; this means that if you

use too much persuasion on a rusted screw, you'll wring it off. While a screwdriver bit hand-turned in a drill press is often effective on corroded modern screws, such force would often be too much for early fasteners. Rely on small amounts of penetrating oil. I like Blue Ribbon and buy it when I can find it, for it almost invariably loosens screws if they don't have blind threads that I can't reach — which you might encounter on the lock "side nails" or bolts on a European arm. If one of those is stuck, then you have A Problem. I have my methods, but I hesitate to put them in print lest the faint at heart think that I have all the sensitivity of Attila the Hun.

Guns that are heavily corroded on hidden surfaces are serious problems. Any side lock should be removed very gently by backing the side nails off half a turn at a time, tapping the screw heads very lightly with a small leather mallet. If the edges of the lock plate are badly rusted, though the lock still fits the mortise tightly, you can bet that small pieces of stock around the lock will fracture off as the lock begins to move. Watch the wood closely, and if that happens, remove the broken piece before it falls out, by touching a piece of drafting tape to it. Mark it for later replacement.

That is one situation where you are going to cause damage no matter how hard you may try to avoid it. The same thing is even more likely to happen around a trigger plate, especially a thick set-trigger housing. Trigger plates, incidentally, should be removed in the same manner that a lock is loosened, by tapping lightly on the tang screw. The plate will likely have to be tapped back down flush and restarted several times before the tail begins to lift; don't be tempted to just lever the thing out from the front to the back.

Removing the barrel of a long rifle — even a new one — is a potentially dangerous chore, since the wall of the fore-end of such a rifle is so thin and fragile, especially on an antique rifle stocked in maple. With the tang screws and the pins or wedges pulled, and the lock out, turn the rifle up-side-down with the sights resting on the top of the bench. With a helper steadying the rifle by holding the fore-end, start the stock off the barrel, beginning with the breech, by lightly slapping upward on the top of the wrist.

A really tight or corroded barrel requires some gentle persuasion beyond that. Lifting up on the comb, I tap on the lower forestock with a well padded mallet, and as the barrel begins to move out, I continue tapping all the way down the forestock as necessary to loosen the stock. Lift the comb no more than is necessary to avoid stressing the stock, and proceed slowly with judicious love pats, and the stock usually lifts right off the barrel. Don't even think of standing a full-stock rifle on its butt and yanking away at the nose cap to pull the stock, even on a new rifle, unless you plan to have a two-piece fore-end and don't care where the joint will be.

About the only strength that a long rifle has lies in the support that the barrel gives the stock. Avoid doing any work on the stock with the barrel out, if you can. By no means attempt to remove other parts such as guards or triggers after you have pulled the barrel. After I have removed a barrel and then want it back in the inlet to be able to hold the rifle in the vise, I use two rubber bands cut from inner tube, one at the breech and the other at the muzzle, for temporarily holding the barrel in place. Repeated removals and replacements of pins or wedges lead to trouble — though if you're working with a stock that is fitted with slotted wedges held in place with keeper pins, you'll just have to use the wedges.

Since iron parts such as barrels and trigger plates must be returned to their inlets for work on the stock to be safe, I clean these parts before proceeding with other work; this is especially important if corrosion has built-up on hidden surfaces, for a rough metal surface is hard on brittle inlet edges. Small parts such as locks and the like can be soaked in one of the thin preservatives such as CRC for excellent long-term protection as well as penetrating and loosening rust, though most of the volatile water-displacing oils like CRC are designed to evaporate.

For that reason, I use penetrating oil on barrel surfaces, inside and outside, and apply it several times over three or four days. Use kerosene, if you like, but I like the smell of the stuff about as well as an east wind from a landfill. After such soaking, scrape loose, heavy corrosion off with pieces of heavy sheet brass, say 0.062 inch thick. I cut strips half an inch wide or so and three inches long, and as the edges dull, I toss them in the scrap box and cut more. Sharp-edged brass doesn't hurt patination and finish.

While wrought iron is relatively stable after it has oxidized, unlike carbon steel, leaving heavy patches of

corrosion is not good conservation practice — especially if they're under a barrel, where they're not likely to be treated periodically. Where there are such heavy deposits in unseen places, I remove all of the rust. Such cancerous growths often resist scraping with brass, even after repeated scraping and redosing with oil, and — though it's a harsh measure — I take to a phosphoric-acid colloid for removing the junk. Sold in hardware stores as *naval jelly*, such colloids are relatively mild and require repeated application for complete removal of heavy rust. They etch the surface slightly but not to the point of masking original tool cuts and the like.

The side flats of octagonal barrels may also require this treatment because of moisture entrapped in the barrel inlet, but removing corrosion from those places requires refinishing of the side flats. When surface corrosion is heavy, I prefer to do that and be satisfied that the metal is stabilized for many generations to come. Iron or steel treated with phosphoric acid should be neutralized with strong household ammonia, and I'll cover further treatment for long-term preservation later. By all means avoid using this treatment on any visible surface if you can remove heavy encrustations of rust by mechanical means; a very large part of the value of an antique arm lies in the quality of its patination or remaining original finish.

With the Eagle rifle taken down as far as necessary, which included removal of the lock, set triggers, side plate, trigger guard, barrel, and the remains of the shattered fore-end, I catalogued the condition of the rifle. Typically, it showed evidence of four distinct stages in its life.

First, there were good traces of the original finish, including a deep reddish-brown spirit varnish and patches of plum-colored browning on the barrel where wear and corrosion hadn't taken their toll. Second, the rifle showed normal attrition for an American rifle — heavy use. Relief carving at the wrist, tang, and lower ramrod pipe was heavily worn, and the lower part of the forestock was worn to the point of leaving a large coin-silver inlay standing well above the wood and the forward edges of the inlay ground down to a ragged razor edge. That sort of wear *behind* the balance point of the rifle tells us that the rifle was carried for many hundreds of miles across a saddle.

Further, the rifle showed loss of wood forward and behind the lock, brought about by what is often called "dry rot" but is really a destructive fungus that fed hungrily on the animal oils that past owners had slopped liberally down the bore — and allowed to run out the vent and soak into the wood. The fungus broke-down the structure of the wood, and it crumbled away, leaving the usual sickly white, dead look.

The third stage of the rifle's life included normal alteration, clumsy reworking, and careless use that probably occurred after 1850. The rifle was shortened twice, both times at the breech — a usual thing, caused by corrosion. The first time the rifle was shortened, a gunmaker did the job. He carefully remortised barrel-pin lugs in new positions in the stock and care-

fully centered pin holes. He removed the upper ramrod pipe and set the nose cap back, holding it in place with rivets from the sides rather than from the bottom, as it had originally been held — these bits of evidence telling us that another gunstocker had likely done the job, not Eagle himself. Two upper forestock inlays were lost during the first cutting, which amounted to exactly four and an eighth inches.

For the second shortening, the owner took the rifle to a real backwoods bumbler, perhaps a blacksmith of indifferent skill who fancied himself an armorer. This time, four and five eighths inches was lopped-off, for a grand total of eight and three quarters inches of shortening. The barrel evidently needed a new breech plug then, so this smith beat-out a crude item with the tang an inch and a half longer than the original, meaning that it had to be inlet right through the nice shell carving that Eagle had used in that location. Judging from the quality of the work, the same man "percussed" the rifle at the same time, cutting-off the waterproof pan of the lock to clear a drum.

He did a fairly competent job of beating-out a percussion hammer, but as in the case of the tang, he didn't grace any of its surfaces with file work to finish it. He again moved the nose cap back, and this time, he nailed on through the side rivet holes. He also moved the third ramrod pipe back slightly. Rather than removing the original rear sight and repositioning it forward to compensate for the shortening, he filed it down and installed a crude new sight on the barrel. The muzzle still remained untouched.

By this time — probably after the Civil War — the rifle likely had wound-up in the hands of family youngsters who wanted to hunt squirrels, and things went from bad to worse. Years of overtightening the lock bolts had compressed stock wood to the point that a leather gasket had to be cut and pinned inside the lock mortise, and a wood screw added under the tail of the lock prevented the plate from wallowing around in the worn mortise. The lock was so worn-out by this time that a blacksmith-made sear was made, the half-cock safety was cut off the tumbler, and a copper shim was placed in the tumbler hole to take-up enormous play in the tumbler.

Inlays were beginning to loosen by this time, so new holes were punched through three of them, and small brass sprigs were cut to hold them down. The upper fore-end split diagonally forward of the ramrod entry pipe, and the joint was drawn together by drilling the stock and lacing it up with heavy iron wire. At about the same time or slightly after, the upper fore-end split full-length in the ramrod groove, then the lower forestock cracked for about five inches into the ramrod hole. A generous amount of hide glue was dumped into the joints, and transverse wooden pins were driven through the stock in four places to hold the thing together.

Virtually all of the original varnish finish was worn off the stock by then, except in places where wear normally doesn't occur. Another forestock inlay had fallen off, and a small tear-drop inlay forward of the lock mortise, too. Four silver inlays were now gone, and three others had been defaced with new nails. The two remaining upper thimbles were lost.

By that time, perhaps at the end of the last century, poor Eagle's good work had seen so much use and trauma that it was no longer a working rifle, and no doubt the kids had been given breech-loaders by then, anyway. But grandpa's rifle was put away, not thrown out. Thirty or forty years later, someone found it in the attic, or wherever it lay in exile, and it entered its fourth stage of existence.

Wood under the lock had been broken, probably because the original mainspring had worn-out and slipped off its stirrup. The broken wood was torn out and a thin brass plate screwed on to cover the hole. More wood had fallen out of the old forestock break, so copper wire was wrapped around the stock to hold the mess in place. Things were pretty crudded-up by now, so someone undertook some light sanding so that "the wood could show." The light sanding was done with hundred-grit paper, right over the metal as well. Fortunately, very little of the butt stock was given such loving treatment. The brass was all shined-up, and the entire rifle was liberally varnished-over with a yellowish synthetic-resin varnish, either an alkyd or a phenolic.

To plug all of the numerous holes in the wood and the gaps in the inletting around the loosened lock and barrel breech, a hard, dark wax was liberally poured on and wiped into the crevices. Then it was ready for hanging over the fireplace, and it probably looked very cozy and Early American unless you got within twenty feet of it. So ended the rifle's fourth phase; in the next two installments, I'll describe a fifth phase

— which I hope resembles a second life for this old rifle.

All of this is a very pointed illustration of how any object of material culture provides us with a documentation of how people lived and particularly how they used the objects that surrounded them. In a way, it's this sort of detective work that is the most interesting part of restoring some antiquity. The evidence is all there; we must make ourselves seek it out. I'm sure that I spent a good four hours or so studying this particular rifle before I picked-up anything other than a screwdriver or pin punch.

As a gunmaker, I never tire of studying the evidence of early technology: tool cuts, methods of fabrication, and the like. I particularly like finding mistakes. In the process of determining just how much barrel had been cut from the Eagle rifle, which involved matching-up empty pin-lug dovetails on the barrel with empty pin holes in the stock, I discovered that the old boy had made an error when he pinned the barrel. He had put the top lug too close to the muzzle, not leaving enough room for the long nose cap, so he had to remove the lug, fill the dovetail, and position another farther back. When he installed the cap, he drilled through it with small spade bits for the rivet holes, and the bits left tiny marks on the barrel when they broke through the wood — one of them smack over the blanked-off lug dovetail. That one almost fooled me into believing that the muzzle had been cut back as well, but measurement of the thimble locations showed otherwise.

Such clues are important if we are to do an accurate job, and we must be able to discern just how and when something was done to the piece in its past. Knowing that there was no such thing as pointed wood screws much before 1850, and that wire nails came in after the Civil War, and such academics as the fact that wire nails of that period were slightly oval in section, are the sort of tidbits that we need, to piece a record together. And photography proves that we found such evidence, which some arms student three centuries from now will appreciate.

In the next *Rifle*, I'll move on from matters of philosophy and examination to the repair of wood and metal — and in the final installment, I'll relate some techniques for repairing finishes, artificially aging both wood and metal, as well as taking a look at historical stock finishes and the proper application of long-term preservatives.