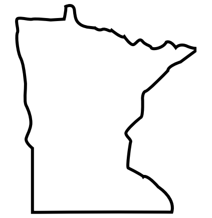
MINNESOTA HISTORICAL SOCIETY

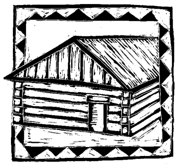
# TECH TALK
## This issue: Firearms • Part I



## Curatorial Care of Firearms
### by Paul Storch

The aim of this article is to supply background definitions and information needed for intelligent handling and choices of treatment for firearms collections. Part II, to appear in a future issue, will discuss actual disassembly and treatment.

Antique and modern firearms should be thought of as complex, *composite* mechanical objects that require specific care and handling. *Composite* means that various raw and manufactured materials used as components are in close proximity to one another, and may even touch. In the case of firearms, a typical flintlock consists of wood, steel, brass, flint, leather, silver and other metals. In earlier firearms, the wooden stocks were often inlaid with elaborate patterns of ivory and bone. Each of these materials responds differently to environmental stresses and each can affect the stability of adjacent surfaces.



### *Terms and Concepts*

*Restoration.* Collectors, restorers and gunsmiths commonly perform *restoration*—the process of bringing back the original form and appearance of an object. Firearms can be restored by refinishing parts, replacing broken or missing components, and mending broken pieces so as to conceal the break completely. Sometimes a restorer ignores the fact that every aspect of the object contains ethno-historic information, and in general, restorers do not concern themselves either with the proper storage and handling of the object, or with control of the exhibition or storage environment.

*Conservation,* on the other hand, consists of a series of procedures by which objects are stabilized to prevent continued deterioration. Stabilization includes controlling the environment in which the object is stored and displayed, removing harmful dirt and corrosion, and coating surfaces to exclude harmful oxygen and moisture. Mending and reconstruction of broken and missing parts may be done by conservators, but only when necessary to stabilize the object, and when approved by curatorial decision. Conservation proceeds logically: problems posed by the composite nature of the firearm are analyzed, then proposed solutions are tested, and finally, a series of treatment steps for each object is devised.

**Editor's note:**
TECH TALK is a bimonthly column offering technical assistance on management, preservation and conservation matters that affect historical societies and museums of all sizes and interests. Comments and suggestions for future topics are welcome.

Materials and treatments used in conservation must meet these requirements:

1) *Retreatability/reversibility.* Treatments must be reversible, as far as practically possible, so that what has been done may be undone as better techniques and materials become available.

2) *Compatibility.* Materials and treatments must be chemically and physically compatible with the original object.

3) *Stability.* The chemicals used in treatment must not give off harmful substances or reaction products.

*Working order* pertains to the action mechanism of the firearm, e.g., flintlock, percussion, firing pin, etc. If all of the springs, levers and other components of the firing mechanism are able to perform their functions, then the firearm is in working order. If a firearm is not in working order, it is a curatorial decision whether to restore it to that condition or not.

*Firing order,* however, is quite another matter, one far removed from museum requirements. Test firing of a firearm is strongly discouraged, for it is dangerous to both the object and the person attempting it. Metal parts can become fatigued over the years due to stresses during use and conditions of storage, and can possibly rupture when fired. Current professional museum and conservation ethics hold that original collections objects should never be used for living history and military reenactments. Several companies make and sell accurate replicas of historic firearms for these uses.

*Patina* also requires a precise and consistent definition in this context. At the last stage of manufacture, an artificial corrosion layer called *bluing* or *browning* is chemically induced on the finished surfaces of the steel components. These intentional coloration and protection treatments will be referred to as *patination* and *patinas.*

*Tarnish.* Over the years, powder residue and oils from handling may darken the original coating. These types of alterations are referred to as tarnish, and are fairly easily removed, especially on case-hardened steel parts, silver and brass. Some weapons, such as military percussion muskets of U.S. manufacture, were never patinated, but may appear to be so due to a uniformly colored corrosion layer over the exposed surfaces of the barrel and other stock furniture.

*Brass.* Active, disfiguring corrosion products should be distinguished from the intended oxidation of patination. Brass parts, although not patinated originally, may develop a thin layer of corrosion



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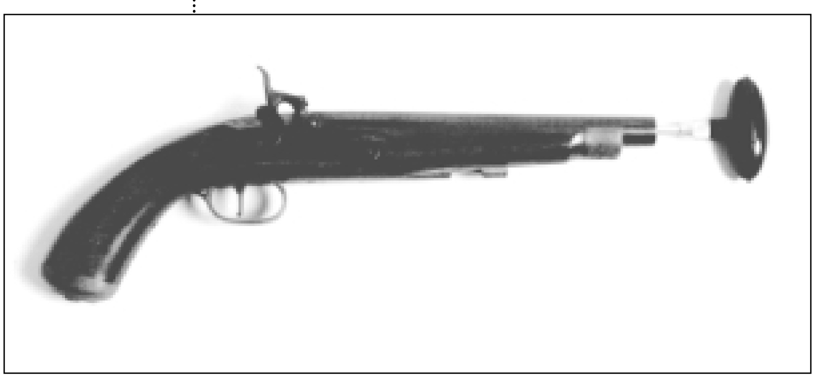
products that darken the bright brass color. In brass patch boxes, grease may combine with the copper in the brass to form blue-green copper and fatty acid salts, which are waxy and may stain the surrounding wood surfaces. Unless the brass is deteriorating from active corrosion products, it is suggested that it not be cleaned down to bright metal.

*Organic materials.* Wood and other organic components are affected by a variety of factors that speed their deterioration. Metal corrosion products, insects, fungi, low and high humidity, and ultraviolet light can all contribute to the breakdown of organic materials.

***Recommendations for Handling***

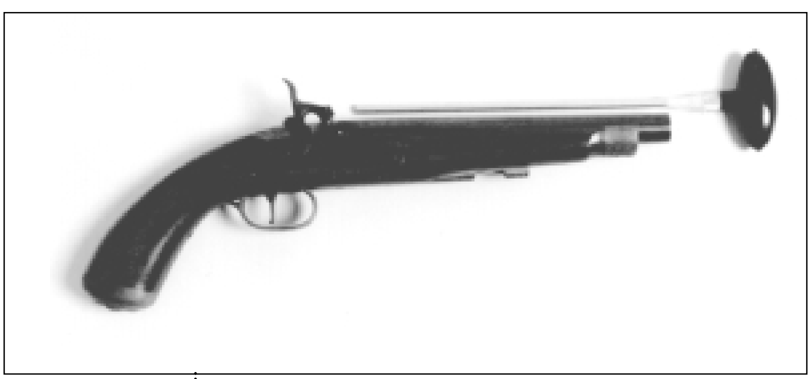
*Load-Checking Procedure*. When a firearm is received by a museum, it must be checked immediately to ascertain that is not loaded.

The load-checking procedure for muzzle-loading long arms is illustrated in figures 1 and 2. First, a cleaning rod without a brush is inserted down the barrel of the padded and clamped object as far as it will go towards the breech. The rod is then marked at the end of the muzzle with a piece of tape (fig. 1).



*MHS file photo; photograph by Paul Storch*

*Above: Fig. 1, with the rod inserted. Below: Fig. 2, the rod is removed and marked.*



*MHS file photo; photograph by Paul Storch*

Remove the rod and align it with the muzzle (fig. 2). If the distance from the end of the rod to the touch hole (in flintlock firing mechanisms) or nipple base (in percussion-cap firing mechanisms) is one-and-a-half inches or more, there is probably an obstruction in the barrel, most likely a projectile and powder. In an unloaded weapon, the rod should stop within 1/4" of the touch hole or nipple base, and within 1/2" of the nipple base on a "patent" type breech (i.e., "hook" type).

NOTE: Black powder retains its explosive capabilities over time, so *it is very dangerous to attempt to remove a load.* If there is a high probability that an obstruction near the breech is indeed a load, *do not handle or further treat the firearm.* Tag it properly, store it separately from the other objects, and consult a gunsmith experienced in handling black powder weapons. *Unloading requires special tools and experience and should only be undertaken after proper training.*

*Systematic Survey*. The first step in a preventive conservation program is to do a systematic condition survey of all the objects. The overall condition of each firearm should be assessed and recorded, along with catalogue information and other file data. (One way to do this is to devise a condition survey form specifically for the firearms collection, using a proprietary database on a laptop computer.)

Observe the exterior metal portions of the object. A pitted surface accompanied by light red-to-orange rust on the iron parts indicates active corrosion and probable loss of original patina. Light rust around the margins of the lock plate where it is set into the stock ("lock mortise") usually indicates active rusting of the iron parts inside. Check the interior of the patch box for brass corrosion. There will usually be some amount of a blue-green product that has formed with the residue of patch grease. To determine the condition of the barrel and pistol cartridge chambers, insert a cotton swab into the openings. If the cotton removes a greasy, reddish residue, then there is still some (but only some) protection afforded by a previous application of rust inhibiting grease. If the cotton comes out with particles that are dry and gritty, it can be assumed that the barrel interior is extremely corroded and requires treatment.

Check the stock for cracks, loose pieces and previously repaired areas. The unfinished wood in the patchbox area can give a good indication of the condition of the wood on the other interior surfaces. Extremely dry wood will be structurally weak. Firearms kept in humid conditions may have been subject to the growth of fungus on both the exterior and interior surfaces, especially in the lock mortise area.

Table 1 (p. 5) gives an example of a condition-rating scheme. Also consult the *Gun Collector's Handbook* (National Rifle Association, 1959) for an example of condition standards for antique firearms. This scheme can be used as a rough guide in designing a collection survey and proposal for a treatment project. Categories can be added to or

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changed to fit the needs of a particular collection but should be applied uniformly throughout the collection.

*Carrying long arms.* When carrying long arms, support the object firmly with both hands and keep it in front of the body. Never point the barrel at another person or yourself, even when it is unloaded. When placing a match-lock, wheel-lock, flintlock or percussion-lock arm on a flat surface, lay it down on the side opposite the lock mechanism. For weapons with locks on each side of the barrel, have a piece of polyethylene foam or other padding large enough to support the object under the forestock so the underside of the butt is resting on the table.

*TABLE 1. Suggestions for Conditions Ratings used to Survey Objects*

| *Rating* | *Condition* | *Priority/Treatment Recommendation* |
|---|---|---|
| 1. | Stable, no observed corrosion, breakage or structural problems | Low priority; surface cleaning only |
| 2. | Stable, some previous corrosion observed, possible active corrosion | Low priority;surface cleaning; check on regular basis |
| 3. | Stable, with active corrosion in several areas; wood fair to good | Medium priority; surface cleaning required; treat corroded areas |
| 4. | Unstable; active corrosion observed; structure unstable; loose/broken parts. | High priority; stabilization treat-ment required; restoration may be part of overall treatment |

## *Storage and Exhibition Environment*

*Temperature and humidity.* The environment in which collection objects are stored and exhibited is the most critical factor in stabilizing existing conditions and slowing down deterioration. Daily fluctuations in *temperature* and *humidity* must be kept within controllable limits. The key point is to avoid extremes of either temperature or humidity, and to minimize the daily fluctuations to within +/- 5 percent relative humidity (RH) and +/- 2$^{O}$F, while allowing realistically for seasonal shifts.

In a small museum in the Upper Midwest with heating and air conditioning but no humidification or dehumidification capacity, this would translate to 35-to-45 percent RH in the heating season months, and 45-to-55 percent in the cooling season months. RH can be kept below 63-to-65 percent (the point where fungal growth can flourish) by using portable dehumidification units in the storage areas. Keep temperatures in the range 65$^{O}$-70$^{O}$F (+/- 2$^{O}$F) daily year-round, allowing for shifts between the different seasons. Do not store firearms collections in attics or basements; a well-insulated interior room is best.

*Light.* Light in the wavelength range of ultraviolet light (UV) is a damaging component of visible sunlight, fluorescent and other artificial light sources. It can fade and bleach wood. Light levels on firearms should not exceed the maximum recommend exposure levels of 100 lux (10 foot-candles) for an eight-hour exhibit day, six days per week per year. The UV ideally should be eliminated, or at least kept to below 75 microwatts/lumen through the use of light filters and low UV sources. In addition to low UV light sources, UV-filtered glass or acrylic (Plexiglas®/Perspex) can be used.

*Visible light* also causes damage over time and can be just as problematic as exposure to UV light. Infrared (IR) wavelengths are a component of incandescent and halogen light sources and can cause drying in wooden components. IR can be a problem if there are incandescent spots inside the case itself, as found in older displays (ca. 1970s and older). Light sources should be completely outside of the cases, or built into a vented “light attic” above the case space itself.

Objects on display can be rotated, which is especially critical with firearms. Often, only the side showing the lock is exhibited for years under strong light; this causes differential fading and damage to that side of the stock. Changing objects on exhibit every year or so is costly, but is the most responsible way to preserve collections that must be displayed.

Atmospheric pollution, which includes dust, corrosive gasses and moisture-borne salts, can be controlled by installing proper filtering systems on the air-intake ducts of the air-conditioning system. Tobacco smoking should also be prohibited throughout the building and in areas adjacent to the air intakes for the HVAC system, if applicable.

*Labeling*. Labeling should be done on an unobtrusive area, such as the interior surface of the trigger guard, illustrated in fig. 3 (p. 6). First, coat the surface of the metal with a small (1/2" long) patch of reversible acrylic resin. Write the number with a pen and indelible black ink. After the ink has dried, over-coat the number with the resin. The number can be removed by using the same solvent used to make the resin solution. AVOID type-writer correction fluid and tape of any kind.

*Storage of collections.* All surfaces in contact with should be are padded with polyethylene microfoam. Cabinet construction materials must be stable and not give off any harmful acids or other fumes. If wood is used, it must be well-seasoned and coated with a



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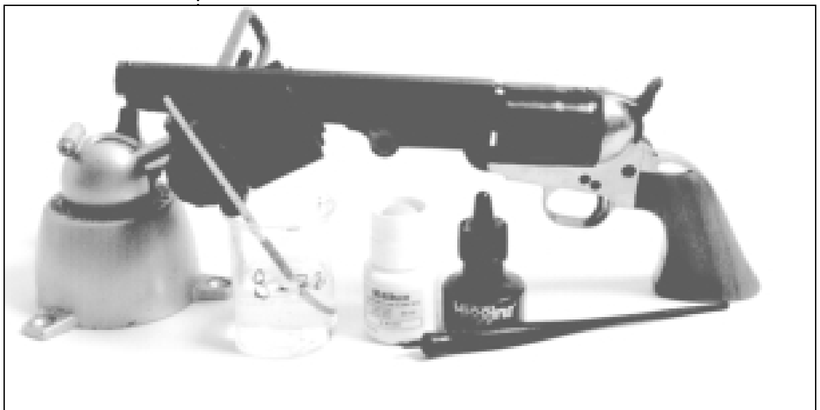
water-borne polyurethane or acrylic sealer. Metal cabinets should be powder-coated and tested to make sure they meet specifications.



MHS file photo; photograph by Paul Storch

*Above: fig. 3, showing the vise and assorted tools and cleaning and marking fluids.*

## *Cleaning without Disassembly*

To clean firearms without disassembly, wipe the surfaces periodically with a clean, soft, lint-free cloth. DO NOT USE wood and metal polishes or oils. This is contrary to the usual gunsmith and curatorial advice to wipe firearms with a protective oil coating. That treatment is not protective in the long term, however, and it gives a false sense of security and leads to the belief that the environment does not have to be controlled.

NEVER apply any kind of varnish to the exterior wood and metal of a historic firearm. Varnish, especially those that are cellulose nitrate-based, are yellow even when newly applied and thus cause color changes and can obscure details of decoration. Do not coat the entire weapon externally with an acrylic spray lacquer coating. Do not use aqueous cleaning agents, such as ammonia. Avoid brass and silver polish, because most of those proprietary formulations contain ammonia or acid, usually mixed with various abrasives. If a curatorial decision has been made to clean and polish brass and silver surfaces, an experienced objects conservator should be consulted.

## *Conclusion*

This article is intended to serve as an introduction to an understanding of the conservation and preservation problems posed by large firearms collections. It is not intended as a substitute for the advice of a conservator or qualified collections manager. Neither the author nor the Minnesota Historical Society assume responsibility or liability for the application of any of the information supplied herein.

## *References and Further Reading*

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## *Additional Notes*

• Readers can contact the John and Martha Daniels Objects Conservation Lab for more detailed information on any of the topics covered in this article. (651) 297-5774; fax (651) 297-2967; e-mail: **paul.storch@mnhs.org**

• As one of the services of its on-going Field Services Program, the Minnesota Historical Society (MHS) offers an electronic data-logger lending program. An institution may borrow, without cost, this easy-to-use instrument for periods of four weeks at a time in order to gather data on the interior levels of temperature and humidity. Upon the logger's return to MHS, the objects conservator will read and interpret the data and send an analysis back to the institution, along with suggestions on improvements. There are also Environmental Monitoring Kits available that can measure the light levels mentioned in this article. Contact David Nystuen, MHS Field Services Coordinator at (651) 296-5460, e-mail: **david.nystuen@mnhs.org**.

• Several vendors currently sell ready-made kits for labeling objects, which include the lacquers and solvents necessary for the patches, and detailed instructions: Archival Collections Systems, 137 Fourth Ave. N., South St. Paul, MN 55075, (651) 457-5399; and University Products, Holyoke, MA; 1-800-628-1912, **www.universityproducts.com**.