

Living History Association Master Manual of Safety for Flintlock Era Units 1700-1850

This was the first Living History Association Safety Manual and was originally designed for the specific use of Revolutionary War reenactors (1775-1781). Ideas and information were drawn from this first manual in order to create safety manuals for all other Living History Association reenacted time periods.

*This manual shall be used as the Safety Manual for
Living History Association Events & Units portraying:*

Queen Anne's War 1702-1713

Governor Dummer's War 1720-1725

King George's War 1744-1748

The Great War for Empire or The French and Indian War 1754-1763

The American Revolution 1775-1783

The War of 1812, 1812-1815

The Napoleonic Wars 1790-1815

The Fur Trapping Era 1700-1850

The Texas Revolution & Mexican War Era 1835-1850

Current as of March 2005

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Preface

The rules and regulations contained in this manual are the collective efforts of the LHA Board of Directors and the LHA Safety Committee, and were, in part, derived from the following sources.

- Soldiers Manual – The Brigade of the American Revolution
- Safety Regulations Manual – North-South Skirmish Assoc.
- Safety Regulations – Council of Minutemen
- National Rifle Assoc.

Also, the cumulative efforts of the 1982 LHA Safety Committee (Lance A. Kozikewski – Chairman, Robert Dana (Ivy) Iverson, and Salvatore Tarantino) and their years of experience in the reenactment field contributed greatly to the overall structure of this manual.

Living History Association
April 2002
Revised 2005

Introduction

The subject matter of this safety manual has been compiled as a standard of “time tested” rules to be followed by the membership of the Living History Association. Adherence to the rules, regulations and recommendations set forth, will enable the membership to enjoy a safe encampment and/or reenactment, and will greatly reduce the probability of an accident or fatality due to negligence, ignorance or carelessness.

Men, using black powder, have been hurt, maimed and almost killed in completely preventable accidents. In most cases, it was a matter of laxity in following procedures because of over-enthusiasm or arrogance on the part of the individual. Please understand that these rules are not 100% perfect; unpredictable things can happen.

The contents of this manual may serve as a resource for any new member or unit, enabling them to establish an immediate safety program. This manual will also serve as a guideline in any disciplinary action taken against any individual or unit of the LHA found to be in violation of any of its rules.

Ignorance is not bliss when safe practices are concerned. **All shall take heed, know, and be aware of the contents of this manual.**

I Gunpowder

A Basic Regulation

- 1 The only type of incendiary material allowable for use in any muzzle-loading weapon (musket, rifle, pistol, or artillery ordnance) covering the time period up to and including the Civil War, shall be **black powder**.
- 2 Absolutely no smokeless powder will be used. Any person found to be employing same, shall be ejected immediately from the event and severely disciplined.

B Storage of Gunpowder

- 1 During re-enactments or tacticals
 - a. No loose powder will be employed; all powder must be in proper paper cartridge form (see appendix for instruction on construction); these cartridges will be stored in a cartridge box of either tin or leather construction while the individual is on the field.
 - b. No powder horns or priming horns are to be filled with powder or used to load or prime a musket during a re-enactment.
- 2 In camp
 - a. All prepared cartridges and any other contained black powder shall be stored in spark-proof, nonflammable containers.
 - b. These containers shall be secured so that only authorized persons have access to the contents. (This will eliminate the possibility of unauthorized access by either children or spectators.)
 - c. These containers shall be stored at least a minimum of 75 feet from the area of fires, sparks, or heat.
 - d. Cartridges should be made before coming to an event. Under certain circumstances, permission to fabricate cartridges may be obtained from the camp Provost Marshal or safety officer, who will set aside a safe and secured area for this purpose and will have strict control of the situation.

II Edged Weapons

All edged weapons such as swords, tomahawks, knives, bayonets, etc., shall remain sheathed at all times, in camp or in tacticals, with the following exceptions:

A Swords

- 1 Officers commanding in the field and using the weapon as a tool of command. Care will be taken not to brandish weapon at or near an individual nor will it be pointed at anyone.
- 2 Officers on parade. Care must be taken to hold the sword in a secure manner, especially when using it to salute.

B Spontoons and Halberds

- 1 Same as A. 1 and 2.

C Tomahawks

- 1 Will not be used in tacticals or re-enactments.
- 2 Will be properly secured and sheathed on belt or carriage, with care being taken if person intends to become a feigned casualty in a battle.

D Knives and similar edged weapons

- 1 None will be used in any tactical or battle.
- 2 Same rule as C.2.
- 3 Sharp edged kitchen utensils shall be kept in a safe area when not in use, and precautions taken to minimize accidents when they are used.

E Bayonets

- 1 Shall remain sheathed unless the order is given to fix bayonet under the following circumstances:
 - a. Picket duty
 - b. Guard duty
 - c. On parade
 - d. A strictly controlled tactical demonstration of a bayonet charge, with no less than 20 feet separating opposing forces or spectators and with ground free of obstructions.
 - e. Will not be leveled at any person or animal.
- 2 Will be fixed only on command of a responsible officer.
 - a. It will be the duty and responsibility of the respective line officers to maintain strict control and order in the use of the bayonet in items 1-a through 1-d.
- 3 No firearm will be discharged while having a fixed bayonet.
- 4 There will be no feigned casualty by anyone carrying a weapon with fixed bayonet under any circumstances.
- 5 There will be no running with fixed bayonet in a staged bayonet charge, or tactical.

III Firing of Muzzle Loading Pieces

A Introduction

- 1 Since the bulk of LHA sponsored events employ long firearms weapons that issue will be addressed at this time. As the need arises for revising the rules, all others firearms will be dealt with at that time.

B Safety Duties of Unit Commanders and NCO's

- 1 The backbone of any safety regulations is not only the safety officer, but also must include the unit commanders and NCO's. They shall have the responsibility of seeing that each man of their unit is well aware of the safety regulations of the LHA, and of observing the weapons handling of their men at LHA events, and correcting any unsafe practices they notice. They also have the responsibility of inspecting the blank cartridges of each man before every LHA event, to make certain that there are no "live ball" rounds in their cartridge box.

C Firearm Safety Requirements

- 1 Lock Function
 - a. The half-cock position of the cock must withstand a moderate pressure on the trigger without releasing.
 - b. The lock must mate tightly to the barrel in the pan-vent area.
- 2 Trigger Pull
 - a. Muskets & Rifled Muskets – at least three (3) pounds
 - b. Pistols – at least three (3) pounds, no set triggers
 - c. Rifles – no limit, but must not discharge when struck smartly on the butt on full cock.
- 3 Vent Sizes
 - a. Musket – New vent, 5/64" to 3/32" is recommended.
Vent size must be less than #37 drill (0.1040).

- b. Rifle – New vent #50 drill size.
Vent size must be less than #46 drill (0.0810).
- c. Pistol – Smooth bore, same as musket.
Rifled, same as rifle.

D Hammerstalls (Frizzen Covers)

- 1 The purpose of the hammerstall is to prevent the flint from striking a spark should the lock be accidentally triggered. Every flintlock firearm used at LHA events must be equipped with a leather cover that fits snugly over the frizzen, and thick enough to perform its intended purpose. See appendix for construction details.

E Flashguards

- 1 All flintlock firearms used at LHA events must have a metal flashguard heavy enough to withstand the vent blast without bending. It must be securely attached so that it will not slip down and expose the vent. It must keep all flash and power particles from traveling a distance more than one foot in a lateral direction. Material must be at least 1/16” thick of brass or steel. The guard height must be at least 5/16” above the center of the vent on muskets, 5/16” to 3/8” on rifles and pistols. It should wrap around the pan to form a barrier at least 1/32” under the cock in a fired position. See appendix for construction details.

F Proof Testing

- 1 The firearm shall have been proof tested before it can be used in a LHA event.

G Safety Inspections

- 1 Before all LHA units enter events the following items will be checked; any that are found unacceptable will cause that firearm to be rejected as unsafe and will not be allowed on the field until the condition has been corrected and passed.
 - a. Flashguard
 - b. Vent
 - c. Hammerstall
 - d. Lock function
 - e. Fit of lock in pan-vent area
 - f. Trigger pull
 - g. Fit of barrel breech to stock (no gaps between metal and wood)
 - h. General inspection for obvious cracks and weakening of stock
 - i. Fit of bayonet to barrel on a military weapon
- 2 In addition to checking of firearms, blank cartridges may be randomly checked for wrapping and contents.

H Cleaning

- 1 The firearm should be cleaned after every day of firing, oiled, and inspected for overall damage or malfunction.

I Ammunition Specifications

- 1 Powder – Only black powder will be used. Smokeless powder is strictly prohibited.
- 2 Cartridges – Blank cartridges will be of paper construction in the 18th & 19th century manner. The paper will be heavy enough to withstand accidental ignition by a spark. See appendix for details. Smokeless brass cartridges will follow commercial manufacturers specifications.
- 3 Blank charge loads – Use the lowest load that produces a satisfactory report. Use a reliable powder measure.

Musket Blank Loads

The following are recommended blank loads. Do not use FFFFg powder for blanks. Flintlocks:

<u>Bore Size</u>	<u>Charge (Includes priming)</u>
.75 to .70	5 drams (135 grains) FFg or FFFg
.69 to .65	4½ drams (123 grains) FFg or FFFg
.64 to .60	4 drams (109 grains) FFg or FFFg

Rifle Blank Loads

Same rules apply as for muskets.

<u>Bore Size</u>	<u>Charge (Includes priming)</u>
.45	50-70 grains FFg or FFFg
.50	60-90 grains FFg or FFFg
.54	60-90 grains FFg
.58	60-100 grains FFg

Early 19th Century muskets or conversion muskets using percussion caps as a primer should use a blank load of 50 to 80 grains FFg. Post 1840s pistols should use 25-40 grains FFg or FFFg. Weaponry must fit the time period you are portraying.

Smokeless powder brass cartridge weapons should use commercial manufacturer loads or reloads by commercial manufacturers specifications.

Pistol Blank Loads

Use approximately ½ of the rifle load of the same bore size, not to exceed 50 grains.

1 Dram Equals 27.3 Grains

J Firearms Handling Regulations

- 1 Always keep the muzzle elevated when firing, sufficient to avoid causing injury to the person to the front of you.
- 2 When pouring powder down the barrel, keep muzzle away from your face or body, and away from anyone in your vicinity. Keep the hand and fingers clear of the muzzle. Powder has been known to ignite, on rare occasions, when poured down the barrel.
- 3 Absolutely NO wadding of muskets or any other firearm is allowed.
- 4 No ramrod is to be removed from its pipes and inserted in the bore during a battle or firing ceremony.
- 5 Each flintlock firearm will have a hammerstall, to be used as directed by the commanding officer.
- 6 Open powder containers are prohibited at all times.
- 7 During blank firing a muzzleloading weapon, if you suspect there is more than one load in the gun, do not fire, bring firearm to the “shoulder” position, and wait for the opportunity to safely drop the load. Failure to do so, and the discharge of the gun could cause it to blow the breech plug, causing severe injury.
- 8 Vent picks should be used at frequent intervals to clear out the vent to insure good ignition.
- 9 Be sure that the flint in flintlock weapons is securely held in the jaws of the cock. Failure to do so could result in it flying out and causing some deep, nasty cuts that are slow to heal.
- 10 Unit commanders and NCO’s are advised to place new recruits next to experienced troops in the ranks so that the more experienced man can observe him and help him if a problem should occur.

IV Rules and Procedures for Firing Muzzleloading Artillery

A The Artillery Piece

- 1 The muzzleloading artillery piece, brass or iron, shall be made according to modern safety standards. If purchased as a reproduction, the manufacturer's certificate that states it has been proof tested and is ready to fire, following standard practices, will be acceptable to the LHA for use in their events. Any other tubes must have been magnafluxed, radiographed, or dye-tested after proof firing, to be acceptable. The bore should be lined with seamless steel tubing with a minimum of ¼ inch wall thickness and a yield strength of 85,000 psi or better. Where acceptable, the breech plug should be threaded and pinned; welded and pinned plugs will be allowed with sufficient proof (i.e., x-ray) that no flaws are evident. The vent should be bouched in order to provide an unbroken line through the casting, the liner, and into the bore.
- 2 The barrel (tube) shall be mounted and secured on a properly constructed gun carriage. The pillow block (trunnion caps) of the gun carriage shall be affixed in such a manner as to absorb the shock of concussion and recoil.
- 3 No evidence of dry rot will be allowable on any segment of the gun carriage.

B Safety Zone

- 1 A minimum of 150 feet shall exist between the gun and spectators. Such areas shall either be cordoned off or secured by posting pickets or observers.
- 2 In a battle re-enactment or tactical demonstration, the safety zone will be inconspicuously marked off, enabling the field officers to keep their troops at a safe distance. If the field does not permit adequate maneuvering space for use by troops and guns, but meets the safety zone requirements, it is suggested that a barrage of a predetermined number of rounds be fired by the opposing gun crews to start the battle sequence. At termination of the last round, all guns will be cleared and secured, the infantry signaled to take the field.
- 3 In all cases, the ammunition box shall be placed at least 15 to 20 feet to the rear of the gun.

C Required Equipment for Safe Operation

- 1 No field piece will fire unless it is served by a minimum of a five-person crew, properly schooled in safety and firing of artillery weapons.
- 2 An ammunition box
 - a. Stoutly constructed of wood or metal
 - b. Interior to be lined with a non-sparking material
 - c. Must have self-closing lid opening at no greater than an 80° angle.
 - d. Vent brush
 - e. Vent pick
 - f. Thumbstall
 - g. Heavy leather gloves
 - h. Sponge
 - i. Worm
 - j. Ramrod
 - k. Water bucket
 - l. Priming powder device (if used) or brass primer
 - m. Pass box (non-sparking)
 - n. Linstock or lanyard

D Basic Safety Regulations

1 Powder charges

- a. Must be prepared in advance of event
 - b. Powder charge content should not exceed 2 oz of Fg or 4 oz of FFA per inch of bore diameter.
 - c. Should be put into plastic baggies with end twisted and tied in a small knot. (Care should be taken to evacuate as much air as possible so that the trapped air doesn't make a balloon effect.) Sandwich bags work well.
 - d. Cut off excess plastic above knot.
 - e. Place baggie of powder in a cartridge made of heavy-duty aluminum foil. (See appendix for construction methods.) One overlapped layer for small guns; double layer for 6-pounders and above.
 - f. Do not break the baggie, as it serves to keep powder granules from becoming trapped under folds in the aluminum foil. (Aluminum foil, used alone, will often yield unburned powder when wormed out after firing.)
 - o NOTE Massachusetts state regulations formerly required only totally consumable plastic baggies, which have been changed to now permit use of aluminum foil.
- 2 All gun crewmembers should wear ear protection devices.
 - 3 No one shall cross in front of the muzzle of a gun while it is being cleaned, loaded or fired.
 - 4 Only crewmembers will be allowed in the area of the gun while it is being loaded or fired.
 - 5 Absolutely no smoking on the line or near the powder box.
 - 6 No drinking of alcoholic beverages 4 hours before serving on a crew actively firing a gun. (Any crewmember showing signs of effects of alcohol or caught drinking on the line, or under the influence of drugs, shall be immediately escorted off the field and subject to disciplinary action.)
 - 7 The ammunition box shall be attended at all times or locked.

E Loading Procedure

These loading procedures will be used at all LHA sponsored events to insure safe uniform procedures by gun crews.

1 Clean The Vent

Clear the vent hole to eliminate debris that either clogs the vent or extinguish any glowing particles, using any of the following methods: compressed gas, a 22 cal. or similar sized bronze cleaning brush that will fit the vent, the priming pick or gimlet run down the vent and twisted a few times.

2 Tend Vent (Stop Vent)

Using a thumb stall or heavy leather glove, seal the vent with thumb pressure during the entire cleaning and loading procedure until the charge is seated and the ramrod is withdrawn.

3 Search Piece (Worm The Bore)

Using a tool with sharp points at the end, patterned after an original cannon-cleaning worm, chase the bore twice. Give the worm two complete turns at the breech each time to clean it of debris. The worm should fit the bore closely.

4 Sponge Piece (Sponge The Bore)

- a. Sponge with a wet, but not sopping, tight-fitting sponge with a head covered with lambs wool or wool carpeting fixed to a shaft that is at least one foot longer than the bore.
- b. Push sponge into bore until it seats against the breech, then give it two full rotations.
- c. Withdraw halfway and reseal again, giving another two full rotations.
- d. Withdraw all the way out, check for powder residue or debris. (If any is found, re-worm and sponge again.)
- e. Repeat entire sponging process a second time.

5 Handle The Cartridge

- a. Matross will open ammunition box long enough to remove a prepared charge.
- b. A bombardier will carry the charge to the muzzle of the gun in a leather pass box.

- c. The bombardier will advance to within arms length to the rear of the muzzle.
- 6 Place The Cartridge
 - a. The bombardier will remove the cartridge from the pass box and place the cartridge into the muzzle of the gun.
 - b. It is recommended that the crewman wear leather gloves.
- 7 Ram Cartridge
 - a. The gunner will stand to the side of the barrel with as much of the body as possible to the rear of the muzzle face.
 - b. Grasping the rammer handle underhand, with one hand, thumb to the side, the gunner will then seat the charge against the breech, using light, short, smooth strokes. Do not pound the rammer against the charge.
 - c. Upon feeling the charge has seated against the breech, drop the hand away, releasing the rammer. After approximately five (5) seconds, remove the rammer by using the underhand method as seating the charge. It may require grasping and releasing the shaft a few times. It is emphasized that the body must always be kept to the rear of the muzzle.
- 8 Prime (Pick and Prime)
 - a. Using a pick or gimlet held by the shaft between glove-protected fingers, the gunner will prick open the powder charge through the vent. It should not be necessary to use any extreme force. Pick should not reach the bottom of the breech.
 - b. Priming the vent depends on the system used: linstock and priming powder, fuse, or quills.
 - c. If priming powder is used, priming is to be done from an open-topped container having a sufficiently long handle so that the hand is never over the vent when pouring the powder. The container shall be of a size sufficient to hold only enough 4Fg or 3Fg priming powder to fill the vent. Priming is not to be done from a priming horn or flask.
 - d. If fuse or quills are used, crew members must be aware of the hot debris being blown out of the vent from the discharge of the gun. Some sort of headgear should be worn for protection.
- 9 Take Care or Prepare to Fire
 - a. The gun commander shall issue this command to alert all other crews, including his own, that the gun is going to be fired.
- 10 Fire
 - a. The priming powder, fuse or quill, will be ignited by a linstock containing a slow match. The handle of the linstock shall be long enough to allow the gunner to stand outside the wheels.

F. Misfires

- 1. If the primer ignites but the gun does not fire
 - a. Immediately call “Hang Fire” or “Cease Fire the Primer Has Failed.”
 - b. Summon the safety officer.
- 2. Wait THREE (3) MINUTES before the next step.
- 3. Approach the gun slowly from the rear and to one side.
- 4. Wearing gloves, use a gimlet or pick grasped only by the shaft to clear the vent. Take care to keep the face away from the vent area.
- 5. When vent is clear, reprime and fire.
- 6. If the gun fails to fire in the next two attempts, swamp the gun with water, both vent and bore, then carefully worm out the contents, after a thorough soaking. Use of a fire extinguisher with a vent fitted nozzle is also acceptable.

One Final Reminder: When you are loading and firing a muzzle loading artillery piece, you are dealing with an extremely lethal weapon. Exercise great caution. The careless mistake you make may be your last on this earth.

V Camp Safety

Definition of Provost Marshall: person in charge of setting up reenactor camps

A. Introduction

The use of common sense while setting up, starting and maintaining cook fires, participating in the encampment, and dismantling the camp, will reduce the number of hazards and accidents. The overall Commander of the camp shall be the Provost Marshal. This person will be in charge of castrementation, the fire pit areas, and the general administration of the encampment. The Provost Marshal will advise all participants of specific rules and regulations regarding the camp, since various locations, city and state ordinances and conditions would necessitate accommodation to the situation. The rules and safety suggestions that follow are a general guideline only, and will be augmented by specifics as required by local ordinances or space restrictions.

B. Campfires.

1. All fires will be enclosed in proper fire pits, steel plate, or fireboxes not to exceed an area of four (4) feet in diameter in all directions cleared of flammable material such as limbs, leaves, etc.
2. Fires shall not be left unattended in camp areas at any time and must be attended by an adult.
3. No fuels other than wood should be used for fires, in consideration of safety and authenticity.
4. The area surrounding the fire pits shall be tended by an adult reenactor to prohibit direct contact of the fire with any member of the general public.
5. Fires must be extinguished before turning in for the evening.
6. The hours of burning and size and placement of fires shall be in accordance with local and state regulations and shall be regulated by the Provost Marshal or host or both.
7. No bonfires are allowed.
8. Fires must be no closer than five (5) feet to a cook fly, and twenty (20) feet away from tents.
9. A bucket of water must be at each fire pit.
10. Children must not be allowed to tend fires without adult supervision; no playing around fire pits.
11. At the end of its use, fire pits must be drenched in water, stirred, and drenched again, replacing the sod and re-leveling the ground to its former appearance.
12. No garbage may be burned in a fire pit.
13. Axes and hatchets must not be left around camp fires, wood piles, or in walk areas, but rather they must be sheathed and put in a secured tent or camp chest.

C. Evening Lighting

1. Candles ensconced in a properly constructed lantern are strongly recommended as the lighting in and around camp, to preserve authenticity.
2. Lanterns should be kept at a safe distance from flammable articles, such as tents.

D. Smoking

1. Prohibited in tents.
2. Shall not be allowed within 50 feet of black powder storage areas of cartridge fabrication designated by the Provost Marshal, event safety officer or host unit.

E. Public Safety: Camps

1. Camps must be neat and well organized with clear walkways through and around camps.
2. Camp fires must always be attended by an alert adult that will keep spectators a safe distance from fires.
3. Cook fires must always be a bed of coals or of practical size. Bonfires are not allowed.

F. Battlefield and Demonstration Areas

1. No firing or handling of weapons is allowed by spectators.
2. No firing of weapons in camp areas is allowed.
3. All battlefield and demonstration areas must be designated as such and must have a rope or other barrier to separate spectators from participants.
4. All weapon demonstration firing must take place at a distance of twenty five (25) feet or more from the public, and weapons shall be fired away from the public, but never in the direction of the public.
5. Battles, where an opposing force advances toward the public may not fire in the public's direction, except when the opposing line is between the attackers and the spectator line. At that time, the defending force (those with their backs to the public) must be at least fifty (50) feet from the spectators. Those firing in the direction of the spectators must be at least one hundred and fifty (150) feet from the spectators and be aiming fifteen (15) feet in front of the opposing troop line, and at an oblique.
6. Cannon fire must always be at a distance of at least one hundred (100) feet from the spectator line when firing in the general direction where spectators may be located. Artillery must be obliqued with the spectator line, or firing away from the spectator line.

Appendix #1

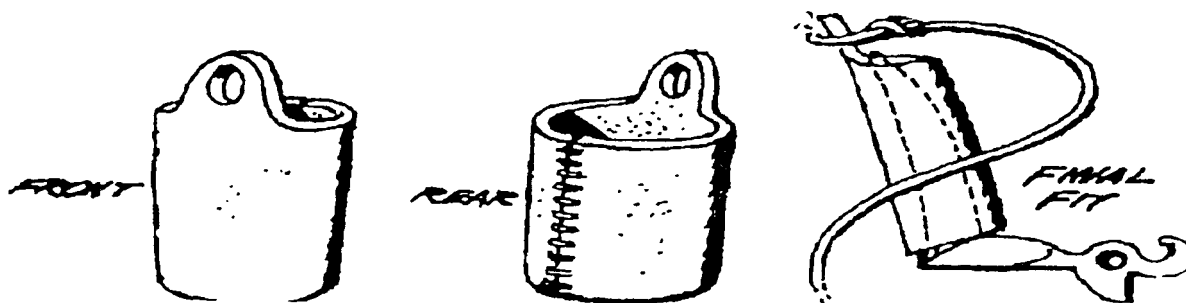


Figure I – Hammerstall (Frizzen) Construction Guide

The leather over the face of the frizzen is to be less than 1/8" thick.

I. Hammerstall (Frizzen Covers):

- A. Good fitting hammerstalls must be attached to all weapons used at LHA events.
- B. Hammerstalls must be of such length as to completely cover the striking surface of the hammer (frizzen). The thickness of the hammerstall must be sufficient so as to prevent the flint from cutting through it.

II. Flash Guards:

- A. All arms used at LHA events must be equipped with a flash guard of metallic material strong enough to withstand the vent blast without bending. It must keep all flash and powder particles from traveling more than one foot in a lateral direction.
- B. Materials for construction may be 1/32" (preferably brass).
- C. The guard height must extend at least 5/16" to 3/8" above the center of the vent and wrap around the pan to form a fence at the back approximately 1/32" under the hammer in a fired position. It must be constructed in such a way (i.e., by hooking over the lockplate by "ears" or other means) that it will not fall down and expose the vent should the hammer screw become loose.

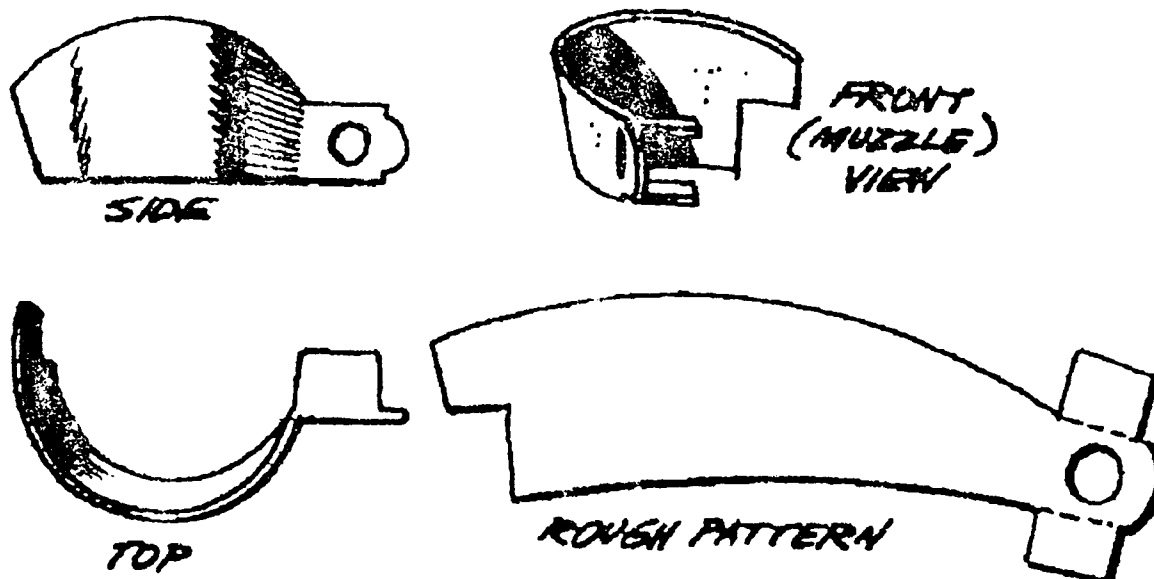


Figure II – Flash Guard Construction

Appendix #2

Musket Cartridge Guide

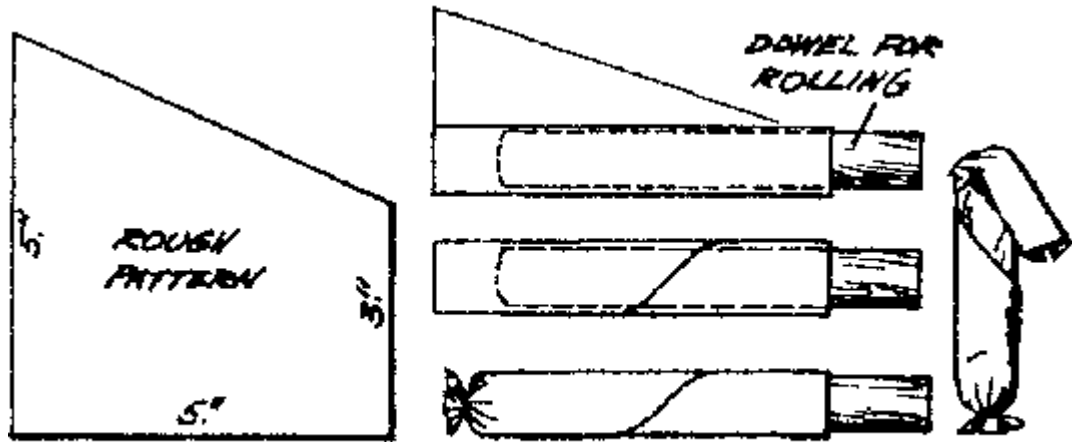


Figure III – Cartridge Rolling Guide

Appendix #3

Recommendations as pertains to muzzleloading artillery

- A. Cartridge: Fixed, pre-loaded cartridges are the safest known. Use only unquilted broiler weight aluminum foil. Let "D" equal the exact diameter of the bore of the specific piece to be used. Make a sturdy cartridge pattern cut exactly to the dimensions you calculate from.
- B. Former: Make a former to the specifications in Fig. 1. It can be a wood turning, paper tubing, or other material built up to size with gummed paper tape. In the case of tubing, close one end with a heavy, glued cardboard disk to prevent punching in the foil when folding the overlap. If the tube is porous, seal it with a thin coat of varnish. After it fully sets, simonize it. If possible, provide an air hole to prevent suction when withdrawing the former.

Prepare a former (a tube 0.2 inches smaller than the bore) using aluminum foil 3 times the length of the circumference, roll it upon the former and fold one end closed and hit that end on a hard surface to lock the foil. Remove the former, fill with powder and fold closed.

NOTE: Make former with air passage in center or on circumference to facilitate its removal.

- C. Cartridge Forming: Place the cartridge on a flat smooth surface. Position the former as shown in Fig. 1. Roll up the cartridge into a cylinder leaving $\frac{3}{4}$ "D" overlap as shown. Fold overlap over end of former and press out creases and puckers. Withdraw former. Make desired number of cartridges at one time.
- D. Charge: The only acceptable charge is FG black powder. In the 18th and 19th century, copper, brass or wood was favored. The object of both is to eliminate the chance of a static electricity spark. Measure each load carefully. Charge only one cartridge at a time, and put it aside to avoid mistakes. Seal the cartridge as shown in Fig. 2. "A" shows the cartridge with the powder level indicated at the bottom. Fold and crease the upper end as in "B."

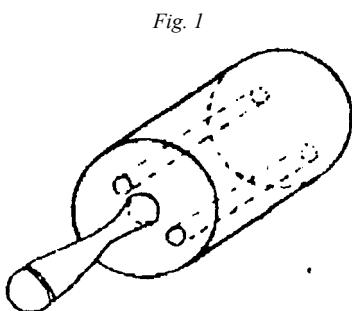
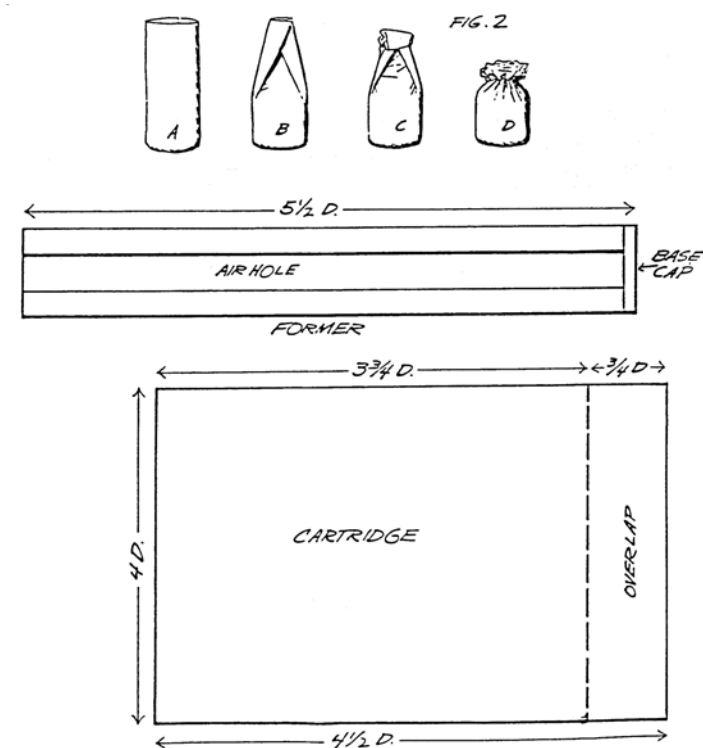


Fig. 1



Appendix #4

Bore/Charge Relationship Guide

Number of gage	Bore Diameter	Max. Charges FG Powder	Max. Charges FFG Powder	Max. Charges FFFG Powder
1	1.669	Considered as Wall Gun size and will vary charges with weight 6 drams 163.8 grains	Not recommended too fine and can produce high pressure 5 drams 136.5 grains	Not recommended too fine and can produce high pressures
2	1.325			
3	1.157			
4	1.052			
5	.976			
6	.919			
7	.873			
8	.835			
9	.803			
10	.775			
11	.751	5 drams	4½ drams	3½ drams
12	.729	136.5 grains	122.85 grains	95.5 grains
13	.710	4½ drams	4 drams	
14	.693	122.85 grains	109.2 grains	
15	.677	Not recommended too coarse to give good burning with light ball	3½ drams	3 drams
16	.662		95.55 grains	81.9 grains
17	.649			
18	.637		3 drams	2½ drams
19	.626		81.9 grains	68.25 grains
20	.615			
21	.605		2½ drams	2 drams
22	.596		68.25 grains	54.6 grains