

A detailed historical painting depicting a military camp or demonstration site. In the foreground, several large, dark-colored cannons on wooden carriages are positioned on a dirt ground. A soldier in a green uniform is riding a white horse on the right side of the frame. In the background, a large number of soldiers are lined up in formation, and various tents and structures are visible, suggesting a busy military encampment. The scene is set in a field with trees and a distant landscape under a clear sky.

Manual of Instruction for the Safe Use of Reproduction Eighteenth Century Field Artillery in Historic Weapons Demonstrations

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PART I - INTRODUCTION

The four primary causes of accidents in historic weapons demonstrations using artillery are:

1. Rapid Firing
2. Poorly Maintained or Improper Equipment
3. Improper Drill
4. Improper Ammunition

This manual sets forth the procedures that must be followed by persons demonstrating 18th century field artillery to the public in areas administered by the National Park Service. It also provides instruction on proper maintenance, inspection and repair procedures. This manual must be used in conjunction with Director's Orders, DO-6, Historic Weapons Demonstration Safety Standards and the Historic Weapons Program Manual.

Once an individual has completed training based on this manual. He/she will be able to perform historic weapons demonstrations that meet all NPS regulations and avoid all four of the primary causes of artillery accidents. This manual addresses basic nomenclature, equipment maintenance, ammunition manufacture, and drill. For additional interpretive information see the 19th Century Historic Weapons Reference Manual.

The material in this manual was originally written and compiled by former National Park Service Historian William Meuse and Park Ranger Jack Dugan in 1977. Both possess an extensive background and years of experience in the subject and the many hours they spent on this publication are greatly appreciated. Further work on this manual was done by Park Rangers Ron Gimmillarro (VAFO), Eric Olsen(MORR), John Sutton (WICR), and Rick Martin (VICK).

The material in this manual was updated in 2008 to meet current training and certification needs of the National Park Service.

In contemporary times, cannon and other forms of artillery from the War for American Independence are nothing more than quaint, noise-makers. We see them only in demonstrations at historic sites or in the movies and TV. In their day, cannons were the most powerful, far-reaching weapon which humans controlled. From clumsy beginnings in the 1300's, cannons had become by the 1700's examples of sophisticated technology in terms of manufacture and in performance.

Artillery could destroy walls of cities and fortresses. It could annihilate whole bodies of troops instantly, and at a greater distance than any other weapon. They were complicated and expensive to manufacture, fearsome in their execution, and hazardous to operate.

Cannon firing demonstrations in National Park Service sites are programs understandably very popular with visitors. The noise, smoke and smells provide them with immediate experiences that help them understand the past in a unique and exciting manner. These demonstrations also require a good deal of respect on the part of the participants, not only for the power of the weapons, but also for those who operated the guns, or faced them in battle.

There were three types of artillery pieces in the era of the War for American Independence: cannon, howitzers and mortars. Each had their role, strong points and weaknesses.

Cannon are the most familiar, and most misunderstood. Cannons were long guns which fired solid, non-exploding projectiles. The cannon ball or shot relied on the velocity of the firing and mass of the projectile to smash or batter the target. The projectile would travel in a flat parabola, similar to the path of a pitched baseball.

Cannon fired spherical projectiles, which smashed. Cannon balls were useful against ships and defensive walls. Clusters of smaller cannon balls, called grapeshot, were horribly effective against living targets. An improvement on grape shot, called cannister, was a tin cylinder filled with musket balls. In an emergency, handfuls of broken, scrap iron could be fired. For specialized situations, like fighting against ships, bar and chain shot were developed to wreck masts and rigging.



Reproduction Battalion 6-pounder Cannon

Mortars and howitzers were shorter, stubbier guns, which fired exploding projectiles called shells. Shells would be fired at a higher arc than a cannon shot, not unlike an outfielder's throw to home plate. Mortars were used in stationary situations like sieges. They were used to lob shells over walls to harass the defenders. Howitzers were mounted on carriages, similar to those for cannons. They were sometimes found on battlefields, but apparently in more static situations, like defense of a redoubt or prepared position.

Howitzers and mortars usually fired exploding shells, but could also fire solid projectiles like grapeshot. They also could fire light-balls (incendiary shells), smoke balls, stink-balls, message balls and carcasses. The last mentioned were mostly fired from the largest mortars in a siege and were bundles of flammable, explosive and anti personnel materials.

Swivel guns were smaller caliber cannon used in naval actions and static defense (forts, stockades &c.) mostly firing anti personnel ammunition. Intended to be operated by one or two gunners, the National Park Service requires a crew of three.



Reproduction 5.8 inch (Royal) Howitzer



Reproduction 4.2 inch cohorn mortar

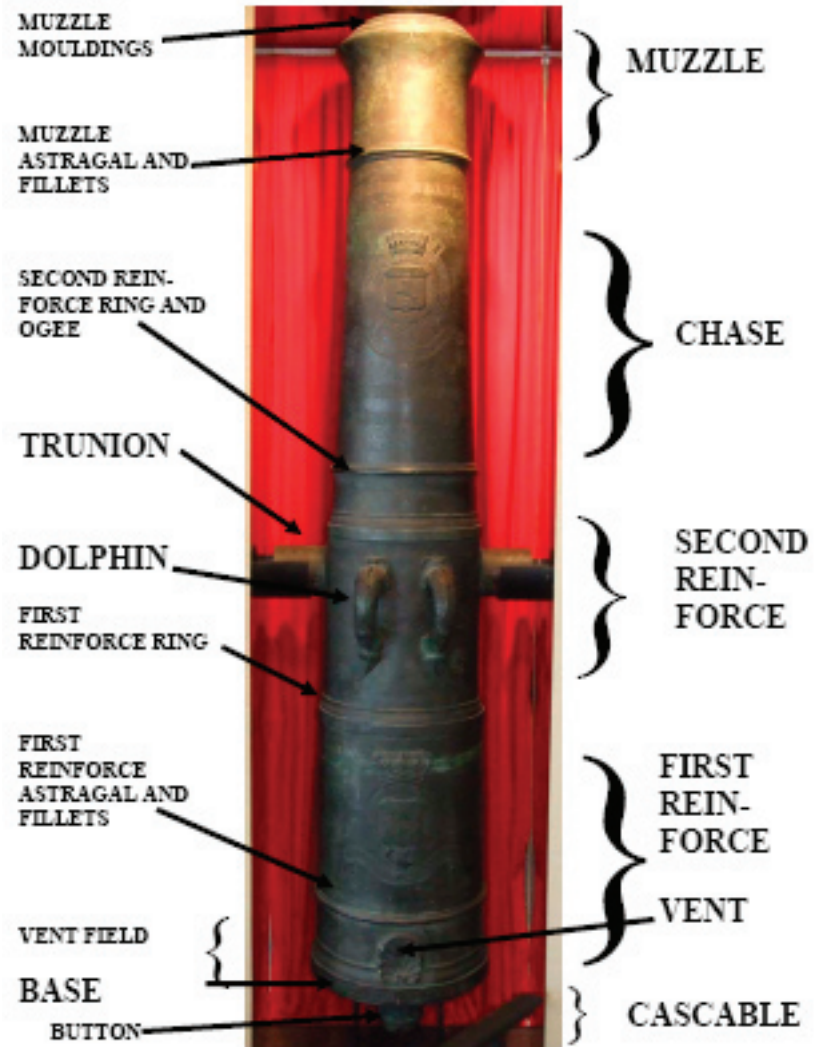


Reproduction Swivel Gun

PART II - ARTILLERY NOMENCLATURE

THE GUN

- The **bore** is the interior hollow cylinder which receives the charge. It includes all the part bored out.
- The **muzzle** is the entrance to the bore.
- The **breech** is the mass of solid metal between the bottom of the bore and the cascable.
- In **howitzers**, a **chamber** is located at the base of the bore to accept cartridges with reduced charges.
- The **cascable** is the projecting part which terminates the piece. It consists of the **knob**, the **neck** and the **fillet**.
- The **reinforce** is the thickest part to the body of the gun to offer resistance to the force of the powder and the shock of the projectile.
- The **chase** is the conical part of the gun in front of the reinforce.
- The **swell of the muzzle** is the large part of the gun in front of the neck; it gives strength to the gun at its termination to prevent the mouth from splitting from the shocks of the projectiles, and facilitates aiming.
- The **face** is the front plane terminating the piece.
- The **trunnions** are the cylinders at the sides of the gun, which support it on its carriage.



- The **rimbases** are the short cylinders uniting the trunnions with the body of the gun.
- The **vent** is a cylindrical hole, terminating near the bottom of the bore, through which fire is communicated to the charge. It is bored through a **vent piece** made of wrought copper, which is screwed into the gun.
- Markings on guns included the date of manufacture, the serial number, the foundry, the inspector's initials, and the weight.

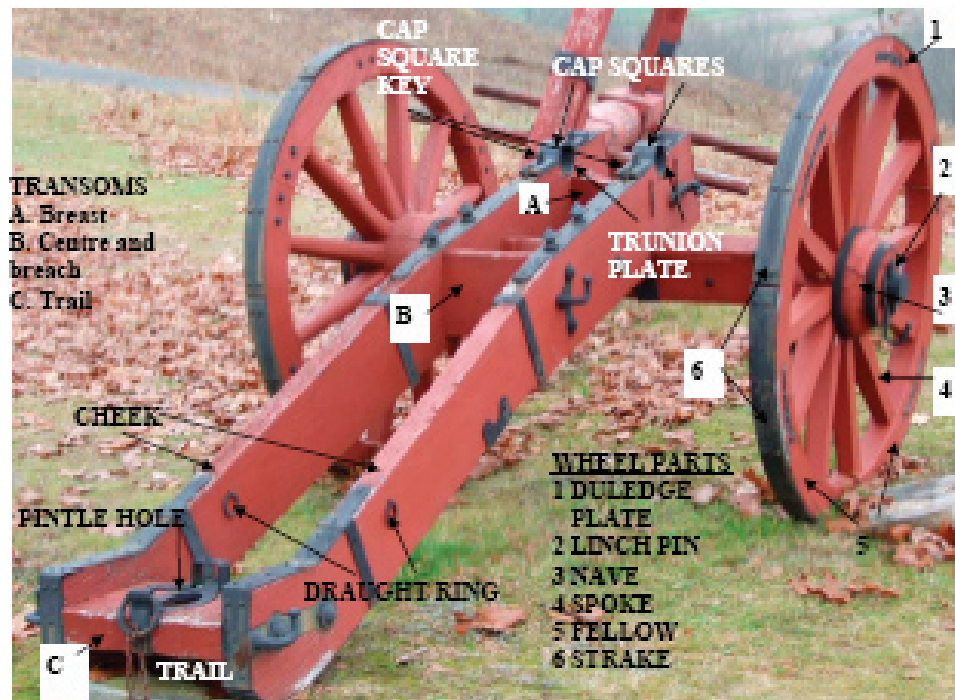
THE CARRIAGE

Carriage parts made of white oak are:

- The **cheeks** are two pieces of wood between which the gun rests and serves as the trail.
- The **transoms** are wood, in three pieces, joined to the cheeks and serving to connect the two parts of the carriage together. Breast, Centre and Breech, & Trail.
- The **axle body** covers the axletree.
- The **wheels** consist of the nave, spokes and fellies, streaks.

Carriage parts made of iron are:

-
- The **trunnion plate** protects the cheeks.
- The **cap squares** are placed over the trunnions to hold them in place. They are fastened by chains, pins and keys.
- The wheel is attached to the axletree by means of a **linch pin and washer**. The washer prevents the pin from cutting into the nave.
- **Duledge Plates** hold the fellies in place.
- The nave is reinforced by the **nave bands**. The wheel is mounted with a tire.
- On naval and garrison carriages, the trucks are iron.



IMPLEMENTS

- The **sponge rammer** consists of the sponge head, the rammer head, staff and sponge.
- The **staff** is made of ash or hardwood, the sponge head is made of elm or poplar and held in place by dowels. The rammer head is made of ash or elm and is held in place by dowels.
- The **worm staff** is made of ash or hardwood and is mounted with a worm made of iron.
- The **sponge bucket** is made of wood.
- The **thumb-stall** is made of leather.
- The **priming wire** is made of brass.
- The **gunner's haversack** is made of leather.
- The **trail handspike** is made of hickory or oak and consists of a ring and staple, and key made of iron.

The following list of implements and equipment are considered to be the minimum levels for conducting safe demonstrations:

Sponge Rammer - 1

Worm - 1

Sponge Bucket - 1

Tube Pouch - 2

Thumbstall -2

Priming Wire - 2

Haversack - 1

Trail Handspike or Tiller - 2

Linstock -1

PART III - INSPECTION AND MAINTENANCE

INSPECTIONS

Frequency of Inspections

The piece should be inspected before demonstrations and after the final cleaning on that particular day. Ordnance in storage should be periodically checked.

Problems to Encountered During Inspections

Overall poor cleaning: If the piece is not cleaned immediately after use, the residue will harden in the bore, particularly in small voids or pits. This is very dangerous, as, in subsequent firings, this residue can retain a spark or smolder and ignite the cartridge breaks during ramming.

Overall poor maintenance: Be especially aware of cracks and checks on the cheeks and trail of the carriage since these areas receive the shock of recoil.

The wheels are the most critical and important part of the carriage. They should be tight and roll freely and straight. Spokes should give a “ring” when tapped with a wooden or leather mallet. Flat sounds indicate the presence of rot. Spokes that jiggle or move when grasped indicate shrinkage of the wood and the manufacturer should be notified for re-tightening or replacement. The wheels should be rotated frequently to prevent rot of the felloes, especially if the piece is left on the field for appreciable amounts of time. Any wheel that has to be kept wet in order to be tight is unsound, and should be repaired or replaced.

Rot and insect infestation can be detected by looking for blisters in the paint, a softness of the wood, tiny holes bored into the paint and evidence of fungus. Areas where water can be harbored, such as between the spokes on the wheels, the prolong hooks, the lunette and the felloes of the wheels if stored in soft ground or grass especially susceptible to rot.

Wooden implements should be free from serious cracks and splinters. Sponges should be inspected closely for soundness.

The chest should be properly made, having non-sparking materials on the inside. All nails are countersunk and the heads puttied over.

The lid should fit snugly and be provided with a lock. The chest is to be kept locked when not serving ammunition.

The chest is clean and free of spilled powder. All equipment and ammunition are neatly and securely stored in the chest.

Enlarged vent:

Bore and vent measurements are taken annually and recorded in the Gun Book. Vents were originally .2" in diameter. A vent in excess of .25" in diameter should not be used as this may cause misfires. On reproduction guns, an extra vent piece should be purchased with the gun.

Condition of the bore:

Injuries to bronze guns is minimal, except for the bending of the trunnions after long service or heavy charges. Internal injuries are caused by the action of the firing of the gun.

The lodgement of the shot is a compression of the metal on the lower side of the bore, at the seat of the shot, caused by the pressure of the gas in escaping over the top of the shot. There is a corresponding burr in front of the lodgement, and the motion thereby given to the shot caused it to strike alternately on the top and bottom of the bore, producing other enlargements, generally three in number. Scratches in the bore are caused by fragments of a broken shot or the roughness of an imperfect one.

The entrance of the vent should be checked during inspections for corrosion. The bottom of the bore under the vent should be checked for pits caused by the priming wire striking the bottom of the bore during drill.

The breech face should be checked during inspections to detect any deformities during manufacture caused by boring tools, or scarring caused by excessive use of the worm.

Iron guns will display the above defects in a less degree than bronze, except for corrosion of the metal. The principle cause

of injury in iron guns is from the rusting of the metal. Iron guns that have liners cast in place will have a slight narrowing of the bore at the cascable. Extra care should be taken if firing projectiles to ensure adequate windage as a shot may be fused-welded in the bore.

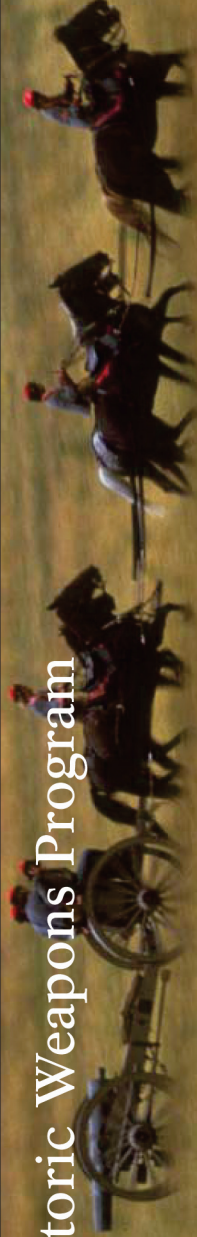
The following checklist should be used when inspecting individual pieces. Newly purchased ordnance should be inspected using this checklist prior to placing into service.

Recommended tools for inspections include:

- Rawhide mallet
- Craft knife (“X-Acto”) knife, or a pocket knife with a thin blade
- Pocket Mirror or “Mini-Mag” light
- Vent gauge



Historic Weapons Program



Artillery Inspection Checklist

Park: _____ **Weapon:** _____ **S.N./Prop.#** _____

The Gun:

- The gun is clean and free of rust and corrosion.
- No sign of external damage or strain (dents, cracks, etc.).
- Inside of bore is smooth or relative smooth.
- No internal signs of damage (bulges, lodgments, pits, etc.).
- No sign of corrosion damage at breach of the bore.
- On iron guns with liners, the liner is secure.
- The vent is clear and of acceptable size (not to exceed .25").
- No signs of cracks or bending around the trunnions.
- No signs of weakness at the chaplets on bronze tubes.

The Carriage:

- Wheels are tight and free of rot or insect infestation.
- Body of the carriage is free of rot or insect infestation.
- No parts are missing, cracked, bent or broken.
- Wheels move freely.
- Elevating mechanism works smoothly and properly.
- None of the ironwork is loose.
- Tube rotates freely on its trunnions.

Equipment:

- All necessary equipment is present.
- Sponge is in good condition and fitted to the bore.
- Rammer head is secure and free of cracks.
- Prongs of the worm are sharp and not bent.
- Smaller items in good condition (linstock, thumbstall, buckets).
- Leather gauntlets in good condition (not hard, dry, or torn).
- Limber box and haversack is clean and free of spilled powder.
- The gun book is kept up to date.

- Trunnion caps fit snugly and are properly keyed.
- Lids of limber chests and/or side boxes fit securely.
- Wood generally free of serious checking or splintering.
- Wheel hub does not gouge the end of the axle tree.
- Linch pin is not digging into wheel hub.

This Firearm: _____

Passed: _____

Failed: _____

Comments: _____

INSPECTOR: _____

DATE: _____

MAINTENANCE

Following the Day's Demonstrations

The cannon should be cleaned with mild soap (i.e. "Ivory") and fresh water after the conclusion of the day's demonstration. Use a sponge or brush to scrub the bore. The elevation screw should be turned up fully to allow excess water to run out the bore. Excess water should be wiped off the carriage. Fouling should be removed from the vent field with water and a toothbrush. The bore on iron cannons should be lightly oiled after being completely dried with a rag to prevent rust.

For better cleaning, you can use a pressure washer or the hose from a coin-operated car wash to clean the bore.

The sponge should be washed in soapy water after the day's demonstration. It should be spun to prevent the nap from matting. The sponge should be allowed to dry in a standing position.

Since powder fouling deteriorates the fibers, sponges should be inspected frequently and replaced as necessary. In no case should a sponge be allowed to deteriorate to the point where there are loose threads and rotting of the material.

The worm should be cleaned thoroughly of fouling and dried.

The sponge bucket should be rinsed and turned over to dry.

The priming wire should be wiped clean of fouling.

The ammunition chest is checked to ensure it is clean of any spilled powder.

The day's entry is made in the Gun Book.

The piece should be kept limbered when on the field, the limber wheels chocked, the lock chain secured and the ammunition chest padlocked. If a piece must be kept in the field, then it should be covered with a tarpaulin to protect it from rain and dew.

Long Term Maintenance

For long-term maintenance and preservation, the piece should not be left exposed to the weather. The piece should be kept in an unheated building or other similar structure. Carriages left exposed to the effects of the elements will deteriorate rapidly.

The Gun:

Notations on bore and vent diameters are recorded annually in the Gun Book.

Hardened fouling in the bore can be removed by use of a stove pipe brush of proper diameter attached to a staff. Fouling can also be removed by use of scrubbing patches.

The vent can be cleaned of fouling with a .177 caliber bore brush with a pistol cleaning rod. The vent should be covered while in storage.

Iron guns in storage should be checked from time to time to see that moisture does not collect in the bore and re-oiled as necessary.

The Carriage:

Some checking of the wood can be expected. Filling of cracks or checks should be done with soft, elastic filler that will allow expansion and contraction of the wood. Hard putty or similar products will sink into the crack and act as a wedge as the wood breathes.

It is recommended that cracks on horizontal surfaces be filled, since they would allow water to soak into the wood, shortening the life of the carriage.

All surfaces (carriage and implements) should be painted (or stained) as needed.

The elevation screw and the axle should be kept lightly lubricated with common ball bearing grease.

Wheels:

Wheels are, perhaps, the most critical and important part of the carriage. They should be tight and roll freely and straight. The axle is to be greased as necessary, with a heavy lubricating grease.

The spoke should give a musical “ring” when tapped with a wooden mallet. Flat sound indicate the of rot. Spokes that jiggle or move when grasped indicate shrinkage of the wood and the manufacturer should be notified for retightening or replacement.

The wheels should be rotated frequently in order to prevent rot on the felloes, especially if the piece is left in the field for appreciable amounts of time.

Any wheel that has to be kept wet in order to be tight is unsound, and should be repaired or replaced.

Implements and Accoutrements:

Rammer and sponge heads are securely fastened with hardwood dowels, and non sparking metals are used in the construction. During the off-season it is a good idea to soak the sponge head in boiled linseed oil, to minimize deterioration. Paint as necessary.

The sponge bucket should be checked for rust and painted as necessary.

Leather accoutrements should be cleaned with saddle soap to remove dirt. Gloves and gauntlets should be kept clean and flexible with saddle soap. Leather accoutrements should be removed from the ammunition chest prior to long-term storage. Dry leather can be restored with neats foot oil, Lexol or similar leather preservative.

Sponges should be covered when dried.

PART IV - ARTILLERY DRILL

A number of gun drills existed during the 18th century, some of which varied in complexity and safety. The emerging American artillery did not possess a manual for artillery drill or construction. During the American Revolution the Continental artillery relied on the standard 18th century ordnance text by John Muller, *A Treatise of Artillery*. Muller's work was the only written manual available to the Americans until 1797. Following the American Revolution, William Stevens, a veteran artillerist of the American Revolution, was asked to prepare a manual for the use of the fledgling American artillery, and he quite naturally drew from his personal experience during the war. He published *A System for the Discipline of the Artillery of the United States of America, or the Young Artillerist's Pocket Companion*. The drill he sets forth is basically a modified form of the British drill--a drill most Americans were familiar with from before the war. This manual is the earliest published American artillery manual known at the time of this writing. A. L. de Tousard, a French volunteer in the American Artillery was requested to write a manual which would be published in 1809. Tousard's three volume work the, *American Artillerst Companion*, would be considered the standard reference for the War of 1812. Tousard borrowed heavily from Stevens and Muller as well as manuscript notes and information from George Fleming, another Revolutionary War American artillery officer. Tousard includes an American drill used during the American Revolution and is somewhat different from Steven's version, and is attributed to have been provided by Fleming.

All of the above is by way of introduction to the drill and a slight attempt to determine its possible origin.

The manual is specifically for the brass 6 Pdr. Field gun. It is applicable to field pieces of other calibers, however, and may as well serve for smaller guns. It is necessary to alter some of the positions for safety, i.e. move from the inside of the wheels to the outside on shorter guns. Other drill manuals may be used, but the same safety standards must be adhered to in their demonstration as set aside in this manual.

It should also be noted that the following manual is for training purposes. That is to provide drill commands for training purposes. These are not the commands that were used in actual combat. Tousard mentions in his book, "When the gunners and matrosses know and are attentive to their duty, a field piece may be fired sixteen and even eighteen times in a minute without hearing any other noise but the fire and the word charge (load)." Needless to say we are not going to duplicate the combat rate of firing, but it can be a point of interpretation in your program.

For our purposes, we will be using a modified version of the original Stevens drill. The modified drill reduces the number of gunners from sixteen to six, and is written in simplified modern English rather than the frequently ambiguous terms of Mr. Stevens.

Minimum Time Period Between Firings

Since rapid firing is one of the four principal causes of artillery accidents, it is not permitted in NPS demonstrations. A minimum of ten minutes must pass between firings during demonstrations. This pause also allows for interpretation to take place in between multiple firings.

SEARCHING THE PIECE

No command for securing or searching the piece can be found in the original manual. This is because the piece is meant to go into action after unlimbering and be secured prior to limbering. An administrative action for ensuring the piece is unloaded and free of obstructions or debris has been added to the NPS drill to enhance safety.

Prior to each demonstration, the gunner will ensure that the following procedure is performed by commanding, “SEARCH THE PIECE.”

The No.3 will step in put the priming wire down the vent to check for obstructions. If there are no obstructions, No. 3 will say, “CLEAR,” and return to his “To Your Posts” position. If there are obstructions, the Gunner will remove them using a punch or gimlet.

After the vent is cleared, No. 1 or No. 2 will step in and worm the piece to remove any foil residue or other objects from the bore.

This procedure should be performed prior to each demonstration.

Modified Stevens Artillery Drill

Gun Crew Positions:

Front Left (FL) handles the worm or wad hook. Required safety equipment: Hearing protection, leather gauntlets. *This is the No.2 position in the 19th century drill.*

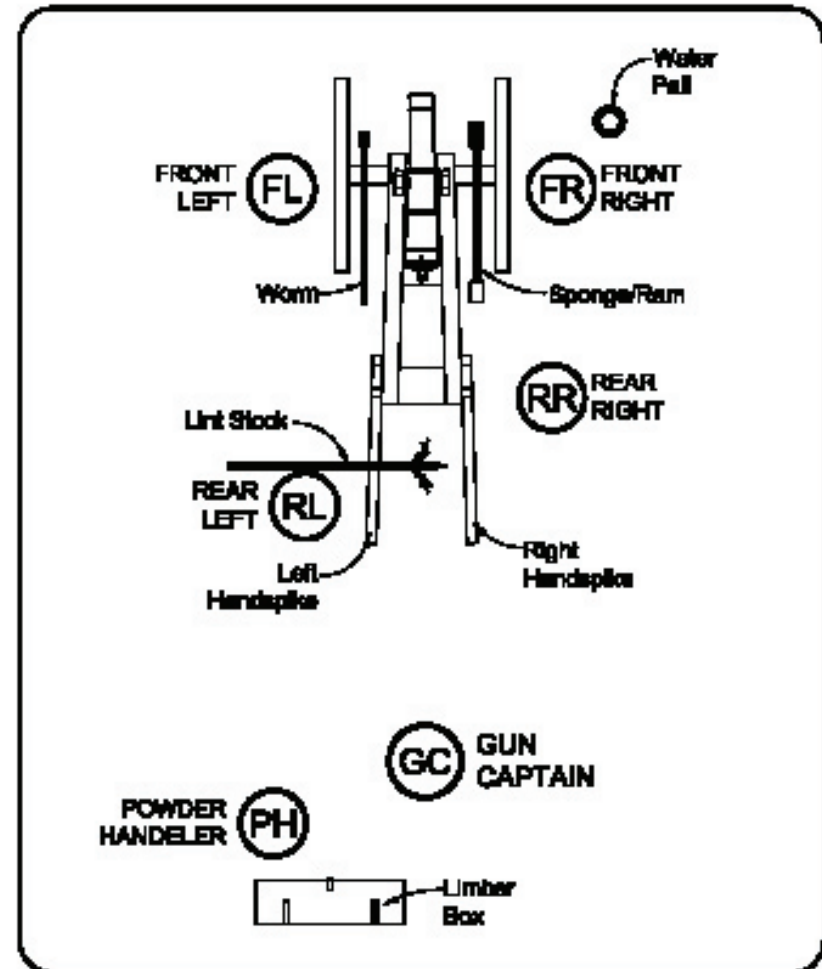
Front Right (FR) handles the sponge rammer. Required safety equipment: Hearing protection, leather gauntlets. *This is the No. 1 position in the 19th century drill.*

Rear Left (RL) handles the linstock and is responsible for keeping the end burning throughout the demonstration. Required safety equipment: Hearing protection. *This is the No. 4 position in the 19th century drill.*

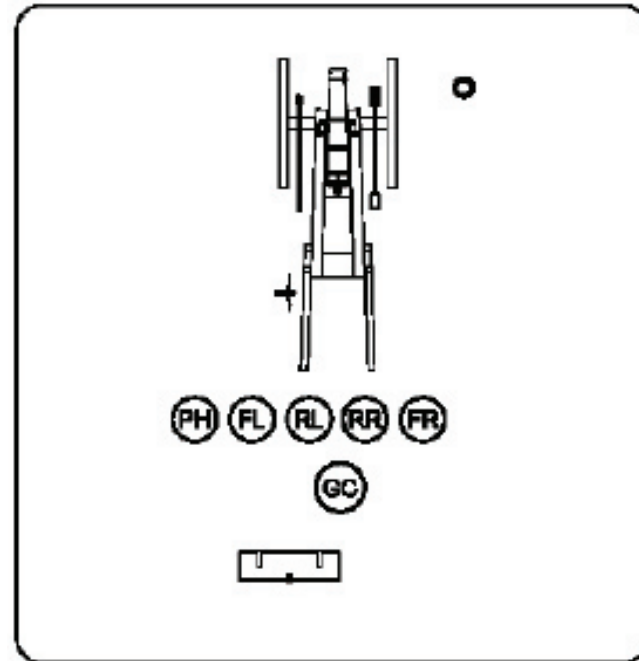
Rear Right (RR) handles the priming wire and quills. Required safety equipment: Hearing protection, leather thumb stall worn on left thumb. *This is the No.3 position in the 19th century drill.*

Powder Handler (PH) carries the cartridge to the gun in the leather haversack and assists in traversing the piece as required. Required safety equipment: Hearing protection. *This is the No.5 position in the 19th century drill.*

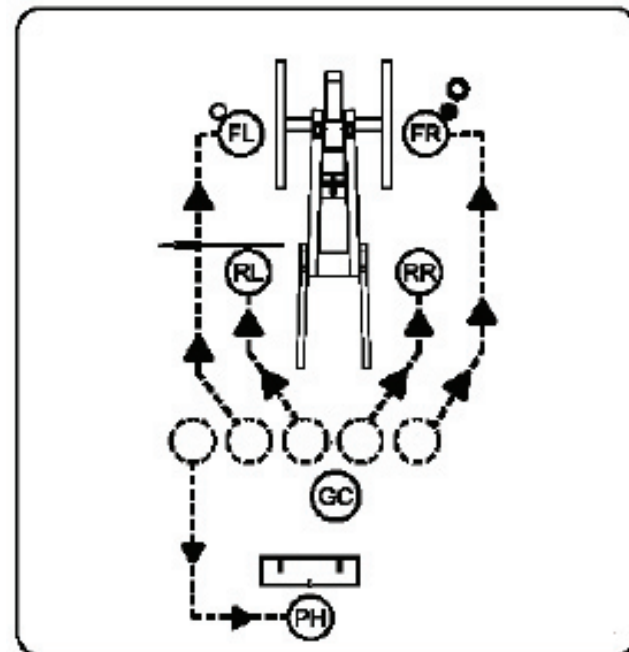
Gun Captain (GC) Commands the firing demonstration. *This is the Gunner position in the 19th century drill.*



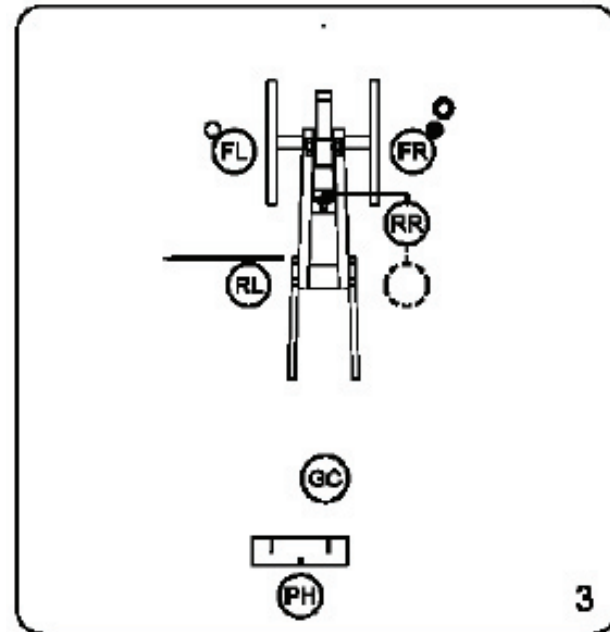
Form at the Rear of the Piece Members of the gun crew standing at their positions perform a “Right about Face” and walk to the rear of the gun. The Powder Handler walks from his post and joins the line at the right.



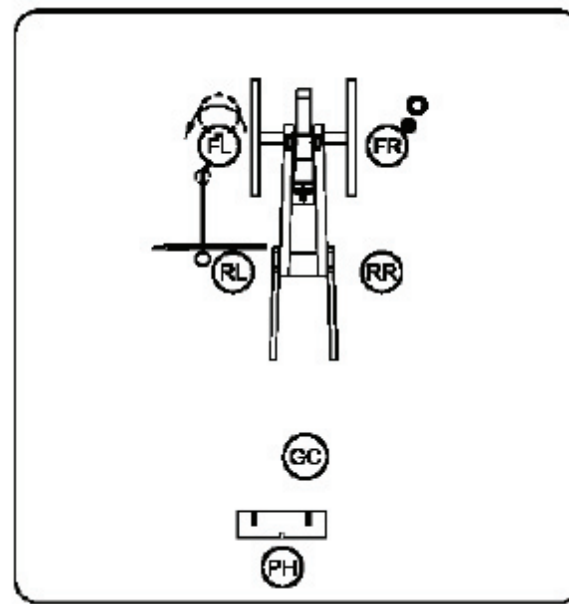
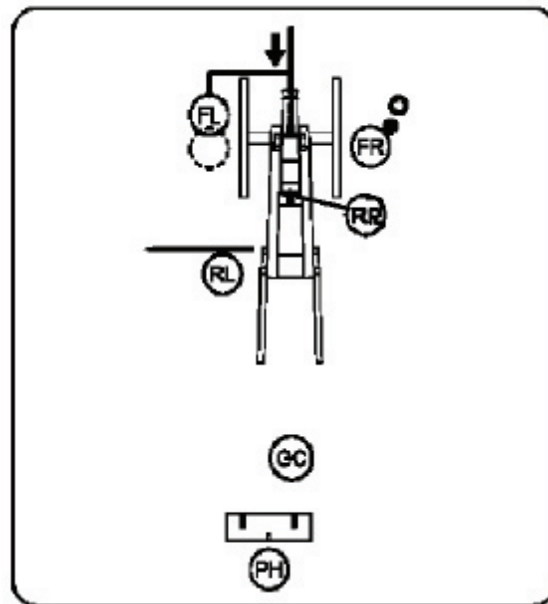
Man the Piece Gun crew performs a “Right about face” and walk to their positions on the gun. The Powder Handler walks to his post by the ammunition chest. When in position, RR checks that vent is clear with pick, and calls out “clear”.



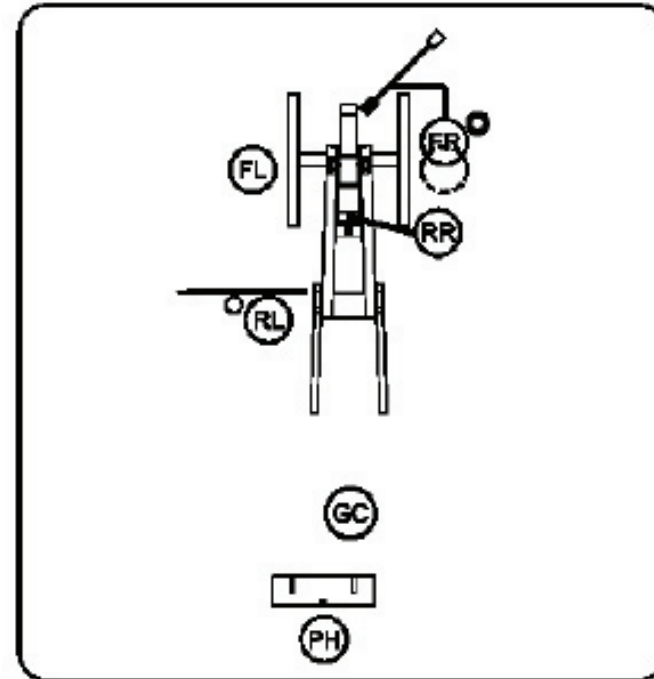
Tend Vent RR covers the vent thoroughly using the thumbstall, standing either “inside” or “outside” the wheel (depending upon the size of the gun).



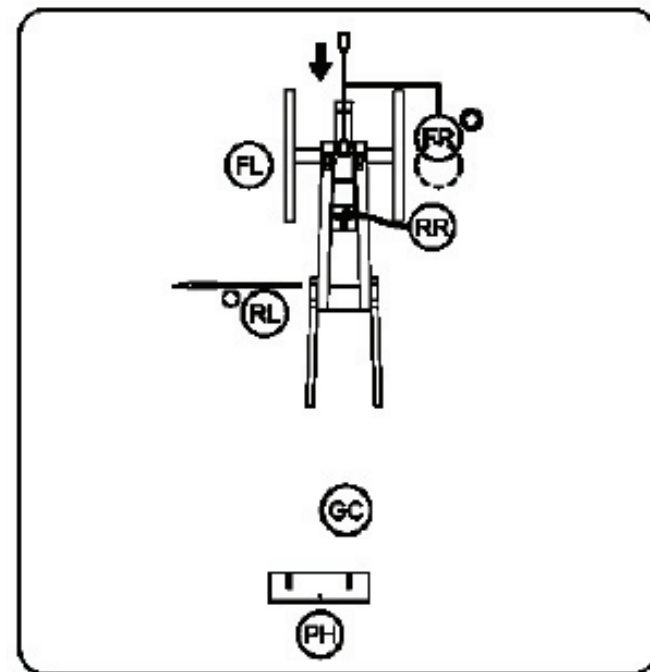
Search Piece FL inserts the wad hook into the bore, and slides it to the breech. He then turns the shaft of the wad hook to search for any debris from previous shots. After searching, he withdraws it. (If objects or debris are found, a second search is recommended.) L hands wad hook to RL, who holds it with his left hand, keeping the linstock in the right.



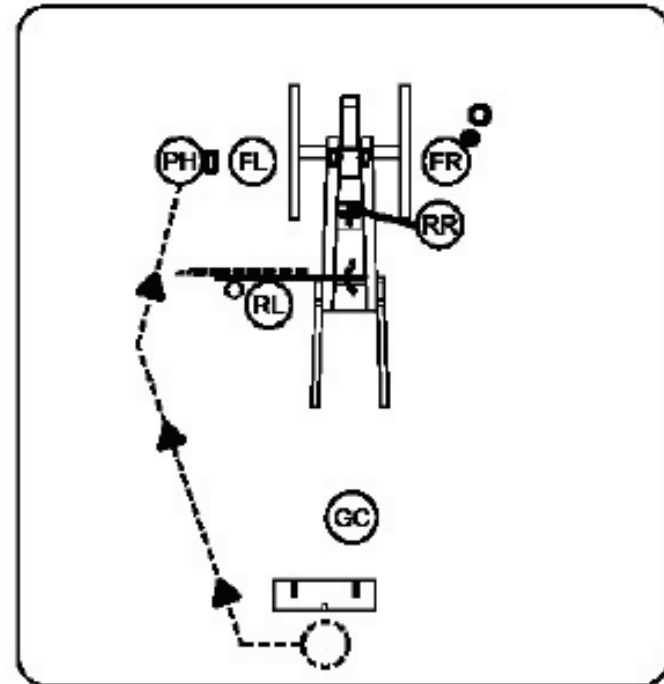
Advance Sponge FR dampens sponge head in bucket and shakes off any excess moisture. (The sponge head should be damp, but not soaking wet.) The sponge is placed against the lower rim of the muzzle of the gun.



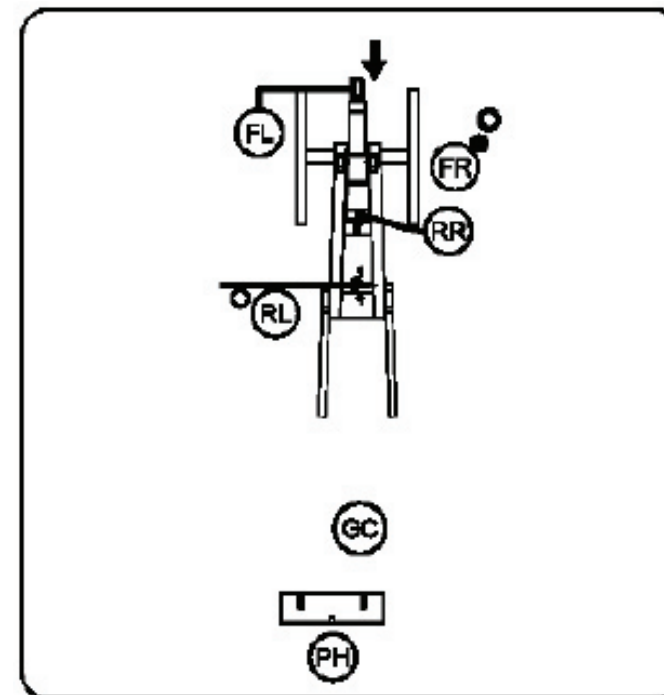
Sponge Piece FR inserts the sponge into the bore all the way to the breech. He turns the sponge several times. FR and RR maintain eye contact as RR maintains the seal over the vent at all times. When the sponge is withdrawn, FR reverses the staff bringing the ram head against the muzzle.



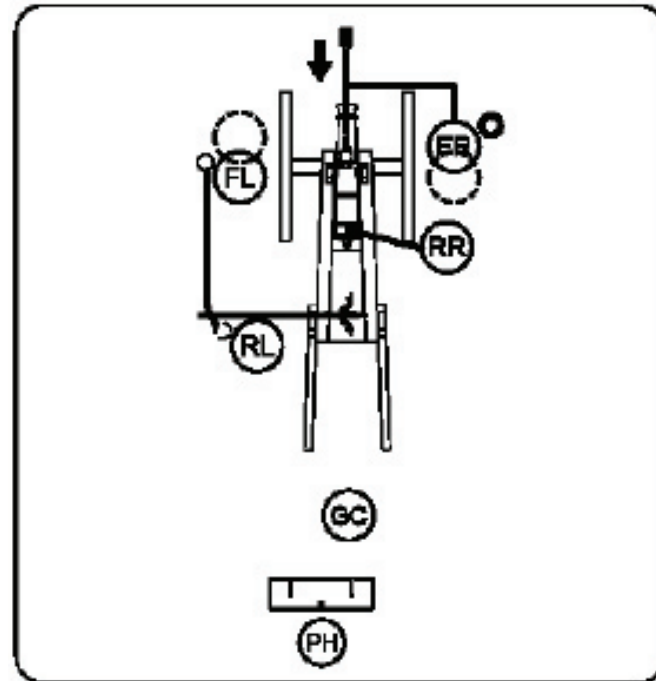
Handle Cartridge PH opens the ammunition chest, removes one cartridge and immediately places it in the leather haversack. The chest is closed. RL places the head of the linstock under the trail of the gun carriage. FL turns to his left to receive the cartridge. PH walks to the left of the gun, halts facing FL and hands him the cartridge. PH walks back to his position by the ammunition chest. FL holds the cartridge with both hands against his body.



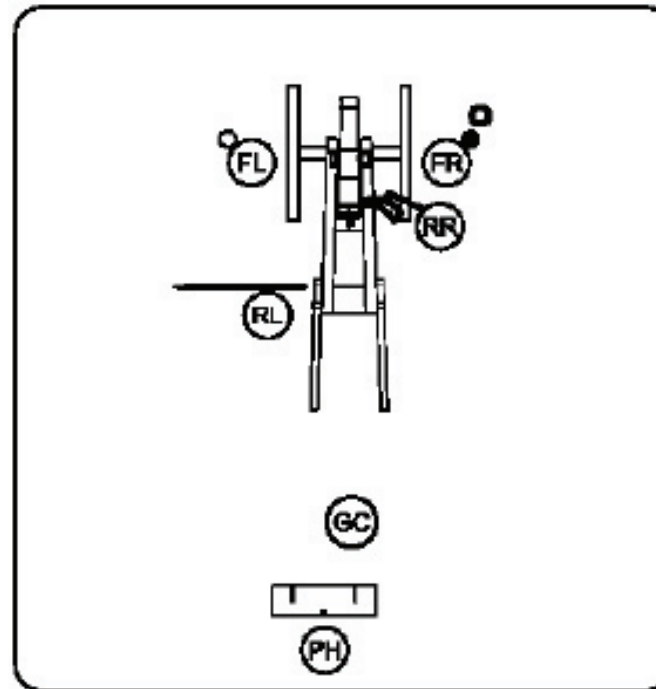
Charge with Cartridge FL turns about and extends his arms to place the cartridge POWDER END FIRST into the muzzle. (FL needs to minimize exposure of his hand over the muzzle, and be certain not to lean too far forward toward the muzzle.) When the cartridge is placed into the muzzle, FL takes the wad hook from RL and resumes his position on the gun.



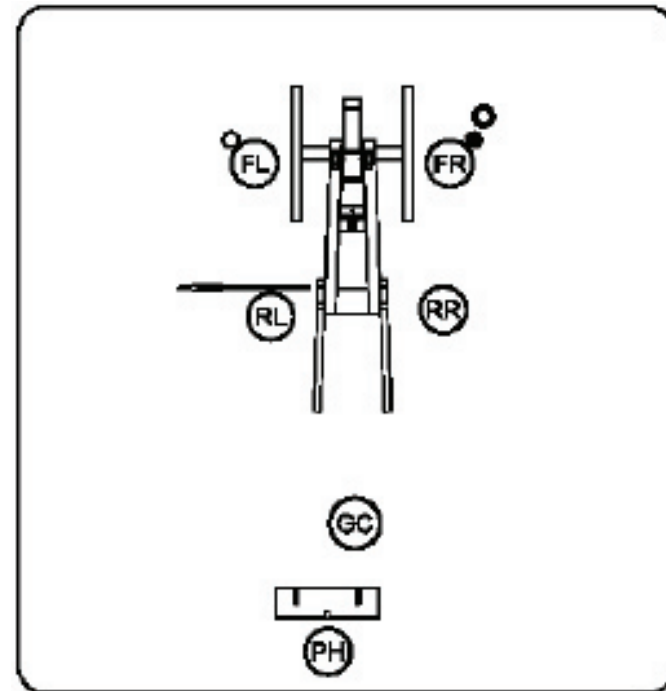
Ram Down Cartridge Using the rammer, FR pushes the cartridge to the breech of the gun in a smooth single movement. (The ram staff is held with both hands “palms up” and thumbs along the side of the staff. When ramming, avoid “throwing” the rammer into the bore, or pounding the cartridge.) When the cartridge is seated, FR immediately withdraws the rammer and resumes his position.



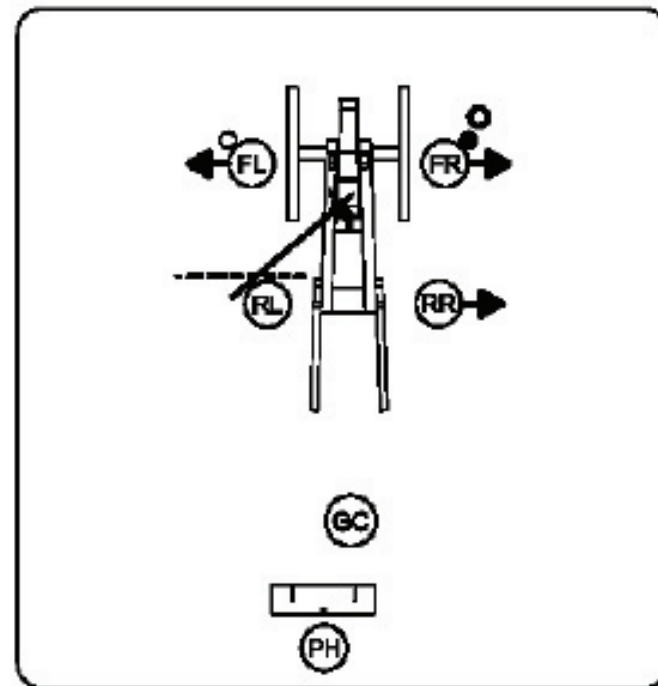
Prime RR withdraws his thumb from the vent. Using the left hand's thumb and forefinger only, take the priming wire (pick) and insert it into the vent hole, letting it drop onto the cartridge. Then still using only thumb and fore finger, push down and break open the cartridge, and the priming wire is removed and placed in its storage location. A quill is selected and placed into the vent again using only thumb and forefinger. RR returns to his original position.



Take Aim GC advances to the breech of the gun and stands to the left of the carriage and does not stand inside the carriage cheeks. PH walks to the handspike at the trail and stands so no part of his body is directly behind the trail or handspike. GC extends his arms and locks elbows and places his palms against the breech of the gun, and aims through his upright thumbs. GC adjusts elevation or depression of barrel, and by tapping upon the cheeks of the carriage indicates to PH which direction the gun must be traversed. PH lifts the trail of the gun with the handspike to traverse it as required. When GC is satisfied with the lie of the gun, he and PH resume their places.



Fire GC makes eye contact with RL and either with drawn sword or hand signal, gives a visual command accompanying the verbal command to fire. RL brings the linstock to the vent in a smooth motion from the breech toward the muzzle, touching the primer quill with the glowing end of the burning match.



Once the gun has fired, the gun captain and crew will secure the piece with the following motions:

Tend Vent

Search Piece

Advance Sponge

Sponge Piece

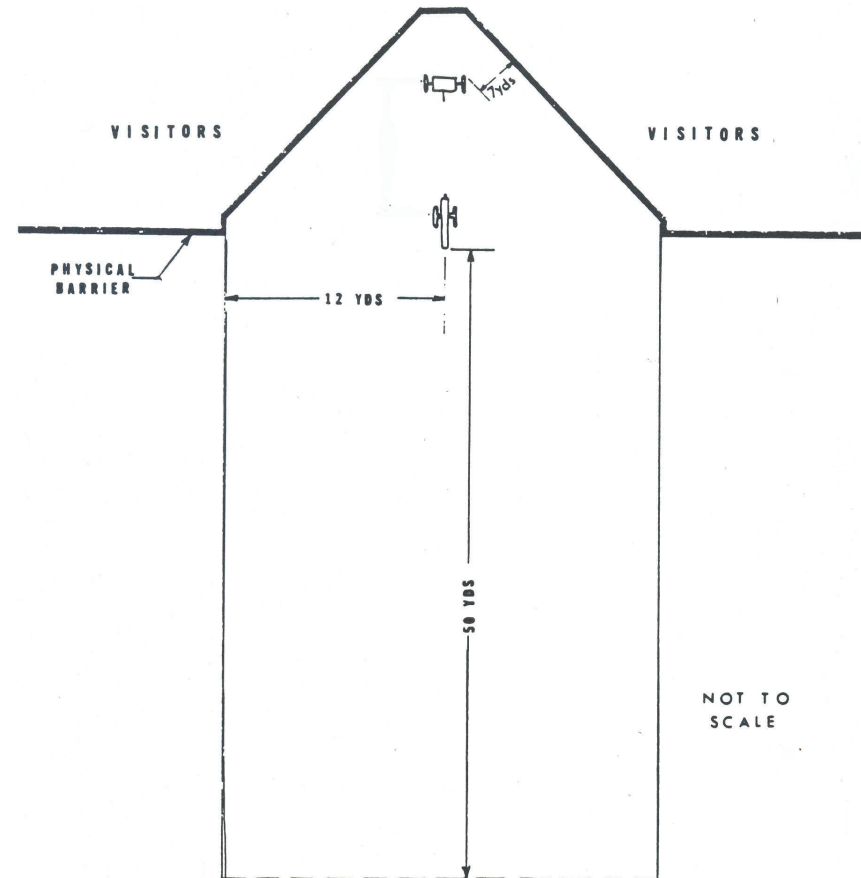
At this juncture, the gun captain may command “Secure Piece” and dismiss the crew.

RATE OF FIRE

Although through drill a crew may feel proficient, it is to be remembered that National Park Service safety guidelines prohibit rapid fire. The rate of fire permitted under NPS safety guidelines calls for a ten (10) minute interval between shots.

RANGE REQUIREMENTS

- A physical barrier must separate visitors from the demonstration area.
- Limber must be at least 7 yards away from visitors.
- Gun must be at least 12 yards away from visitors.
- No visitors must be forward of the plane of the muzzle face.
- There must be at least 50 yards of clear area down range.



PART V - MISFIRE PROCEDURES

Each park shall develop a written Misfire Plan to address the actions necessary to render the piece safe in the event of a Level I or Level II misfire. The plan must include directions on where and how unfired rounds will be disposed.

TYPES OF MISFIRES

A “Level I Misfire” is defined as a misfire that can be cleared at the demonstration area and the demonstration can continue.

A “Level II Misfire” is a misfire that cannot be cleared at the demonstration area without disrupting the demonstration. Specialized equipment is needed to make the piece safe.

CAUSES OF MISFIRES

Some Causes for Level I Misfires:

- The quill/primer failed to ignite, or incomplete ignition.

Some Causes for Level II Misfires:

- The cartridge was inserted with the extender end first.
- The cartridge tumbled in the bore so that the fire from the primer will not strike the powder charge.
- The cartridge was not seated fully. Once fire has been introduced to the bore, do not re-ram the charge!
- There is excessive foil on the base of the cartridge so that neither the priming wire nor the fire from the primer will strike the powder charge.
- There is an obstruction in the vent, such as the remains of a primer which separated when last fired.

LEVEL I MISFIRES

The duties of the detachment are enumerated below:

Demonstration Interpreter: The interpreter will explain the procedure to the audience and be alert for possible range violations.

Gun Captain: In the case of a misfire, the Gunner immediately calls out “Misfire!” and commands the gun crew to “Stand Fast!.”

The gun crew will wait for a minimum of three (3) minutes since the last observed smoke from the piece before taking further action. *This is a longer period than for 19th century artillery using friction primers because quill primers are more likely to cause hang fires a minute or more after the primer is lit.*

When a misfire occurs, the judgment, experience and coolness of the Gun Captain is essential. In some cases, such as smoke coming from the vent, it may be prudent to wait more than three minutes, but in no case shall the waiting time be less than that.

Note: *In the event of a smoking vent, the 3-minute count will not begin until no smoke is observed coming from the vent and/or muzzle. If smoke is observed at any time during the 3-minute count, stop and restart the count when the smoke has stopped.*

The Gun Captain will be alert during the repriming that all members of the detachment perform their duties safely and correctly.

Note: *When firing smaller guns such as the 3-Pounder, the following drill may be modified as needed. For instance, it will likely not be deemed necessary for the FL to move inside the wheels to reprime since he can safely reach over the wheels to perform that procedure without placing themselves behind the gun.*

All cannoneers not mentioned in the drill below, will remain in their “Take Aim” positions until the Gun Captain determines that sufficient time has elapsed and gives the command:

“REPRIME THE PIECE”

Note: Before performing the following procedures, the FL should remove any items that may encumber him or make contact with the gun or carriage such as his canteen.

1. The FL steps inside the wheel to a position near the axle tree with his back to gun.

The RR steps up to a position even with the axle, facing the gun.

2. The FL removes any remaining primer material protruding from the vent using the middle and index fingers of his left hand (palm up).
3. The RR passes the priming wire to the RF over the top of the wheel.
4. The FL takes the priming wire between his left thumb and forefinger and drops into the vent. He then re-pricks the cartridge, removes the wire and hands it back to the RR.

- 5.. The RR passes a quill primer to the FL over top of the wheel then returns to his “TAKE AIM” position.
6. The FL places the primer into the vent and then returns to his “TAKE AIM” position making sure to keep his back to the piece while stepping out.
7. Once the FL is in position he calls out, “READY.”
8. The Gun Captain gives the command to “FIRE.”

The repriming procedure may be tried twice. Once three primers, including the initial demonstration primer, have been expended, the piece should be unloaded using Level II misfire procedures.

LEVEL II MISFIRES

When the piece has failed to fire after three primers have been expended, and the primers are igniting properly, then it is evident that there is a serious problem with the cartridge. In most cases, the cartridge was inserted backwards or the cartridge tumbled in the bore. In these circumstances, the piece will have to be unloaded **administratively**.

Unloading a piece through the muzzle is a hazardous and delicate procedure. Do not attempt to unload through the muzzle until all evidence of smoke from the muzzle and vent has ceased. Every effort must be made to move as carefully and coolly as possible. Distractions such as visitor kibitzing or razzing must be eliminated by park personnel. It is best to explain the nature of the situation to the visitors and move them away from the demonstration area.

This procedure is administrative and **should not** be performed using a set drill. It is recommended that two experienced people perform the following procedures. The bulk of the detachment should be used to secure the demonstration area and range.

Equipment

The following equipment will be necessary to safely unload the piece from the muzzle.

- Gauntlets
- Priming Wire
- Water Supply
- Bucket(s)
- Two (2) 60 cc veterinary syringes
- Worm*
- CO2 Fire Extinguisher with Vent Adapter*
- Face Shield*
- Sponge Bucket

*The need for this item will be determined by the method used to unload the piece.

Procedure

After waiting at least ten (10) minutes. Two experienced cannoneers will perform the following procedure to unload the piece from the muzzle.

1. One person will step into the FL position for a Level I misfire while the other will bring a bucket of water and the syringes to a position even with the left end of the axle. **On smaller guns like 3-Pounders, both cannoneers may work from outside the wheels.**
2. The person inside the wheels will take a full syringe, passed over the top of the wheel and inject the water into the vent. He will repeat the process two more times.
3. The person inside the wheel will insert the priming wire into the vent and re-prick the charge.
4. The person inside the wheel will reach back and gently turn the elevating screw until the muzzle is fully elevated.
5. The person inside the wheel will continue injecting water into the vent until it overflows. When this happens, he will leave his position in the same manner as does FL during a Level I misfire.
6. **Once the breech is flooded, wait at least five (5) minutes before attempting to remove the cartridge.**



When Using a CO2 Fire Extinguisher:

7. One person will put on the welder's gauntlets and face shield and take the fire extinguisher to the rear of the piece.
8. Holding the hose adapter in his strong hand and the cylinder release lever in his weak hand, he presses the adapter into the vent. Holding the adapter firmly against the breech, he gives a quick blast of CO2, ejecting the cartridge.
9. The cartridge is placed in the sponge bucket and broken up to dissolve the powder.
10. The fouled water is disposed of as prescribed by the written misfire plan and the sponge bucket is re-filled.
11. Depress the muzzle and allow excess water to drain from the bore.



When Using the Worm:

7. Fill the entire bore with water using buckets or a hose.
8. One person, wearing the welder's gauntlets will use the worm to remove the round.
9. The cartridge is placed in the sponge bucket and broken up to dissolve the powder.
10. The fouled water is disposed of as prescribed by the written misfire plan and the sponge bucket is re-filled.
11. Depress the muzzle and allow excess water to drain from the bore.

PART VI - ARTILLERY LABORATORY

SPONGES

A sponge should be replaced when it: a) does not fit the bore, or b) is frayed and worn.

Materials Needed:

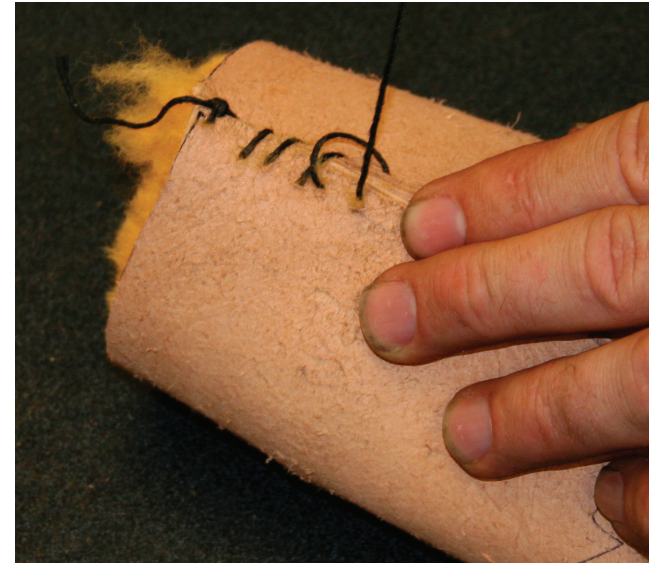
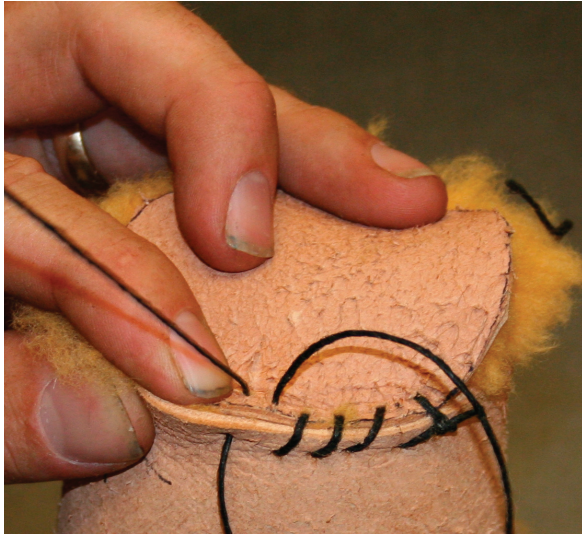
- Vegetable-tanned saddle shearling (fleece)
- Leather for making washers
- Copper or brass nails/tacks, 3/4 inch
- Hammer
- Waxed thread
- Glover's needle, or awl and saddler's needles
- Sponge pattern
- Pen
- Heavy duty scissors

1. Remove the old sponge from the sponge-head. Inspect the sponge head and repair if necessary. It is recommended that you soak the sponge head overnight in linseed oil and allow it to dry before replacing the sponge.
2. Lay the sponge and end patterns on the flesh side of the shearling. Trace the patterns with a pen, making one side and two end pieces. Trace out a washer on a piece of leather using a pattern or an old washer.
3. Cut out the pieces of shearling and leather with heavy-duty scissors.



4. Sew the side seam of the sponge body using an overhand stitch. An awl with saddler's needles or glover's needle may be used. The body will form a cylinder with the fleece inside.

5. Sew the end onto the sponge body.

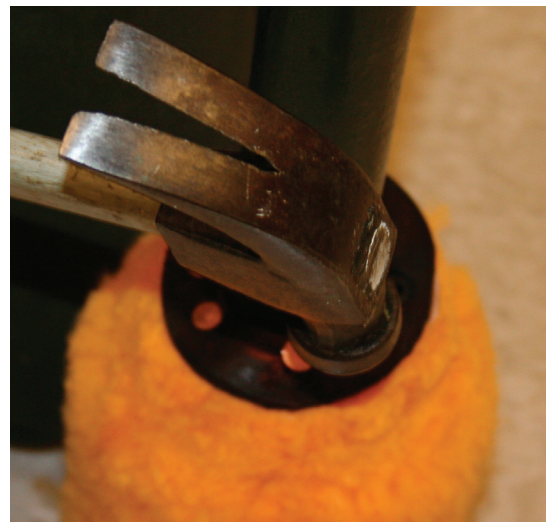


6. Turn the sponge inside out. A large wooden dowel or the handle of a small hammer may be used to help turn the sponge inside out.

7. Place the second shearling end piece on the end of the sponge-head. Slip the sponge over the sponge-head and pull so the sponge fits snugly to the head.



8. Trim excess fleece around the opening so that the sponge can fit snugly around the staff.
9. Slip a leather washer with pre-punched holes around the staff. Drive the nails through the washer holes, through the shearling and into the sponge-head. Also drive one nail into the end of the sponge head.
10. Test the new sponge for proper fit. Trim if necessary.



BLANK CARTRIDGES

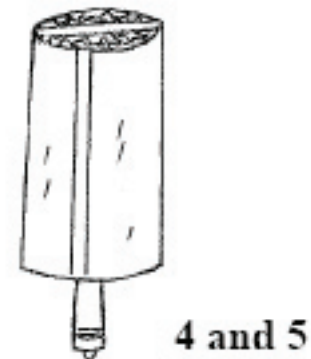
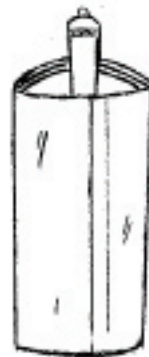
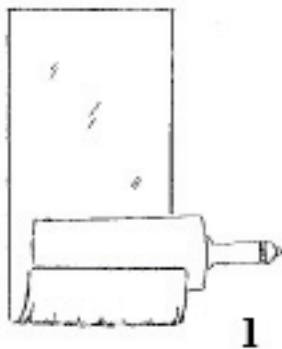
A cartridge must be long enough to prevent tumbling in the bore, must not allow powder to sift out of the aluminum foil container, and must clearly indicate the end to be inserted first into the bore of the cannon.

The Table of Maximum Loads must be consulted for correct powder charges.

Materials Needed:

- Heavy duty aluminum foil
- Former for caliber of the cannon (tapered to be 1/2 inch smaller than the bore at the large end)
- Damped peat moss or vermiculite
- Powder measure

1. Wrap three layers of heavy-duty aluminum foil around the tapered cartridge former, leaving 2½ to 3 inches of foil to overlap the end of the former.
2. Place a piece of clear tape along the length of the cartridge.
3. Fold the overlapped section of foil over the face of the former, tap the former on a solid surface to crimp and seal the face of the cartridge.
4. Place a piece of clear tape over the face of the cartridge to further seal it.
5. Remove the cartridge former



6. Mold an approximately 4½” x 4½” square, double layered, of heavy-duty aluminum foil over the face of the cartridge former. Fold the edges of foil down to form a round disc just slightly smaller than the diameter of the former. Repeat the process so that two discs are available.

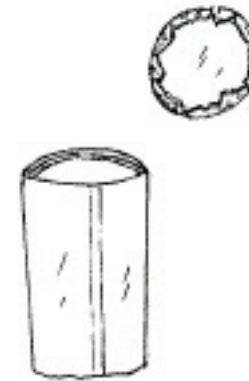


6a



6b

7. Insert one of the circular discs into the empty cartridge so that it is flat against and seals the bottom of the cartridge.



7

8. Pour a measured amount of powder into the cartridge casing.
9. Insert the second aluminum foil disc on top of the powder.



8 and 9

10. At a point approximately 2” above the second disc, begin to crimp the aluminum foil in and down over the disk until the powder is completely sealed in the cartridge below the disk. At this point the cartridge should look like an hourglass.

11. Make a wad/cartridge extender by taking a piece of heavy-duty aluminum foil and wadding it into a loose ball.

12. Insert the wad/cartridge extender into the cartridge above the crimped section.



10, 11 and 12

13. Fold the remaining foil over the wad/cartridge extender.

14. Push down, shape, and mold the wad/cartridge extender so that the cartridge has the appearance of a fixed round of ammunition. While the powder section of the cartridge will be in the shape of a cylinder and the wad extender will be spherical, it is still suggested that measures be taken to insure that the powder portion is easily distinguishable from the extender section. Place a red “X” in magic marker or otherwise mark the powder cylinder so that it is readily recognizable.



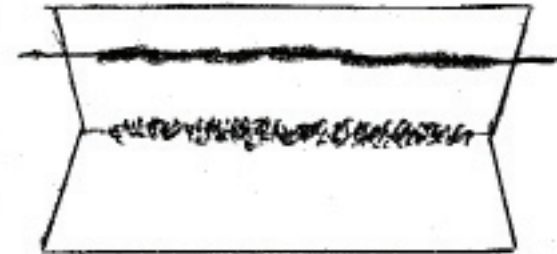
13 and 14

QUILL PRIMERS

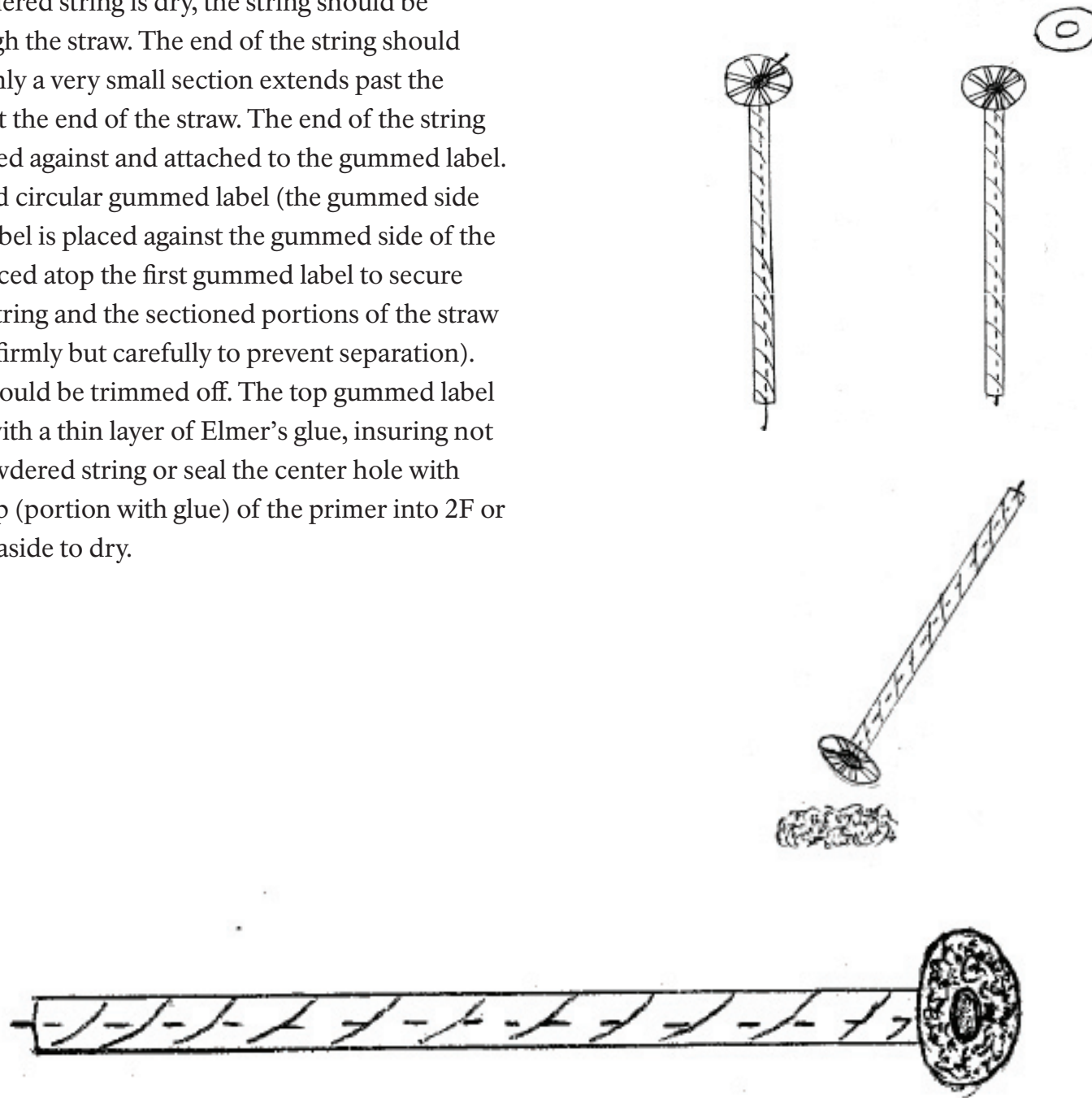
The preferred method for making quill primers for artillery will be to use a whole paper soda straw, thin string or dental floss, Elmer's type glue, 1¼" circular gummed labels, and FFG or FFFg powder.

Cut a piece of string slightly longer than the straw (approximately eight inches in length), allowing enough space at either end to grip the string between thumbs and forefingers. Dip the string in white glue, making certain that the entire piece of string (excepting those portions being held between thumbs and forefingers) are coated with glue. Once coated, the string will undoubtedly have one or two larger globs of glue adhering to the string, so gently brush the globs against a paper towel or newspaper to remove the excess glue. Immediately immerse the string in powder. Shake off any excess powder and set the string aside to dry.

Using a small scissors, segment one end of a paper straw into six or seven sections approximately 1/4-inch to 3/8-inch in length. Peel back the cut portions so that they are perpendicular to the straw fanned out in a propeller shape. Using a hole punch, cut the centers out of two circular gummed labels. Insert the uncut end of the straw through the center of one of the cut circular labels so that the gummed portion of the label sticks to the underside of the propeller cut sections of the straw.



When the powdered string is dry, the string should be threaded through the straw. The end of the string should be cut so that only a very small section extends past the gummed label at the end of the straw. The end of the string should be pressed against and attached to the gummed label. Then the second circular gummed label (the gummed side of the second label is placed against the gummed side of the first label) is placed atop the first gummed label to secure the powdered string and the sectioned portions of the straw (press together firmly but carefully to prevent separation). Excess string should be trimmed off. The top gummed label is then spread with a thin layer of Elmer's glue, insuring not to cover the powdered string or seal the center hole with glue. Dip the top (portion with glue) of the primer into 2F or 3F powder. Set aside to dry.



SLOWMATCH

Slowmatch is manufactured utilizing 100% cotton rope—1/4", 5/16", or 3/8" being preferable. Clothesline or drapery is suitable, although finding 100% cotton line is difficult in these days of man-made fibers. Even if the label indicates the rope is 100% cotton, there may be a core of nylon or synthetic material. If so, the core can be removed by sectioning the rope, gripping the core with pliers or other suitable tool, and drawing out the core.

Before making the rope into slowmatch, the stiffening, or sizing, must be removed. This can be accomplished by stretching the rope outside in an exposed location where it would be exposed to the elements for a period of time, or running it through a washing machine for a few cycles and allowing it to dry; the latter would, of course, be much quicker.

Once the rope is properly prepared, it should be cut into sections between three and six feet long depending upon the particular linstock or other requirements. The rope is then soaked in a supersaturated solution of potassium nitrate in water. Potassium nitrate can be obtained, usually with little or no difficulty, from any chemical supply facility. Using a holding approximately two to three quarts of water, heat the water to a temperature slightly above lukewarm. Maintain that temperature, stir in the potassium nitrate until no more will dissolve (one pound is usually sufficient with two quarts of water). Heat the solution to a simmer and attempt to dissolve more potassium nitrate. The supersaturated solution has been achieved when no more potassium nitrate will dissolve.

After removing the solution from the heat source, immerse the sections of cotton rope in the supersaturated solution. Periodically move the rope around in the solution so that all portions of the rope have an opportunity to become thoroughly impregnated. Make sure the rope stays completely immersed. Approximately one to two hours should be sufficient time for the rope to soak, but a little additional time could not hurt.

When the rope has finished soaking, hang the rope up to dry, insuring that any drops which fall from the drying rope do not fall where they can stain anything. Be sure to store the slowmatch in a safe location.

**National Park Service
Tables of Maximum Loads for Artillery**

18th Century

Weapon Type	Caliber	Maximum Blank Charge
Swivel Gun	2- pounder	4 ounces Cg or Fg
“Grasshopper” Bronze	3- pounder	6 ounces Cg or Fg
British Light Gun	6- pounder	12 ounces Cg or Fg
British Field Howitzer	5.8 inch	10 ounces Cg or Fg
Iron Gun	3- pounder	6 ounces Cg or Fg
Iron Gun	4- pounder	8 ounces Cg or Fg
Iron Gun	6- pounder	10 ounces Cg or Fg
Iron Gun	12- pounder	20 ounces Cg or Fg
Howitzer	8 inch	36 ounces Cg or Fg
Howitzer	8.76 inch	16 ounces Cg or Fg
Iron Gun (Armstrong)	9- pounder	16 ounces Cg or Fg
Iron Gun (Armstrong)	18- pounder	32 ounces Cg or Fg
Iron Gun (Armstrong)	24- pounder	36 ounces Cg or Fg

19th Century

Weapon Type	Caliber	Maximum Blank Charge
M1841 Gun	6- Pounder	10 ounces Cg or Fg
M1841 Field Howitzer	12- pounder	10 ounces Cg or Fg
M1841 Mountain Howitzer	12- pounder	8 ounces Cg or Fg
M1857 Gun- Howitzer (Napoleon)	12- Pounder	20 ounces Cg or Fg
Parrott Rifle	2.9 or 3 inch	10 ounces Cg or Fg
Ordnance Rifle	3 inch	10 ounces Cg or Fg
Lyle Line- Throwing Gun		1.5 ounces Cg or Fg

Note: Maximum blank charges for weapons not identified on this chart will not exceed 50% of the service charge for solid shot. For those weapons for which a service charge is unknown, the maximum blank load will not exceed 2.5 ounces of Fg powder for every 1 inch of bore diameter.

PART VII - ARTILLERY DEMONSTRATION CRITIQUE

NATIONAL PARK SERVICE ARTILLERY DEMONSTRATION CHECKLIST

Before

- () The gun, limber and implements have been inspected using the Artillery Inspection Checklist.
- () Ammunition is properly prepared, with only enough for one days demonstrations.
- () All implements are in their correct place on the piece (not on the ground).
- () Misfire equipment in place at the firing position.
- () Required number of demonstration personnel are present to safely fire the piece.
- () Limber placement is at least seven yards distance from visitors barricade.
- () Cannon placement is at least twelve yards distance from the visitors barricade and muzzle is forward of all visitors.
- () Visitors have a good field of vision of the demonstration.
- () The interpreter has a clear view of all the visitors and downrange area.
- () The carriage is free to recoil if necessary so it won't buck or break carriage.
- () There is a fixed barricade between the visitors and the demonstration area.
- () The wind conditions are not too strong for a safe demonstration.
- () Conditions are not too dry as to risk a range fire from the muzzle blast.
- () First Aid kit is available.
- () Emergency communications are available.

- () There are no open fires nearby (campfires, brush clearing, etc.).
- () Final review of misfire drill and accident procedures.

During

- () The crew is following the approved manual with each person is in their correct position during each portion of the drill.
- () The sponge is adequately damp, but not soaking wet.
- () Cannoneer # 1 and Cannoneer # 2 (the two cannoneers who service the muzzle of the piece) are wearing gauntlets.
- () Gauntlets are not so stiff or heavy as to cause fumbling or other difficulty.
- () When quill primers are used: linstock and lantern are handled safely.
- () The sponge head is not allowed to contact the ground at any time during the demonstration (to prevent grass, sand etc. from sticking to it).
- () If there is a misfire, is it handled correctly.

After

- () After firing, the piece was cleared of all cartridge material, washed and dried.
- () All weapons, explosives and accessory pieces are accounted for.
- () The field piece and limber are secured and stored properly.
- () The demonstration area is inspected carefully for smoldering residue.
- () Sponge head is thoroughly rinsed and dried.
- () All remaining explosives are returned to storage facility.

Demonstration Supervisor: _____ Date: _____

PART VIII - ARTILLERY COMPETENCY EXAM

Rating Sheet – Proficiency in Artillery Drill

Name _____

Date _____

Gun Captain

- ___ Gives all command clearly and in the proper order
- ___ Sets himself in a good observation position before issuing the “Ready” command
- ___ Waits to give the “Cease Firing” command until the sponge has been inserted
- ___ Demonstrates ability to deal with safety issues as they arise (including misfires)
- ___ Demonstrates full competence in all other positions

- ___ Full Competence ___ Approaching Full Competence
- ___ Failed

Comments:

Front Right Cannoneer

- ___ Advance Spnge (uses proper footwork, proper positioning at the muzzle)
- ___ Sponge (Sponge reaches breach, eyes on the vent)
- ___ Ram Down Cartridge (proper hand position, eyes downrange)

- Misfire
- ___ Remains in Prime position, eyes down range

- ___ Full Competence ___ Approaching Full Competence
- ___ Failed

Comments:

Front Left Cannoneer

- ___ Hands wad hook to RL after searching the piece
- ___ Handle Cartridge (Holds cartridge against body)
- ___ Charge With Cartridge (minimizes exposure of hands in front of muzzle)
- ___ Prime (eyes down range)
- ___ Fire (Begins “Load” cycle immediately after gun fires)
- ___ Cease Firing (Returns to “To Your Posts” position)

Misfire

- ___ Waits for command to re-prime
- ___ Re-prime (keeps back to muzzle, does not touch wheel)
- ___ Extracts primer with the left hand palm up then drops it to the ground
- ___ Takes priming wire from RR over the top of the wheel
- ___ Drops priming wire into vent then pushes down to re-pierce the charge
- ___ Properly takes new primer from RR
- ___ Properly re-replaces new primer
- ___ Properly returns to position of Ready

___ Full Competence ___ Approaching Full Competence
___ Failed

Comments:

Rear Right Cannoneer

- ___ Tend Vent (fully covers vent with thumbstall)
- ___ Remains at the vent until “Prime>”
- ___ Holds priming wire along the shaft with thumb and forefinger when piercing the charge (feels for caartridge)
- ___ Steps outside wheel as soon as primer is inserted.
- ___ Fire (Steps in to tend the vent immediately after the piece fires)

Misfire

- ___ Moves to center wheel on the command to re-prime the piece
 - ___ Hands priming wire and the primer to FL over the top of the wheel
 - ___ Returns to “Take Aim” position after giving FL the primer.
- ___ Full Competence ___ Approaching Full Competence
___ Failed

Comments:

Rear Left Cannoneer

- ___ Properly tends slowmatch throughout the drill.
- ___ Search Piece (takes wad hook from FL with left hand)
- ___ Handle Cartridge (holds head of linstock under the carriage)
- ___ Prime (withdraws linstock from under carriage)
- ___ Makes eye contact with GC prior to "Fire" command
- ___ Fire (smooth motion with linstock)

Misfire

___ Remains in position safely tending the linstock until "Fire" command is given.

- ___ Full Competence ___ Approaching Full Competence
- ___ Failed

Comments;

Powder Handler

- ___ Handle Cartridge (Places cartridge in haversack, brings it to the front of the gun, hands it to FL, and returns to chest)
- ___ Take Aim (Proper position at handspike or tiller)

- ___ Full Competence ___ Approaching Full Competence
- ___ Failed

Comments:

APPENDIX A - NATIONAL PARK SERVICE MANUAL FOR THE HANDLING AND FIRING OF 18TH CENTURY SWIVEL GUNS IN INTERPRETIVE DEMONSTRATIONS

INTRODUCTION

This manual sets forth the procedures that must be followed by persons demonstrating the 18th century swivel gun three-(3) man drill in areas administered to the public by the National Park Service. It also provides instruction on proper maintenance, inspection and repair procedures.

This manual draws heavily on the already established NPS 18th century field artillery guideline in wide use throughout the system. NPS employees Eric Williams, Don Long and Timothy Boyd revised this NPS manual. The credit for laying the foundation for the original manual needs to be given to former NPS historians, William Meuse and Jack Dugan who both have extensive backgrounds and years of experience in the subject matter. Their many hours spent on the original publication are greatly appreciated.

Credit should also be given to Mike Williams who provided a preliminary version of a swivel gun drill.

INTRODUCTION TO THE SWIVEL GUN

The iron or brass swivel gun was in wide use throughout the American colonial period and the Revolutionary war. They were particularly effective defending frontier forts against attack. Larger guns were needed to lay formal siege to a fort,

but for close range, anti personnel use the swivel gun was ideal. Being a small stationary cannon, with only a 1 ½ - 3 inch bore, it was simple to load and fire. Apparently there was no formal drill for firing the swivel gun, and just two or three men could serve it.

The modified Stevens drill reduces the size of the field artillery crew from sixteen to six, and this has done well with the larger field artillery cannons. The swivel gun is small in size, with a six-man gun crew firing the weapon could be dangerous. Using a three-man guncrew, modified Stevens drill, written in simplified English, the three-man crew would have better control of the weapon.

In the interest of safety in firing demonstrations of the swivel gun, the modified Stevens drill for field artillery and a three-man gun crew adapts nicely with the swivel gun. The following pages contain the commands for the drill, their respective movements, and special notes (*Italics*) on safety and interpretation.

NOMENCLATURE OF SWIVEL GUNS

Utility was more important than firepower. With no mount but the Y-shaped swivel, swivel cannon, swivel guns, or just plain “swivels” as they came to be called could instantly be turned in any direction. They could be swung around and pointed as fast as a man could aim a musket.

Heavy field artillery had its place, and different sizes had different functions; but wherever men needed mobility, light weight, and speed, the swivel gun became an all purpose weapon. The basic design of the swivel gun was as small as 16 inches long with a 1.5 inch bore and often 23 inches long with a 2.9 inch bore.

Usual bore diameter and ball weights.

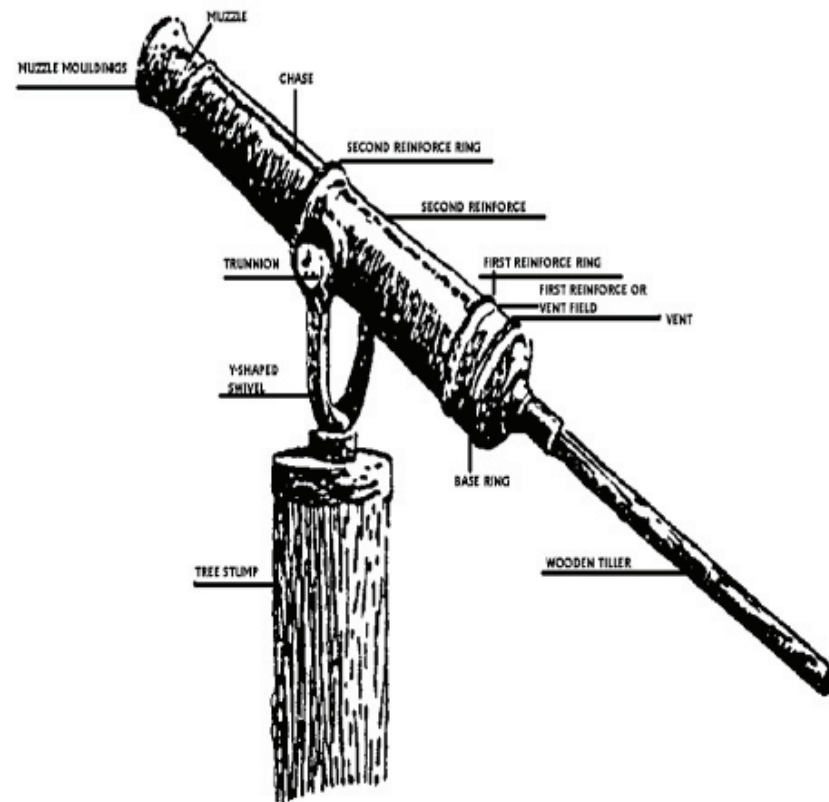
½ Pounder – 1.5” Diameter

¾ Pounder – 1.75” Diameter

1 Pounder – 2.1” Diameter

1 ½ Pounder – 2.5” Diameter

3 Pounder – 2.9” Diameter



CARE AND MAINTENANCE

Most of concerns of care and maintenance for a swivel gun and its implements are essentially the same as standard artillery, referenced elsewhere in the Artillery Manual.

Some special considerations for the swivel gun are listed below.

The Gun, Tiller, and Mounting Post

1. After each day's firings, the bore is thoroughly cleaned using fresh water. A mild, pure soap (i.e. Ivory) may be used to facilitate cleaning.
2. The vent and vent field is cleaned using fresh water and a soft bristle brush.
3. Vents were usually .2" in diameter. A vent in excess of .3" diameter should not be used. On reproduction guns, an extra vent piece should be purchased with the gun.
4. Polishing and/or burnishing of original guns is prohibited. This tends to obscure markings.
5. The Gun Book is kept up to date and notations on bore and vent diameters are updated at least annually.
6. Paint is to be renewed as necessary.
7. It is recommended that cracks in the tiller be filled, since they allow water to seep into the wood.
8. The mounting post for most swivels should be made of a hardwood and resistant to insects and rot (i.e. cedar, cypress, locust, or treated wood).
9. Be especially aware of cracks and check in the mounting post since it receives the shock of the recoil.
10. A light oil or grease on the trunnions will allow the tube to be maneuvered more easily.
11. Since most swivel guns and yokes are easily removed from the mounting post and carried, taking them off at the end of the day's firings provides the best security.

TABLE OF MAXIMUM LOADS

½ Pounder – 1.5" Diameter	2 Ounces
¾ Pounder – 1.75" Diameter	2 ¼ Ounces
1 Pounder – 2.1" Diameter	2 ½ Ounces
1 ½ Pounder – 2.5" Diameter	2 ¾ Ounces
3 Pounder – 2.9" Diameter	3 Ounces

Swivel Gun Inspection Checklist

- Your overall impression is favorable

The Tube:

- The tube is clean and free of dust and corrosion
- No sign of external damage or strain (dents, cracks, etc.)
- Inside of the bore is clean and relatively smooth.
- No internal signs of damage (bulges, lodgments, pits, etc.)
- No sign of corrosion damage at breech of the bore.
- On iron guns with liners, the liner is secure.
- The vent is clear and of acceptable size.
- No signs of cracks or bending around the trunnions.
- No signs of weakness at the chaplets on bronze tubes.

The Yoke:

- The yoke is mounted securely on the post.
- The yoke accommodates the tube easily (i.e. the trunnion fit securely, yet allow the tube to swivel with ease.)
- No signs of cracks or bending in any portion of the yoke.

The Post:

- The post is mounted securely in the ground.
- There are no signs of deterioration (rot, insect damage) which would cause an unsafe demonstration.
- No serious cracks which would make the demonstration unsafe.
- Deep cracks have been repaired.

Equipment:

- All necessary equipment is present.
- Sponge is in good condition and fitted to the bore.
- Rammer head is secure and free of cracks.
- Small items in good condition (lintstock, thumbstall, buckets, etc.)
- Prongs of the worm are sharp and not bent.
- Haversack is clean and free of spilled powder.
- The gun book is being kept up to date.

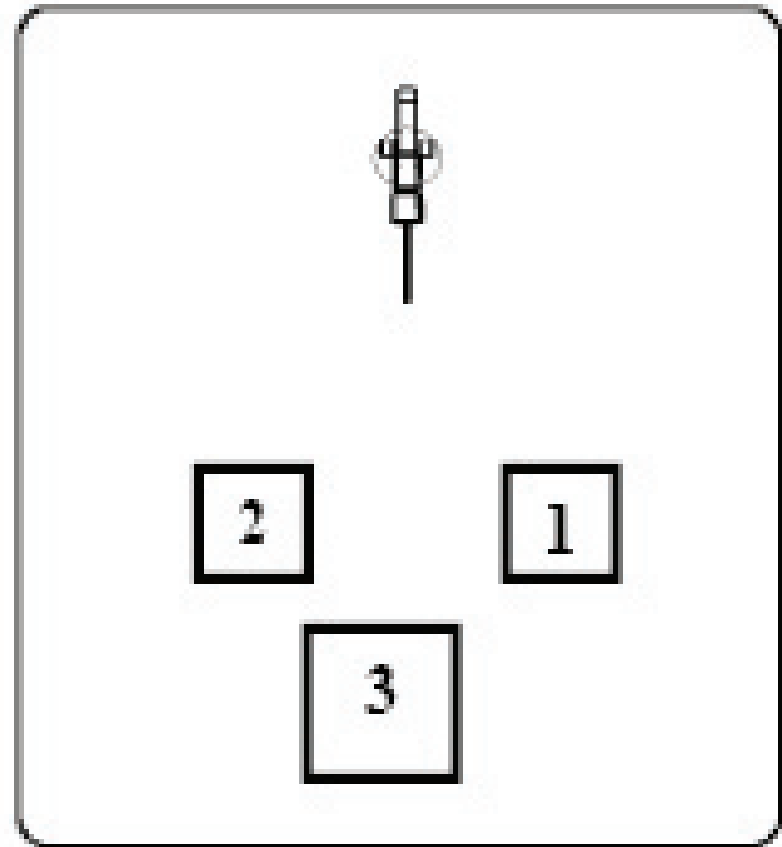
18TH CENTURY SWIVEL GUN DRILL

1. ATTENTION! (atten...SHUN!)

The men of the crew will fall in at attention in a line behind the gun, facing away from it and dressing right to left. They will be fully uniformed and will have full equipment necessary for his duty.

This would be a good time for each man to take a step forward, identify his position on the crew, briefly state his duties, and explain his particular bits of equipment, etc. While this is going on, the officer should make his last minute inspection of the crew, equipment, spectators, demonstration area, wind, etc. Crewmen fall-in the order shown to avoid confusion on the next command.

Note: The officer should observe that Man #1 and # 2 have their gloves and coats are buttoned prior to any movement towards the piece.



2. MAN THE PIECE! (Man thee...PIECE!)

The crew will execute a good crisp Von Steuben “right about face” and move out to their respective positions at the gun, assuming the position of attention and facing to the front.

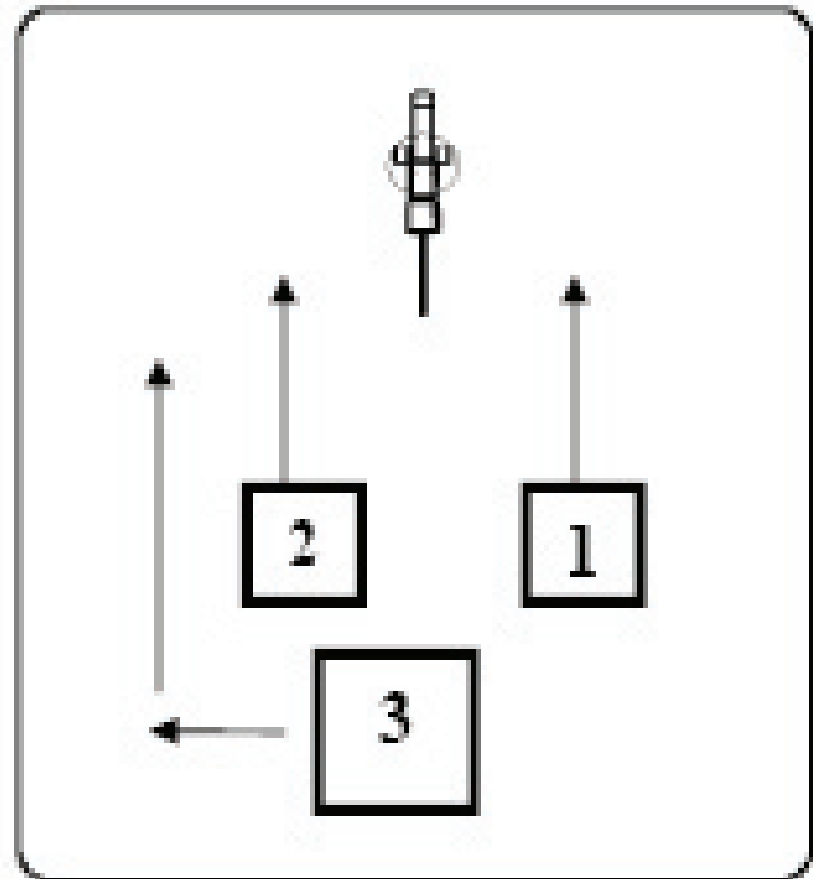
Note: On the command of man the piece:

Man # 1 will take a position facing to the front, in line with the cascabel, one pace from the piece.

Man # 2 will stay in position.

Man # 3 (commander) will move to the left of Man # 2.

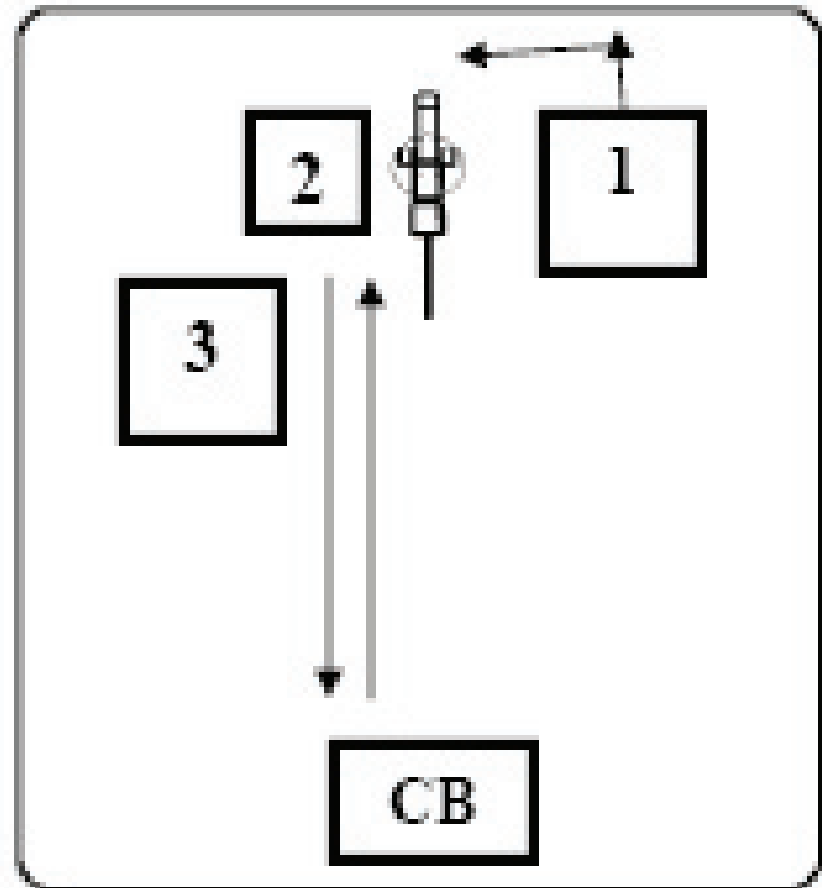
Positions in line have been set to avoid crew members having to cross each other's paths.



3. SEARCH THE PIECE! (Search three...PIECE)

Man # 1 is standing at attention one pace away from the swivel gun. Upon the command “search Piece” Man # 1 will pick the vent and shout “CLEAR” he then holds the worm vertically in the right hand, and he steps forward and to the right until he is at a convenient distance from the muzzle. At the same time he grasps the staff with the right hand near the head of the worm. The right hand should be with the backside down, palm up, and thumb pointing at the target. Man # 1 will now enter the worm into the muzzle. The staff is pushed to the bottom of the bore using the right hand, still backside down on the staff. When it contacts the bottom of the bore, he turns the staff at least once “clock-wise” to clean out any trash left in the bore. Man # 1 withdraws staff from muzzle and returns to position.

Note: Man # 2 will clean any foil that is on the worm and then automatically move to the cartridge chest after the piece has been searched, at this time get cartridge from cartridge box and puts in cartridge pouch. Return to position at the swivel gun with sponge.



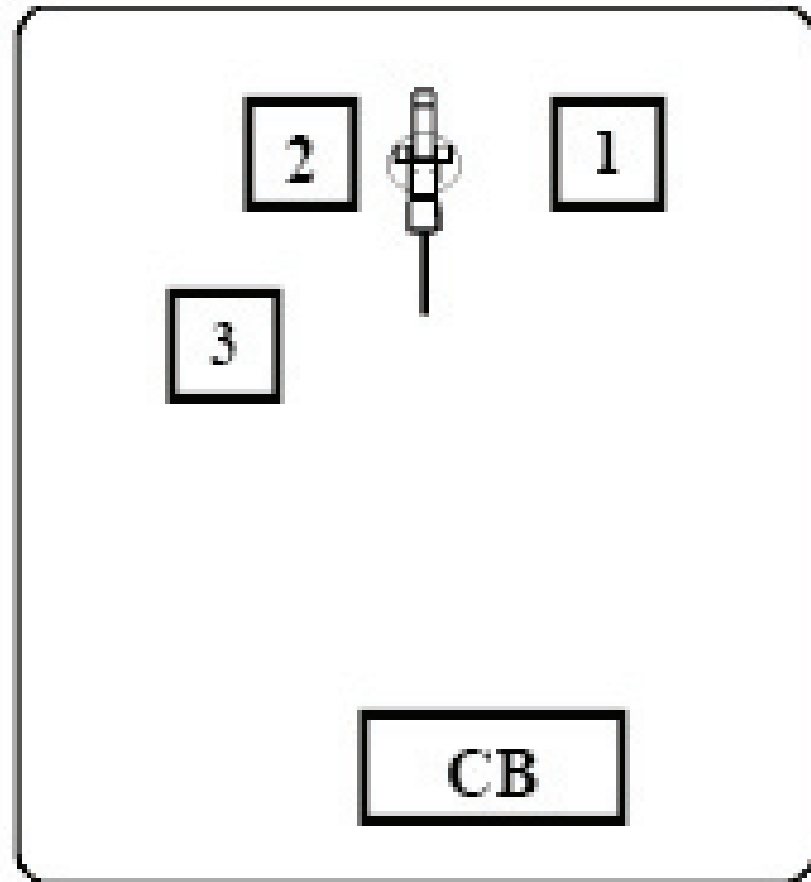
4. ADVANCE SPONGE! (Advannnce...SPONGE!)

Man # 2 is standing at attention one pace away from the swivel gun. He holds the rammer – sponge vertically in the right hand with the rammer head on his right toe to keep it clean and free of dirt. Upon the command “Advance Sponge” he steps forward and to the left until he is at a convenient distance from the muzzle. At the same time he grasps the staff with the right hand near the sponge head and the left hand as far down the staff as is comfortable. The left hand should be with the backside down, palm up, and thumb pointing at the target.

This is important. Whenever sponging or ramming, the backside of the hand must be down! He holds the sponge poised near the muzzle or off to the near side of the muzzle face, but not in it. His body is to the side and behind the muzzle as much as possible

The sponge head should be damp but not sopping. The sponge head is quickly dipped in the sponge bucket and the excess water is wrung out with the hand or by spinning the sponge head as it is held downward. Take care not to shake or splatter yourself and others.

The officer should observe at this time that Man # 1 and # 2 is wearing gloves and uniform coat buttoned prior to any movement towards the piece.

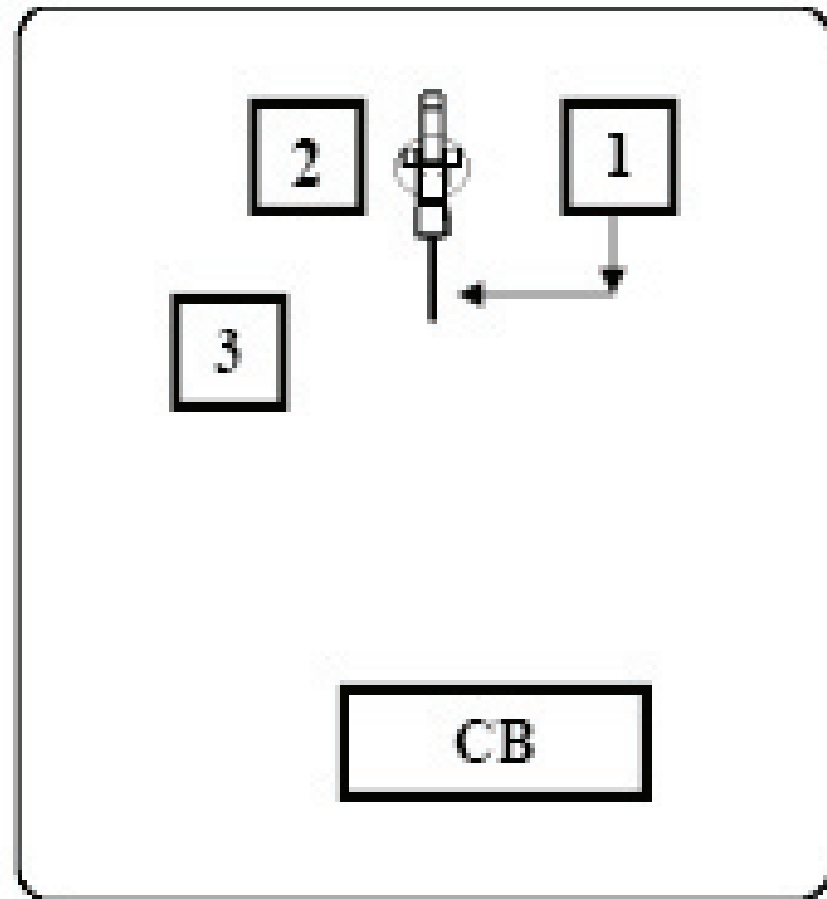


5. TEND VENT (tennd...VENT!)

Man # 1 will sidestep to the left until he is beside the breech of the gun. He will place his right thumb hard on the touch hole so as to seal it completely from the passage of any air. The fingers should be extended just above the breech moldings, and the elbow elevated so as to exert maximum pressure. His body should be erect and square to the front. He must be wearing a Thumbstall. It should be soft and pliable enough to make an airtight seal. His left hand will be holding the tiller. **Man # 1 WILL MAINTAIN THIS POSITION UNTIL THE GUN HAS BEEN SPONGED AND LOADED AND WILL MAINTAIN CONSTANT EYE-TO-EYE CONTACT WITH MAN # 2 THROUGHOUT THAT PERIOD.** Man #2's life may well depend on how carefully the vent is served. **THUMB NOT TO BE REMOVED FROM VENT UNTIL THE COMMAND "PRIME"!**

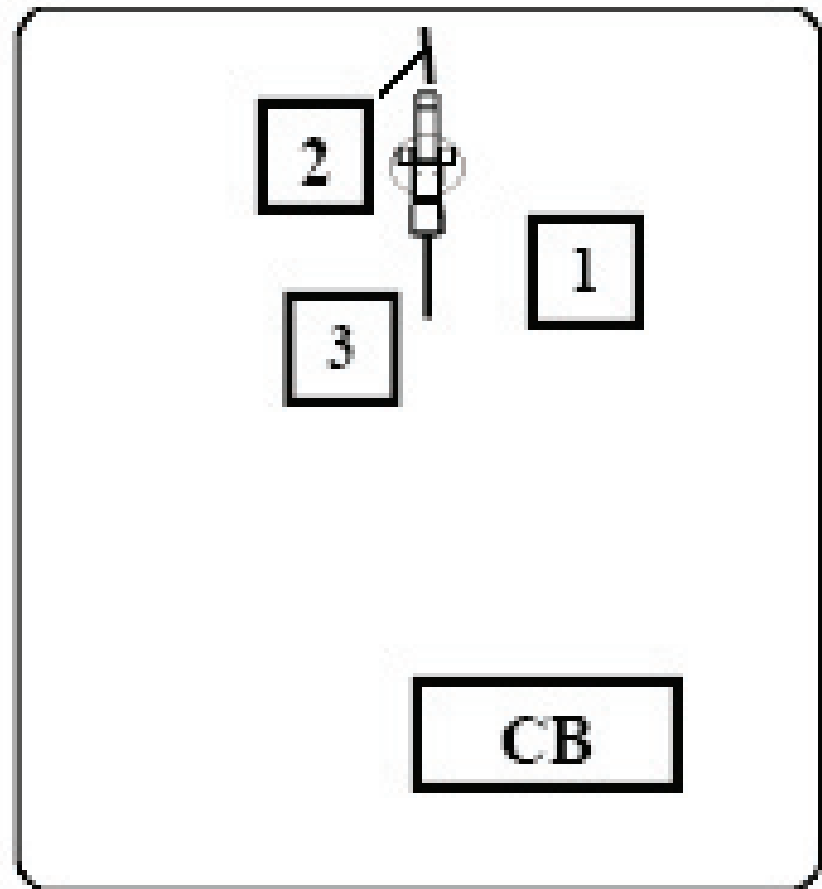
NOTE: MAN # 1 MAINTAINS EYE CONTACT WITH # 2 AT ALL TIMES DURING THIS COMMAND.

The only change here is to have the fingers just above the breech molding, but not resting on it. This assures that full downward pressure is in the thumb and not distributed over the fingers. The officer and # 2 Man should observe that the vent is indeed covered and pressure is being exerted. Care should be taken to select a position comfortable enough to maintain without shifting.



6. SPONGE PIECE! (sponge...PIECE!)

Man # 2 will now enter the sponge into the muzzle. He drops his right hand to his side. The sponge head is pushed to the bottom of the bore using the left hand, still backside down on the staff. When it contacts the bottom of the bore, he turns the sponge at least “once and a half round or more”. More is better, and two or three full turns are to be preferred. The staff must be held with the backside of the left hand down, pressing the sponge against the breech face of bore. As soon as the sponge is entered into the bore, Man # 2 must establish eye-to-eye contact with man # 1 who is tending the vent to make sure that he is alert and is tending to his duty. If he is not, Man # 2 must stop immediately and stand completely clear of the muzzle. While inserting the sponge down the bore, Man # 2 listens for the telltale whistle or hiss of air that would indicate that the vent is not fully stopped. When sponging, only the left arm should be exposed in front of the muzzle, Man # 2 draws the sponge out, again keeping the back of his left hand down. As the sponge clears the muzzle, he passes the sponge to his right hand.



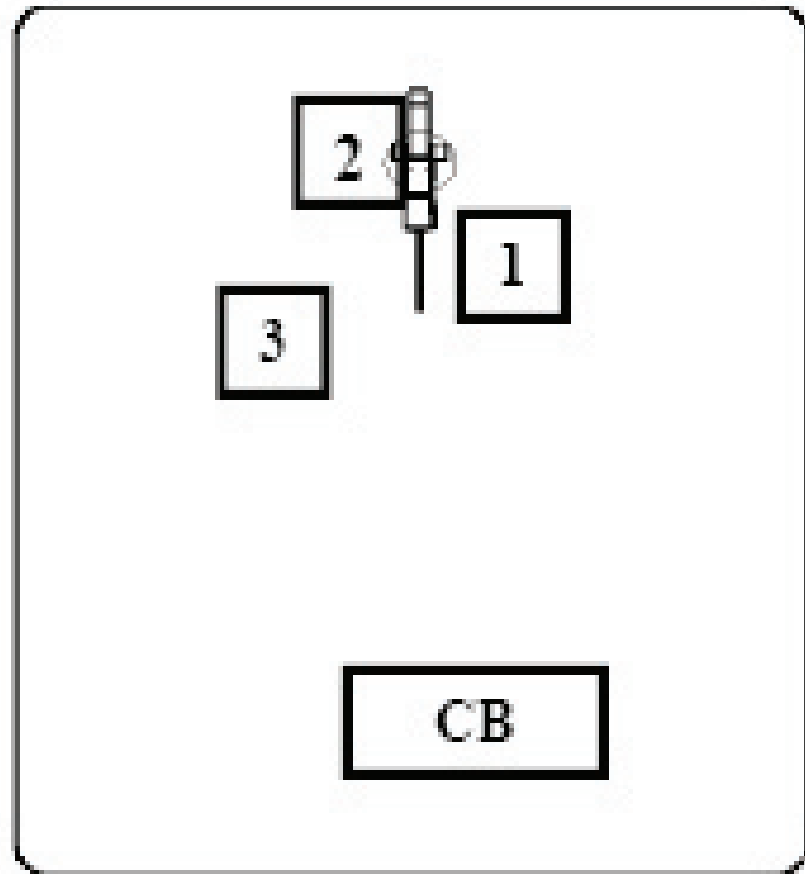
7. HANDLE CARTRIDGE! (han-dle CARTRIDGE!)

Man # 2 is stationed at the muzzle, and has just finished sponging. Using his right hand takes out the cartridge from his cartridgebox, which is slung on his left side. Show the commander the cartridge, so it can be seen that the cartridge is pointing in the right direction.

8. CHARGE PIECE! (charge...PIECE)

Man # 2 will place the cartridge in the gun by cradling it in his left hand, back of hand down, entering it into the muzzle, and sliding it off his left hand with a quick thrust of the palm. A little practice will make this a smooth and continuous motion. Man # 2 is to take care that only his hands and arms are exposed in front of the gun. By sliding it in swiftly, the cartridge will enter the bore a distance, thus making it easier to seat the rammer.

Take special care not to place face and upper body overly close to the muzzle. With the smaller guns this is a common problem keeping the back straight and bending slightly at the knees helps to eliminate this. Enter only the charge and not your hand into the muzzle. Man # 1 continues to thumb vent. Man # 2 holds position with rammer poised.

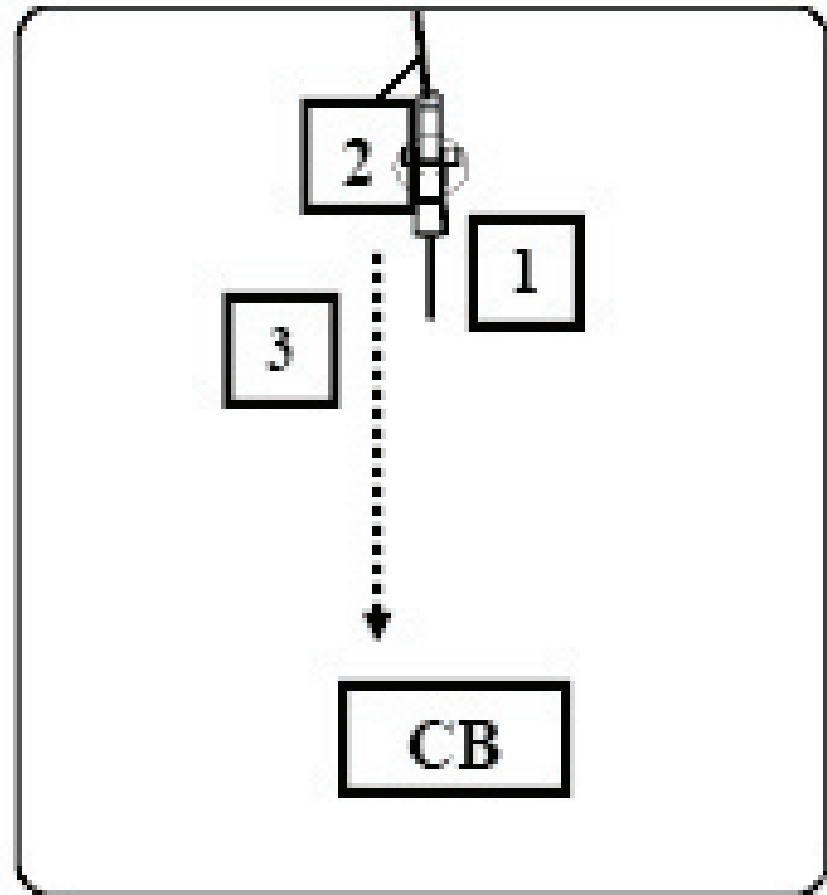


9. RAM DOWN – CARTRIDGE!

(ram downn...CARTRIDGE!)

Man # 2, will insert the rammer head into the muzzle of the gun, let go of the rammer with his right hand which will drop to his side, and maintaining his underhand grasp on the staff with his left hand, ram the cartridge home. No need to move feet or shift position, but on some guns dropping the left slightly will help throw some weight into the stroke. Care should be taken to use the same force in seating the charge each time. Man # 2, must be sure to keep his body clear of the muzzle and keep his eye on Man # 1, to make sure he has the vent sealed. He must not pound on the cartridge, but seat it firmly with one long continuous stroke. As soon Man # 2, feels the cartridge seat fully, he withdraws the rammer and as the head of the rammer clears the muzzle, strikes it with the palm of his right hand. This helps flip the rammer around again so as to make ready for “advance sponge” and serves as a check to make sure the rammer head has not come off in the gun. He then resumes his original position at attention near the cartridge box facing the front.

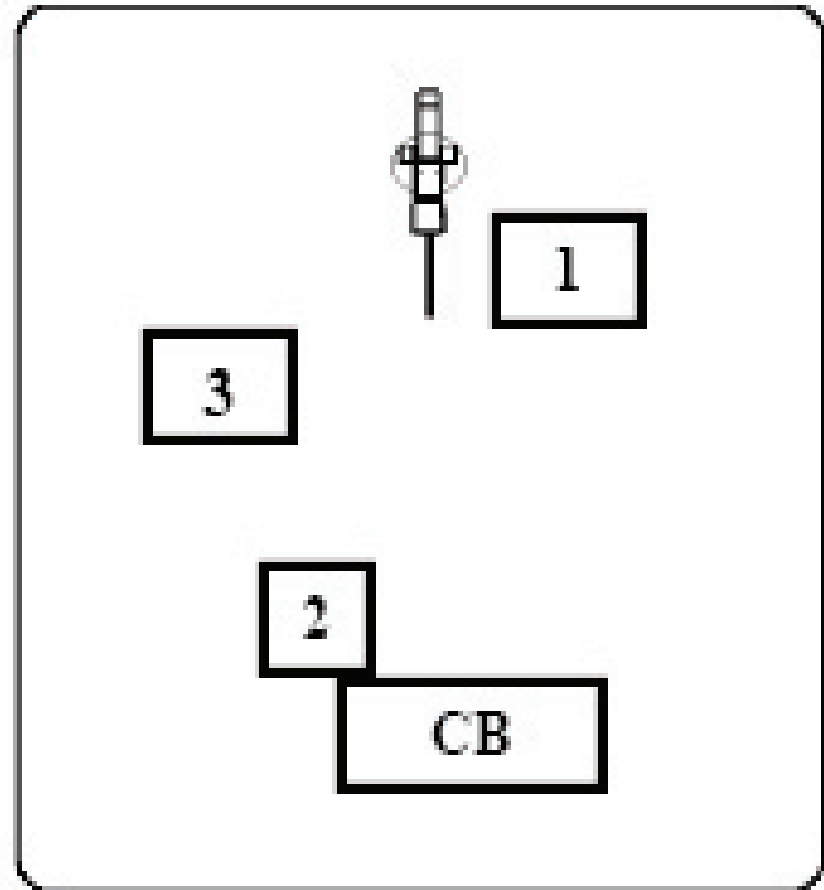
Several key points to keep in mind here. Safe body position right and rear of the muzzle, only one hand used and with the back down / palm up position, eye contact with man # 1, do not pound charge. Man # 1 maintains thumb on vent. Man #2 must feel the charge firmly seat on the breech face. As with the sponge operation, a paint mark on the staff will serve to show where the standard cartridge is seated.



10. PRIME! (PRIME)

On this command, and only on this command, Man # 1 will remove his thumb from the vent. He will take his priming wire in his right hand, insert it in the vent, prick open the cartridge and return the wire to the case on his belt. The priming wire should be handled much the same as a small arms ramrod. The hand should not be placed over the end of it or a finger placed through the loop. It should be held between the thumb and forefinger. He will then proceed to prime with either tube or loose powder. If a quill is used it should be handled in much the same fashion as the priming wire. After priming with loose powder man # 1 will stop the horn and cup his left hand around (not over) the priming to protect from the wind.

The officer does not command “prime” until man # 2 has resumed his original position. For reasons of authenticity, ease, and safety the use of the quill or tube primers is preferred. If using a horn, the quantity of powder should be held to that required plus a re-prime. Do not roll loose powder with the horn as Stevens recommend! Just fill the vent and leave a small pile of loose powder on top and slightly toward the muzzle. The horn should be worn on the right side and slung on the right shoulder. It should be un-slung for use, otherwise there is a tendency to place the body over the vent. Make sure the stopper fits well and is in place when not in use. Treat the vent as a mini-muzzle and keep from being directly in line with it.

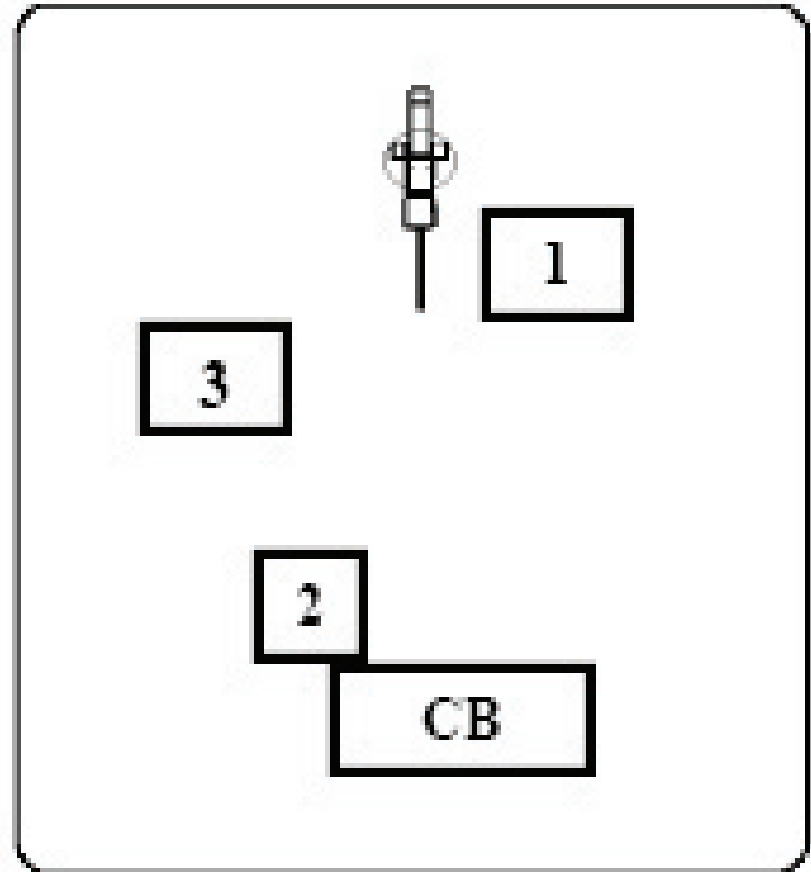


11. TAKE AIM! (take...AIM!)

The commanding officer “man # 3) who is stationed to the left of the gun, will tell man # 1 to take aim. Since the swivel gun was essentially a close-range weapon, sighting is not as precise as with a larger field gun.

Aiming is a key point in shooting any arm and should be given due consideration. It is the job of man # 1 to aim the gun. Since the commanding officer is holding the lintstock and will be giving himself the command of fire, there should be no need of a visual signal of lowering a sword or his arm.

Note: after the command of take aim, and man # 1 has aimed the gun, the commander will step towards the piece prior to giving the command “Make-ready” “Fire”.



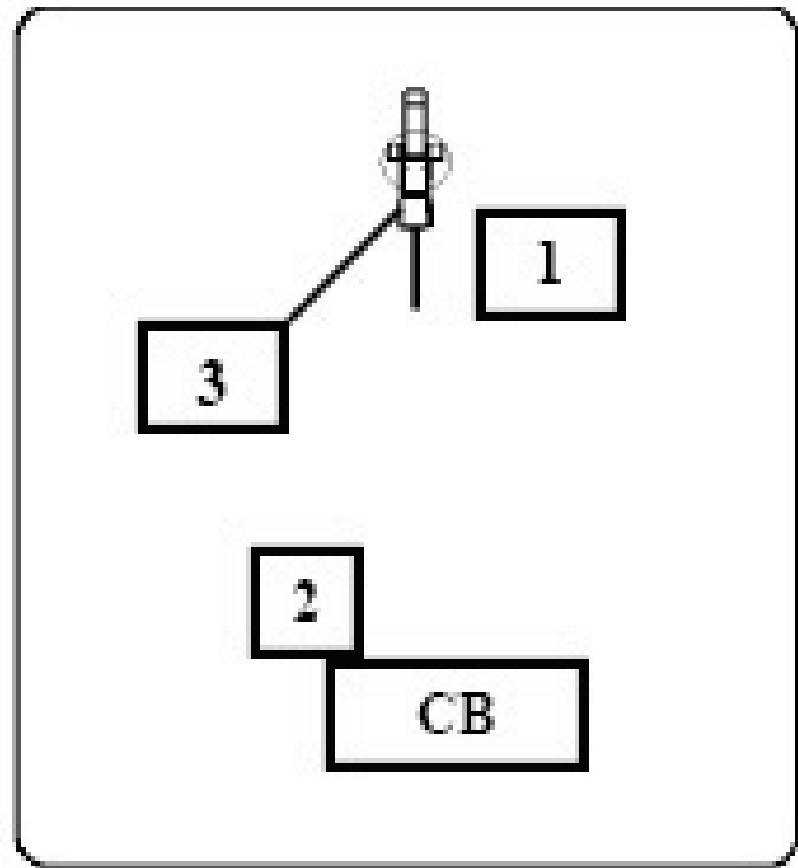
12. MAKE-READY (MAKE READY)

Man #3 (Commander) shouts this command out so the cannon crew and visitors know that the command of fire is next.

13. FIRE! (FIRE)

Man # 3 (commander) is standing next to the gun, with lintstock smoldering. Man # 1 is positioned a pace away from the swivel gun and is holding the tiller with his left hand, his left arm is fully extended to give distance between him and the vent. On the command of “Fire” Man # 1 uncovers the priming. The commander (man # 3) moves only when he gives the command “Fire). He moves to the right if needed, and with his left hand swings the lintstock in a graceful arc, and applies a glowing end to the priming.

All through the drill the commander (man # 3) is giving commands and tending his match, ensuring that both ends are lit and glowing. He also minds the wind and keeps it away from man # 2 and the cartridge as well as man # 1 and priming. He must practice and learn to gauge his distance from the vent to eliminate the need to “fish around” with the slowmatch. He should endeavor to contact the priming from the muzzle side so that recoil carries the vent blast away from the match.



SECURING THE PIECE: Once having fired the gun, the Gun Commander , repeats the orders from “SEARCH PIECE” through “SPONGE PIECE”. Once the gun has been searched and swabbed the Gun Commander may dismiss the crew, or continue (non-firing) drill at his pleasure.

SWIVEL GUN DEMONSTRATION CHECKLIST

Before:

- () The gun has been inspected, inside and out. Bore is clean of foreign material.
- () The accessory equipment is in good condition—sponge head is in good repair, rammer and sponge head secure on staff, etc.
- () Sponge head fits bore snugly, but not too tight.
- () Ammunition boxes, haversacks, etc., are clean and free of spilled powder.
- () Ammunition is properly prepared, with just enough on hand for one demonstration.
- () The equipment is on hand to handle a misfire.
- () The required number of personnel are present to fire the piece.
- () The gun is situated safely in relation to visitors. Note: 60 yards to the front.
- () There is good visibility by the visitors so there will be no jostling and pushing to see and hear.
- () The interpreter can see all of the visitors and also see downrange.
- () Visitors are properly contained at the NPS required safe distance. Note: 12 yards from piece.
- () The ammunition box is at the NPS required safe distance from the piece as well from visitors. Note: 5 yards from piece and 7 yards from visitors.
- () The wind is not too strong for a safe demonstration.
- () Conditions are not so dry as to risk a range fire from the muzzle blast. Equipment is available should one develop.
- () There is a first aid kit and emergency communications system available.
- () There are no open fires nearby—campfires, etc.

During:

- () The crew is following the approved manual with each person where he is supposed to be at any given moment.
- () The sponge is adequately damp but not soaking wet.
- () The man ramming is holding the rammer properly and the vent is being properly tended at the same time.
- () The rammer man is wearing gauntlets, but they are not so stiff and heavy as to cause fumbling or other difficulty.
- () The sponge head does not contact the ground at any time during demonstration to prevent grass, sand, etc. from sticking to it.
- () If there is a misfire, it is handled safely and properly.

After:

- () After firing, the piece is wormed and then washed out and dried.
- () All weapons, explosives and accessory pieces are accounted for.
- () The weapon is secured and stored properly.
- () The demonstration area is inspected carefully for smoldering residue.
- () Sponge head is thoroughly rinsed out and dried.
- () All remaining explosives are promptly returned to proper storage area.

BIBLIOGRAPHY