Return to Previous Page for more Articles

Solid Shot Essentials: A Guide to the Authentic and Non-Authentic

By David Poche with Peter George

I was recently perplexed by the problem of how to identify the authentic solid shot (cannonballs, grape shot and canister) from the non-authentic. Here are some thoughts put forth by Civil War artillery expert, Peter George on the problem.

Terminology: Solid Shot are spherical solid (not hollow) cast iron objects that are fired from Civil War cannons.

The Problem of Identification: Unless you have personal knowledge of an excavated solid shot from a Civil War location, the authenticity of the object is subject to interpretation. Typically, spherical cast-iron or steel balls are purchased at garage sales, auctions, antique shops, or on Ebay. Sometimes individuals state a provenance for the object like "my grand-pappy plowed this up on his farm". Shot of this type can come in all sizes and are usually made of steel, cast-iron or brass. **Civil War cannonballs were never made of steel or brass.** Many non-authentic items at these events turn out to be large ball bearings, cement truck tank cleaning balls, roller mill balls, wrought iron ornamental fence balls, and even old high school Sports shot puts. Each of these items has a telltale set of characteristics that can point us away from being non-authentic.

Cast Iron Versus Steel: Authentic cannon balls and smaller solid shot (canister and grape) are made of cast-iron rather than steel. The Federal Ordnance Manual of 1862 stated that all shot and shell were to be fabricated from cast-iron with only one exception (lead).

How are they cast? The casting of solid shot and shell is well covered in Dean Thomas' book *Cannons*. Basically, two hemispherical sand molds are prepared and are attached together. The mold-pair is filled from the side at the seam between the two mold halves until liquid cast iron appears in the mold's vent at the top.

The casting process creates three distinct telltale identification points on cast solid shot that point to authenticity. These are:

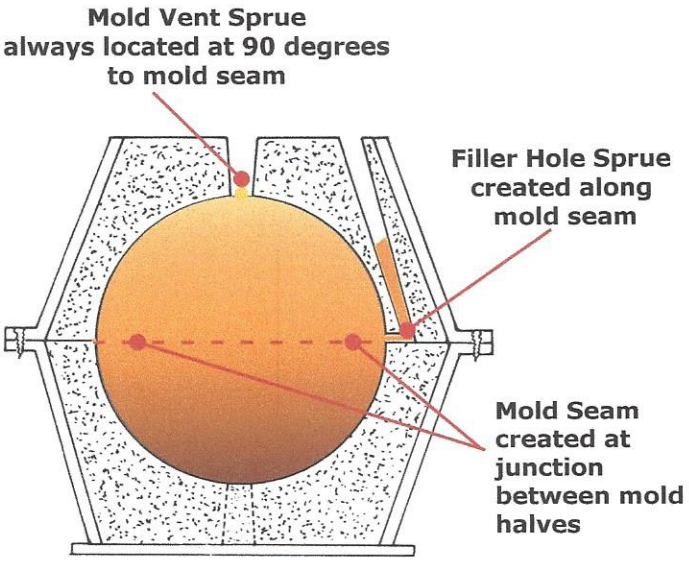
(1) The **mold seam** created by liquid metal flowage into the tiny gap between the two mold halves;

(2) The **filler hole sprue** created at the mold seam from liquid metal entering the mold;

(3) The **mold vent sprue** created as the metal begins to fill the hole at the top of the mold. The vent sprue is always at a right angle to the plane of the mold seam.

The filler hole sprue is always located along the mold seam on cannonballs and is usually represented on the finished product as a small (0.25 to 0.50 inch) imperfection. If the cooling of the metal of the casting caused the metal in the vent to contract and create a depression in the casting this was sometimes patched with lead (rare).

Inherent in this type of casting is the presence of air bubbles being trapped inside the casting. This has the effect of weight reduction of the casting.



Solid Shot Mold

Three telltale "remnants" or projections on the casting that can be used as part of the authentication process for medium and larger solid shot.

In general, as the caliber of solid shot becomes larger, mold and final metal finishing marks tend to less apparent. The exception to this is heavy-caliber (7-inch caliber or greater) cannonballs.

After casting, any metal surface projections on the solid shot were removed by hammer, chisel, and file. Special care was taken with cannonballs since any projections would be likely to come in contact with the cannon's bore and would or could damage the bore due to metal-to-metal scraping. Poorly cast (cannonballs with surface projections) could also jam in the bore causing the barrel to burst on firing.

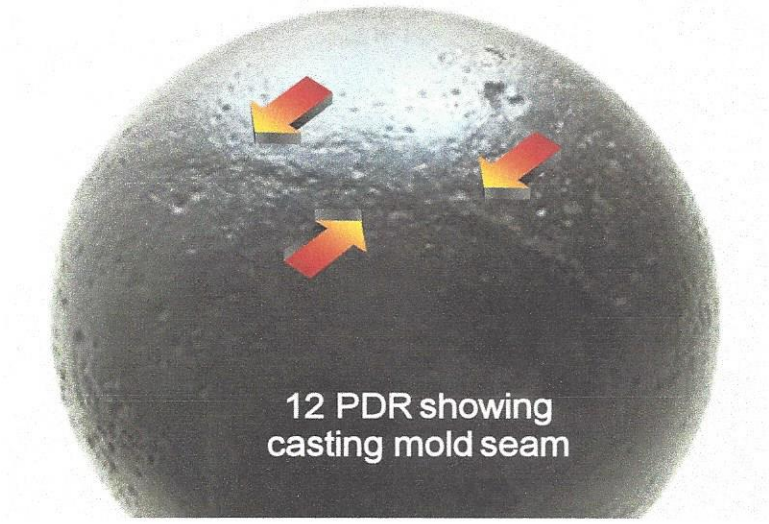
This is why cannonballs were manufactured to be perfect spheres and never out-of-round (like an egg, potato, or onion).

At the smaller end of the caliber spectrum of solid shot, surface projections are more apparent. Canister might display some finishing. Also canister mold seams, casting and vent sprues will be more apparent than on larger caliber solid shot.

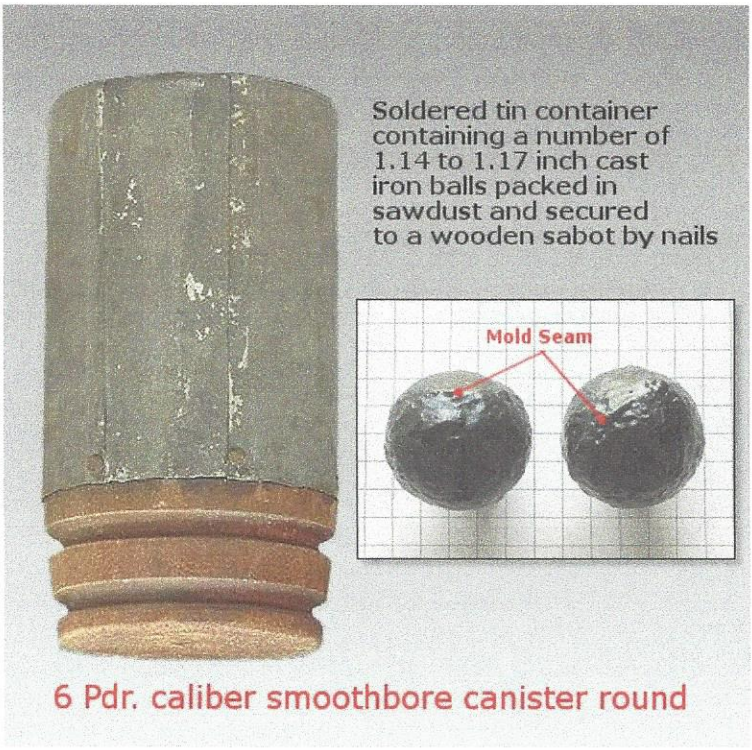
Much less care for removing casting remnants was taken for grape shot and canister since these projectiles have little contact with the cannon's bore during firing.

Knowledge of solid shot casting will bear directly on the types and location of measurements made on solid shot for authentication.

Smaller solid shot was Gang-cast, in which multiple canister or grape shot were cast in a single mold. These shot would all have a mold seam line but would vary in the type of sprue projections present, depending upon the type of gang mold used. Some gang molds had interconnected flow channels; others did not. Thus the castings of canister and case shot frequently have some surface casting projections and are usually much "rougher".



Smooth Surface of a 4.52 inch (actual diameter) 12 Pdr. caliber cannonball showing only a very faint trace of a mold seam.

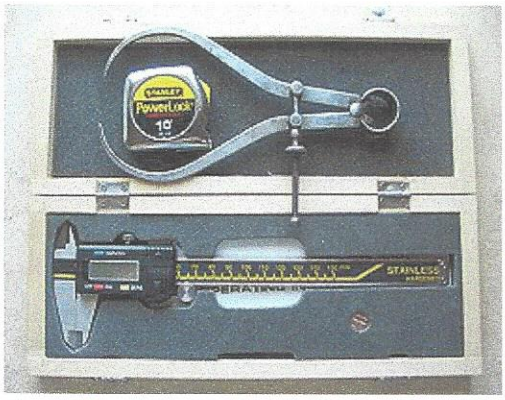


Note the rough and irregular nature of the surface of these Gang-cast canister balls. They may or may not have been tumbled in a milling barrel to remove their casting projections as required by the Ordnance Manual. Expeditious shortcuts in manufacturing were often taken during the Civil War. Steel ball bearings (non-authentic) of this size will have no such casting projections. The gang-cast canister balls in the photo were excavated by the author Poche at Port Republic, Virginia.

Three-Step Procedure for Determining Authenticity

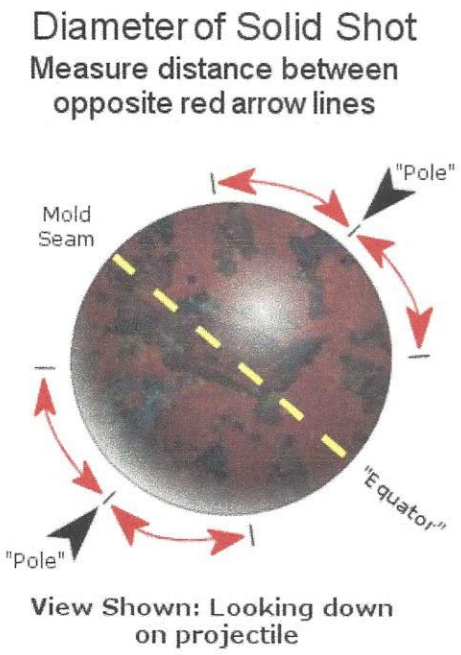
There is a simple three-step method for determining the authenticity of solid shot. This method plus a few caveats will significantly enhance your odds of purchasing authentic pieces.

Step One: Determine the Diameter of the Ball



Three tools for measuring the diameter of solid shot: the diameter tape, the machinist's feeler gage and the electronic caliper.

For large cannonballs, place the ball so that the plane of the mold seam ("equator") is vertical and the "poles" are horizontal. Measure with a mechanist's feeler gage or calipers slightly off the poles along the opposite red arrow lines shown in the figure below.

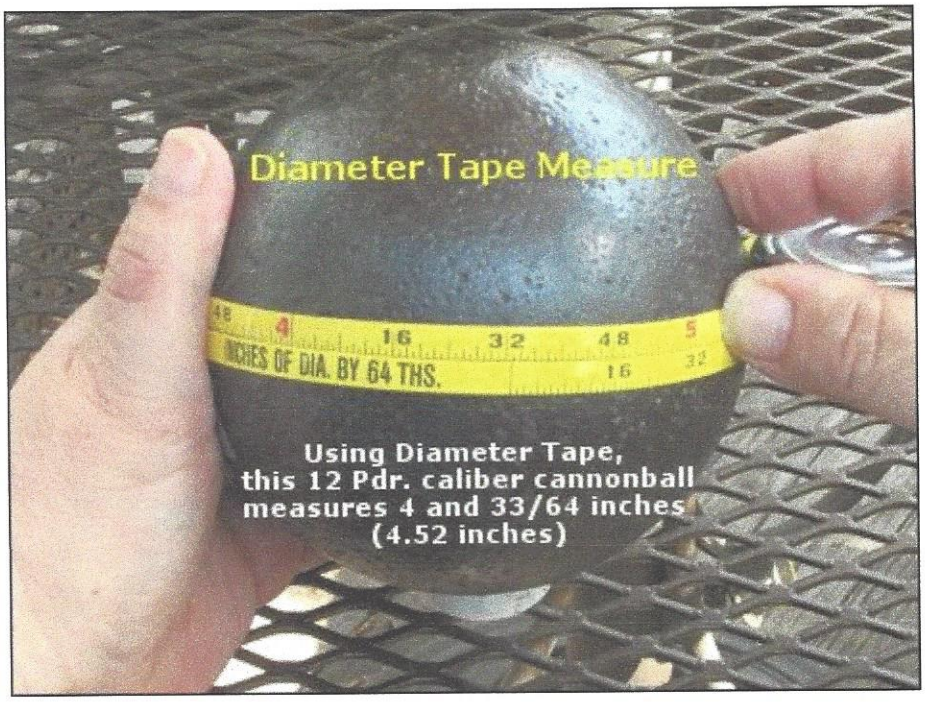


Measurement locations for the diameter of "possible" cannonballs. Measurement should be made with calipers or a machinist's feeler gage in the plane of the "Pole" and using the opposite red arrow lines. CAUTION: Avoid making measurements at the poles since casting projections could disrupt diameter measurements.

There might be a casting projection at the pole location. Slide the feeler gage or calipers up and down to make sure that the maximum diameter (thickest point) is being measured. Take the largest measurement and lay measure against ruler with 10ths of an inch or read the calipers directly.

A casting filler sprue (if any) would be located along the mold seam and the vent sprue, if present, would always be located at the "pole" (90 degrees away from the mold seam). These will surely be present on smaller solid shot (canister).

Another method for measuring the diameter of larger solid shot is to **use a diameter tape** (like Stanley model 33-115 -available from most hardware stores). This tape is wrapped around the "equator" of the ball and its diameter can be directly read from the backside of the tape.

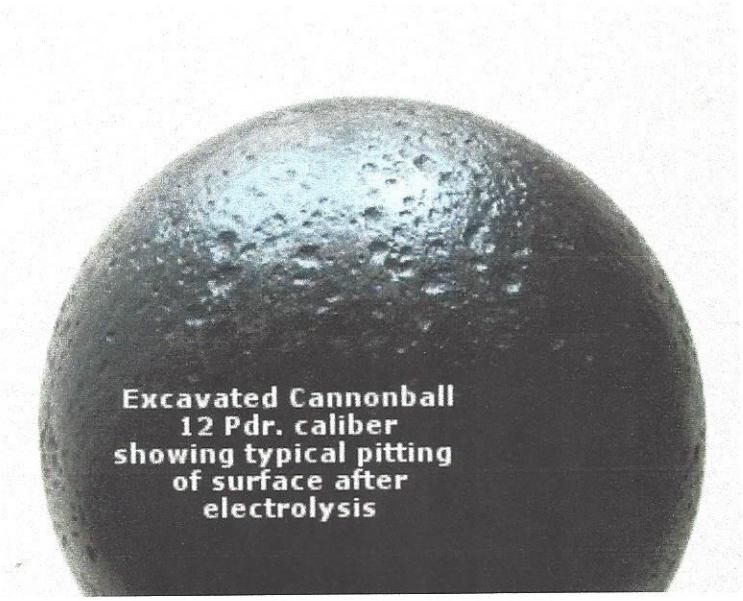


An easy way to measure the diameter of cannonballs is to use a diameter tape, which measures the diameter of the ball directly.

Surface Examination: Any large surface irregularities or pronounced out-of-roundness suggests that the object is non-authentic.

The general surface of a cannonball should be smooth unless heavily pitted by corrosion. **There should be no wide belts or raised bands at the mold seam, but a faint trace of the mold seam (if any) as the previous picture of the 12 Pdr. shows**. There should be **no flat spots, egg-shape or out-of-roundness** to the object.

If surface projections or dimples are present, but not in their correct places (pole and equator), then this points to the object as being non-authentic.



Surface pitting of excavated solid shot is to be expected due to the migration of elemental iron to a new location on the surface of the ball where rust scale (iron oxide) is formed. Excessive scale may influence diameter measurements.

Smaller diameter solid shot (such as grape shot, and canister shot) often tends to be more irregular than midrange-sized cannonballs. Expect fairly pronounced mold seams and clear evidence of the locations of removed filler and vent sprues. These former casting projections are located at the same points on the surface of the sphere as larger solid shot. Because many of these projectiles were gang cast, they will only have filler sprues along the mold seam. In Gang-casting, a mold vent was present only in the last projectile of the Gang-cast line.

Manufacturing tolerances of grape shot and canister were not nearly so precise as those of cannon balls since they were not intended to come into continuous contact with the cannon's bore. Generally armories and their subcontractors were allowed plus or minus 0.03 inches on the diameter of the smaller caliber solid shot they produced.

The measured values of diameter will be compared with ranges given in the Shot Tables of the Ordnance Manual of 1862. Excavated cannonball measured values must fall within the range of the Tables to be considered authentic.

Caveat: The diameter of any solid shot may be altered by the effects of pitting or scaling of its surface, and exposure to acidic ground water. Both effects may make it lighter.

It should be pointed out here that with only one exception, **no military solid shot was ever fabricated at a diameter equal to a ruler fraction (1/4, ½, ¾ or an even 1).** Ruler-fractioned objects are all civilian rather than military and a quick glance back at the Shot Table diameters will confirm this. The single exception is the 32 Pdr. caliber cannonball, whose specified diameter was 6.25 inches. If an iron ball is encountered that has a diameter equal to a ruler fraction, like 3 and ½ inches (3.50) then it is not authentic.

Stamp Marks: Most authentic Civil War cannonballs have no stamped numbers or letters on them. Old sports Shot Puts frequently have the numbers: 6, 8, 12 or 16 stamped on them or their metric weight equivalent for more modern Puts. These stamps represent their sports weight classification.

Peter George says he has seen only one specimen with a low number like "2". Some cannonballs had a Arsenal Inspector's mark, which was a single letter like "G" (Selma Arsenal) on solid shot. He says this is extremely rare. Thus we can probably say any number "6" or greater stamped on an iron ball is probably a sports Shot Put or a machinery counterweight, and not a solid cannonball. Multiple-stamped letters on solid balls are even rarer and also indicate the non-authenticity.

Step Two: Determine the Weight of the Ball

The second step in authentication is to use a digital scale to obtain the weight of the solid shot with high precision. Bathroom scales are notoriously bad at giving correct weight. Grocery stores also may let you weigh a small shot. CAUTION: Be sure to check the maximum weight capacity of any digital scale you use. The maximum capacity is usually written on the front of the scale.

For single items, one can use the public postal shipping scale in the local post office lobby. Put the solid shot in a paper bag so as not to arouse alarm.

Caveats: Often, steel balls are sold as solid shot. Steel is denser that cast iron. **For the same exact size of ball, a steel one will weigh some what more than cast iron one**.

Also when comparing with the Ordnance Manual's specified weights for cast iron shot, remember that cast iron molding inherently creates bubbles inside the casting. Internal casting bubbles will make the solid shot lighter.

Authentic cast iron solid shot may be lighter than the Ordnance Manual Shot Table weight but it can never be heavier. If a particular shot has the correct diameter but is heavier than the weight listed in the Shot Tables, then it is probably steel.

The weight of a military solid shot is never specified to be an even pound. If an iron ball is encountered with an even pound weight, such as 3.0 or 4.0 pounds then it is not authentic and points to civilian. The exceptions to this rule are 8 inch and larger caliber solid shot, but that is because the Ordnance Department was not concerned with specifying ounces at such great weights (65 pounds and up).

Step Three: Match the Measurements to the Ordnance Manual Shot Tables

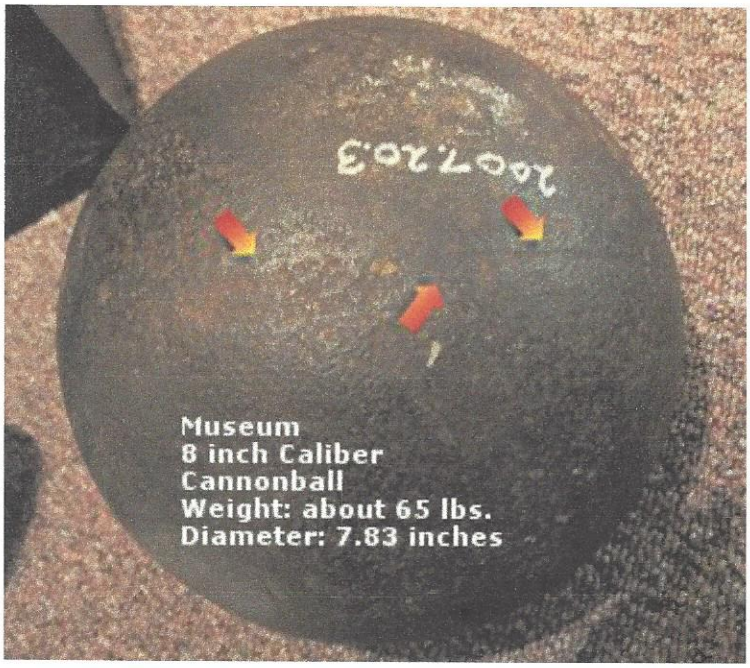
The last step in the authentication procedure is to match a ball's weight and diameter with those published in the Ordnance Manual (1862) Shot Tables or in Jack Melton and Lawrence Pawl's Artillery Website.

The Manual's tables of weight and diameter of all solid shot (cannonballs, canister shot and grape shot) are considered to be the accepted value for authenticity. Compare your values of diameter and weight to the values found in the tables.

A Non-Authentic Example: The figure below shows a classic non-authentic ball actually put up for sale at a recent Civil War Relic Show. It appears to be about the correct size for a 12 Pdr. caliber cannonball, but it is not of Civil War vintage nor even a military cannonball. The metal of the ball is somewhat shiny; this points to steel rather than cast iron. Excavated cast iron will always have rust and visible pitting while excavated steel will have much less rust and little or no pitting.

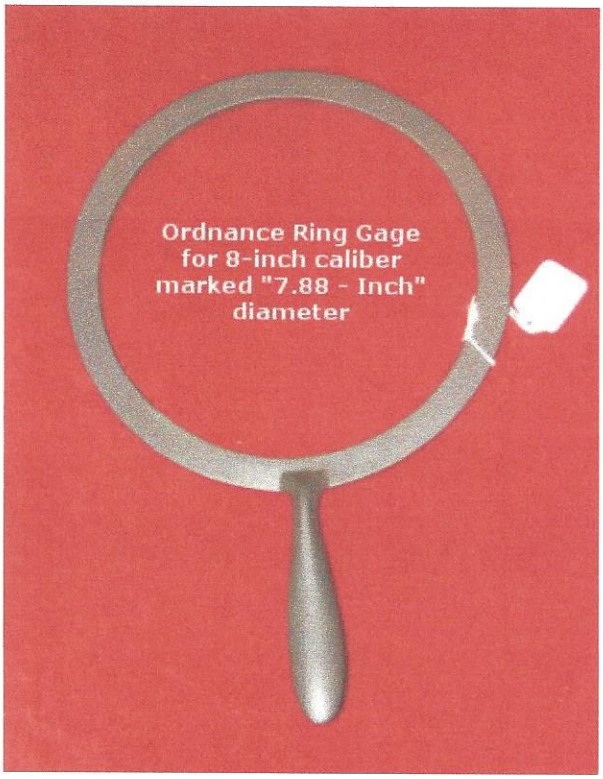
The flat countersunk screw also points to non-authenticity. This screw could cover a filler hole for a Shot Put, or it could be covering a point of attachment of the ball to a larger structure like a fence or gatepost. None of these characteristics point to an authentic piece.

The above ball was put up for sale at a recent Civil Relic Show and is non-authentic. The diameter of the above ball possibly matches a 12 Pdr. caliber cannonball but the weight is probably too heavy when compared with the Shot Tables. There are two obvious telltales that it is non-authentic. The metal of the ball is too shiny to be cast-iron and the screw in the ball suggests it might be Shot Put weight adjustment hole cover screw or the ball may be a gate post decoration.



As the caliber of solid shot increases, the amount of apparent final metal finishing decreases. Shown above is an 8-inch caliber cannonball in a museum with no apparent casting sprues and a very faint mold seam as indicated by the arrows. There are no "wide" band mold seams on authentic solid shot.

The Ordnance Manual required that all shot and shell be inspected both upon delivery from the manufacturer as well as periodically. When ordnance inspectors checked the diameter of solid shot and shell they used two sets of handheld metal ring-gages like the one shown below.



To prove a shot or shell was within specification tolerances, it had to pass in every direction through a "larger gage" but was retained on a "smaller gage". Such ordnance is said to be "in gage". The diameters of these gages are specified in the Ordnance Manual. If a shot passed the wire gage test, it was then tested in a slightly inclined cylinder gage, and shots that stuck in the gage or did not roll smoothly were rejected.

The watchwords at any public sale should be "caveat emptor" even at Relic Shows. A few simple measurements and observations can save the purchaser a lot of money.

Still in Doubt? Get in Touch with a Civil War Artillery Expert: If in doubt about the authenticity of any solid shot you are about to purchase, it is best to contact a helpful Civil War local artillery expert.

Author Poche's Note: Almost the entire above article is based upon discussions with Civil War artillery expert Peter George and author Poche is indebted to him for his tireless efforts to train the author in this subject. Without his knowledge, this article could not have been written.

Good Additional Readings:

Dean S. Thomas, "*Cannons: An Introduction to Civil War Artillery*"; 1985; (ISBN 9780939631032); 72 pp.

United States Army Ordnance Depot, "*The Ordnance Manual for the Use of Officers of the United States Army*"; 1862 & reprinted 2006; University of Michigan Library Reprint; (ISBN 9781425559717); 540 pp. Also available through Google Books.

Dickey, Thomas S. & George, Peter C., "*Field Artillery Projectiles of the American Civil War*"; 1993; Arsenal Publications II; (ISBN 0960902201); 552 pp.

US War Department, *"Instruction for Heavy Artillery"*; 1851, 270 pp. Also available through Google Books.

US War Department, W.H. French; W. F. Berry and H.J. Hunt *"Instruction for Field Artillery"*; 1863, 281 pp. Also available through Google Books.

John Gibbon, *"The Artillerist's Manual"*; 1860; (ISBN 1402114230); 568 pp. Also available through Google Books.