Shell Preservation

By Henry Higgins

The first artillery projectile a relic hunter finds is special. That portion of the world who are non-collectors only see a big piece of dirty and rusty iron, but to the relic hunter who just spent a hard time digging it out of tree roots, hard clay, or a swampy bog, it's a prize to be treasured and preserved.

Now comes the inevitable question - how do I clean this piece of history? In addition, how do I preserve the iron and stop the deterioration?

When I first began relic hunting in 1963, the problem of cleaning and preserving projectiles usually boiled down to washing as much mud as possible off and wire brushing the projectile with some sort of rust remover. Then a heavy coating of marine varnish was applied. Of course, all this did was force moisture into the iron and cause metal cancer to develop. (Metal cancer is caused by the breakdown of iron into a powdery black material, which, over a period of time, results in large pieces of iron falling off the exterior of the projectile.) Many projectiles treated this way during the 60's and 70's can be recognized today by large divots or deep cracks all over the surface.

After a few years of trying different methods of preservation - spray varnish, polyurethane, tung oil, etc. - without satisfying results, and still using the wire brush method of cleaning, I read about the method of electrolysis being used by several of the artillery experts.

If you look up the definition of electrolysis in the dictionary, you'll find that it is "a chemical change produced by an electrolyte by an electric current." And that's the entire operation in a nutshell, but the procedure has several steps involved in reaching the goal of a clean projectile. Your primary goal in using electrolysis is to remove as much rust (and decomposed metal) as possible.

The old method of electrolysis used a metal container, which held the water and lye solution in which the projectile was placed. The fact that a battery charger was hooked up to the container caused it to be dangerous to anyone who touched the container while it was in operation. Besides, the combination of lye and electricity caused a hazardous gas to develop. And, after a few operations, the container developed holes and leaked, thereby making it necessary to obtained another on frequent basis.

Jack Melton, who is the author of several artillery projectile identification books and an artillery expert, had been using the old method for several years. After some serious discussion about the advantages and disadvantages of electrolysis, Jack and I decided to make a few changes of our own in the basic operation in order to make it as safe as possible. I think this method is less harsh on the projectiles as well as being safer than the old method, so I have been using it for the last ten years or so.

SETTING UP THE TANK

1. For most artillery projectiles a 3 ½ - gallon plastic bucket is adequate. For larger projectiles, a 5-gallon bucket might be needed. These buckets can be cheaply purchased in home supply stores.

2. In order to supply the electricity needed I use a battery charger which has two amp selections (2 and 6) and two voltage settings (6 and 12). Although I

usually use 2 amps and 6 volts, I have had a need for the higher settings on really encrusted items. Do not use a trickle charger.

3. There must be an electrolyte present in the water in order to allow the electricity to pull the rust away from the projectile. While many collectors use lye or salt, I found that common baking soda does just as good a job of cleaning. It is less dangerous in that the amount of fumes given off is very minuscule (but do not lean over the tank for long periods of time as it can cause your nose to burn) so the process can be done inside the basement or garage. Baking soda also allows you to handle the projectile immediately out of the water (after the battery charger is unplugged!) without protective gloves. It is also not as harsh on the projectile and, as a result, you can leave a projectile in the tank during the operation for an extended period of time without "burning." And it does not bubble up as much as lye, so you can clean closer to lead sabots without damage (however, the first operation may cause some foaming).

4. In order to conduct electricity into the tank, I use ½ -inch copper refrigerator line found in home supply stores. Some people use brass, but brass is hard (and expensive) to find in large sheets. The only disadvantage I found with copper is that brass sabots and fuses have a tendency to pick up a reddish coloration which is noticeable if the brass is shined up (which is not recommended anyway). But more about that later.

5. I coil the copper line inside the tank, getting the best coverage possible but without allowing the copper to touch itself. I flatten and bend enough of the top end of the copper so it can be connected with the battery charger without being under water. I also crimp the bottom end as the copper seems to last a little longer by not having the water running through it at the beginning of the process. Holes will slowly appear in the copper but this technique gives the copper a fighting chance.

6. I fill the bucket with water to a level appropriate for the size projectile I'm trying to clean. The objective is to completely immerse the projectile (with exception of Hotchkiss shells, as I will explain later). I prepare the baking soda by dissolving about half of a small box of soda in two cups of hot water. Pour the solution into the tank and stir until it is well mixed.

Preparing the Projectile

1. I wash as much mud and loose dirt off the projectile as possible. I find it advantageous to let the projectile soak for a couple of days in plain water. This seems to loosen the mud and dirt better and allows the electrolysis procedure to work faster.

2. In order to allow the electricity to clean the projectile there must be a contact running to the projectile. This means the projectile must have a good contact point. Once the loose mud is removed, I try to find a small section of the shell where bare metal is present or I scrape the mud off a dime-sized section down to the metal. I try to locate an easy drill area on the projectile where the metal may be at its thinnest so a hole can be made easily and at the proper depth. This is important as; once again, good contact must be made.

3. I use a small-gauge copper wire from scrap electrical wire (construction type - not extension cords) as the contact with the projectile. In order to do this a small hole, 4-40 is recommended, is drilled into the shell at the cleaned area made previously. I highly recommend a drill press as a hand drill is apt to wander and break the bit.

First, I secure the projectile so it will not have a tendency to move during the drilling, thereby causing the bit to snap off. I built a cradle for use with elongated projectiles and I use the hole in the table of the press to secure round projectiles. I also make sure the bit will be going in straight rather than "riding" the shell and going in at an angle.

Second, I place a small drop of clean motor oil on the area I have chosen as my contact. I also use oil on the drill bit. Oil does not transmit as much heat as water so it is better for the bit as well as the process of drilling.

Third, I drill the hole only deep enough to adequately secure a 4-40 brass screw. Once the hole is bored, I use a 4-40 metal tap to thread the hole. Be sure to wipe the tap with a little oil before using and do not force it, otherwise, you will plug the hole with the broken tap. Wipe excess oil from the area.

Fourth, secure the wire to the projectile by making a small loop at the end of the wire and set with the brass screw. Apply only the pressure needed to keep the wire from moving around - otherwise the head of the screw will twist off. The wire and screw can be used several times, but they must be cleaned off with a wire brush before each use.

Fifth, make a larger loop on the other end of the wire to help clamp the wire to the battery charger.

Cleaning the Projectile

1. Place the projectile in the tank with the copper wire extending above the surface of the water. Make sure the projectile is sitting or lying as flat as possible without touching the copper coils. I find it easier to use a construction brick (type with holes in it) as a base for round projectiles and projectiles, which cannot stand alone. Elongated projectiles clean better if they can be stood up.

2. Complete Hotchkiss shells, as well as any other shell with a lead sabot in the middle, have to be cleaned twice - once for the nose and once for the base. These shells also require two holes to be drilled. Make sure the water level does not touch the lead sabot. The same holds true for pewter or lead fuses - make sure the water does not cover them, as they will turn gray during the process.

3. Clamp the POSITIVE end of the battery charger cables to the end of the copper coil and the NEGATIVE end to the copper wire from the projectile. Plug the battery charger in and observe the projectile. If tiny bubbles are rising from around the projectile there is good conductivity. If not, **UNPLUG** the charger and reset the clamps making sure there is a tight fit. For projectiles without much rust, there may not be signs of bubbles, but if everything is tight, the process will work.

4. Deeply encrusted projectiles take 10 - 12 hours to loosen the rust, while projectiles with little rust usually clean within 8 hours.

5. In order to see if the projectile has received its maximum cleaning I test the projectile. **UNPLUG** the charger, take the clamp off the cooper wire and lift the projectile out. If the projectile can be wiped off with a cloth or the rust is "eggshell", (meaning it can be easily cracked off) it is ready to clean. If not, it goes back in for a few more hours. Remember, baking soda does not seem to burn up the projectile like lye does so it does not hurt to over-extend the electrolysis.

Final Cleaning of the Projectile

1. After I remove the wire and screw from the side of the projectile I scrub the projectile in clean water with a brass brush. This does not harm the projectile - it simply helps remove the loose rust and the reddish deposit left by the electrolysis. I lightly scrub any sabots or fuses to clean off any deposit. As I stated earlier, brass will take on a reddish hue, which can only be seen if it is highly polished. A shiny fuse or sabot gives the shell an artificial appearance so it is best to do a quick brushing and then leave them alone.

2. Electrolysis usually does not clean out the deep grooves manufactured in the projectile (usually found around the sabot area). For this cleaning, I use WOOD chisels. Lightly tapping the chisel with a small hammer will help remove the rust and other debris in this area. Just take time and use light taps, otherwise there is a possibility of chipping good metal. Do not use METAL chisels, as these will definitely cause damage. I also use soft wire brushes (aluminum or brass) to further clean the grooves.

3. After I rinse the projectile again in clean water, I inspect if for any stubborn rust patches, removing what I can with chisels and brushes.

4. If everything is satisfactory, I let the projectile air dry for several days in a humidity-controlled environment. This allows any moisture, which penetrated the projectile during the process to dry out.

NOTE: Many projectiles will have small divots remaining, which are caused by the action of the rust over the century. This is normal and no attempt should be made to fill these holes or to smooth them out. I have encountered projectiles that have received a treatment of metal putty either in spots or, in some instances, over the entire projectile. To most collectors this is considered to be fraudulent and devalues the projectile.

Preserving the Projectile

The method used to preserve a projectile is up to the individual. Some people say to leave a little patina to make it look old. That's the golden rule for non-harmful patina such as found on lead and brass. However, patina on iron is also known as "rust." This has to come off; otherwise, the projectile will continue to deteriorate. That is exactly the goal of electrolysis. Not coating the shell with a preservative will defeat the goal.

I know some people who use tung oil, and that is fine if you want a shell with an oily layer on it. However, oil does not plug up the pores in the metal and also attracts dirt. Motor oil is definitely out for obvious reasons. I also do not use varnish or polyurethane, as they are less likely to preserve and protect against rust.

I prefer to hot wax a projectile with a product known as Bri-wax. This wax can usually be found in furniture or craft stores. I use a dark color in order to cover the "just cleaned" look most projectiles take on after electrolysis. I have used this for over a decade and my customers have been most satisfied. In fact, dealers find that wax preservation adds to the value of the projectile.

In order to preserve the projectile I do the following:

1. Heat the projectile to a point where it is hot, but can still be handled with gloved hands. This allows the pores in the metal to open and also forces any trapped water to the surface. If the projectile is a solid shot or an unloaded shell, do not worry if it gets overheated. Just let it cool down and reheat. However, a loaded shell should be monitored closely as they could explode (although I have not heard of this happening there is no use in taking chances).

Some collectors place the projectile in the oven to heat it. I have heard of one relic hunter heating an explosive shell in the oven to the point where it starting sizzling. He got scared and threw the shell out the door. It was probably water in the shell heating up, but it sounds as if it was overdone. And that is the problem with using the oven - it is hard to monitor.

I have also heard of people heating the wax instead of the shell. That is extremely dangerous as most wax is highly inflammable. The wax also has a tendency to evaporate when heated.

I use a heat lamp secured just above the projectile. Using this method allows me to periodically test the projectile to determine the point at which it is ready to be waxed.

2. I place the heated projectile on newspapers and start applying the wax with a small brush as if I was painting it. It is important not to let the wax run onto lead sabots or fuses, as it will stain them permanently. I apply the wax to any brass sabots and fuses and continue to paint the shell until the wax begins to solidify.

3. I also use a dark furniture repair pencil to stop up the screw hole. I simply twist the pencil into the hole until it is full, and then break it off. The wax will melt into the hole and, after the final brushing, it can hardly be seen.

4. It is important to begin brushing the wax out once it starts setting up. Otherwise, the final finish may show streaks where the wax collected. For this process, I use an old shoe brush and have it marked for the initial brushing as opposed to another I use for the final buffing. The brush will gather wax so it needs to be brushed against newspaper periodically to clean the bristles.

5. I then let the projectile cool off for several hours. This allows the wax to harden inside the metal pores which helps prevent moisture from entering the shell from the outside.

6. After the projectile has cooled off, I buff off any excess wax with another shoe brush paying close attention to the brass sabot and fuse. I also make a pass or two over any pewter or lead fuses as this tends to highlight numbers of Bormann fuses and very slightly darkens the stark white patina on other fuses. Be careful not to overdo this.

7. For final buffing I place the shoe brush in a white cotton sock and buff the projectile with short hard strokes. This removes the tacky film from the surface left over from the drying process. The projectile should be buffed until it no longer feels tacky.

And that's it! The projectile is now ready to display.

Hotchkiss shell on the left is the new method of cleaning and waxing. The Hotchkiss on the right is an example of the old method used by many people.

Note the shell on the right has been coated with a clear substance, which has continued to rust underneath.

A Word about Cancerous Projectiles

I have found that projectiles with metal cancer do not electrolysize well as too much metal is lost. As stated before, the cancer is caused by the projectile being immersed in a wet or swampy area or excavated deep within a hard packed clay area. Moisture is a serious enemy of iron and many of the projectiles I have seen lately have large patches of cancer - large chunks of iron missing or cracks developing. It may not be apparent when the projectile is first excavated, but over a short period of time, the cancer will present itself. Because of the depth that most projectiles are being found today, I have seen many more cancerous ones over the past few years than ever before

Many times, a projectile is not determined to be cancerous until it is being prepared for electrolysis. If, in the process of drilling the small hole, the drill bit goes in rapidly, or the projectile skin “craters” around the hole, there is a good chance the projectile has cancer.

The prudent thing to do in case of a cancerous projectile is to hand clean it with the chisels and wire brushes to remove as much rust as possible. Then hot wax it and it will last a little longer. I have a 30 lb Parrott shell that came from the Savannah area and I tried to preserve it the old fashion way (varnish) more than 30 years ago. It slowly lost the exterior layer and developed a large crack in the side. I removed the varnish and hot waxed it several years ago and it seems to have stabilized somewhat (of course it looks more like a 20 lb piece of iron than a shell).

Electrolysizing Small Relics

Electrolysis is a very successful method of cleaning larger metal objects such as projectiles, gun barrels, lock plates, and bayonets. I would not recommend using it for any smaller pieces as many times rust is the only thing holding the part together (this is especially true for bullet worms and wipers). Tin items should also not be cleaned by electrolysis due to the poor conductivity.

When cleaning the above mentioned items, an area must be cleaned off as complete as possible in order to wrap the conduction wire around the object - it is too difficult to try to drill a hole in the steel bayonet, barrels, or lock plates. The wire must be secured tightly, otherwise the process of cleaning and preservation is the same.

Some Do’s and Don’ts

1. DON’T touch the water, wire, or coils in the electrolysis tank while the charger is plugged in. The result is a nasty experience and could electrocute you. The outside of the plastic tank can be handled if necessary. However, pay attention to the wire handle - if it is encased in plastic above the level of water it should be harmless, but I would not fool with it while the process is underway.

2. DON’T breath in the fumes from the tank over an extended period of time as it can make you sick. However, it is safe to use the baking soda procedure in a large enclosed area such as a carport, garage, or basement as the oxygen in the room rapidly dissipates the fumes. I would also recommend that the tank NOT be located right next to an open flame appliance, just in case. The fumes are not very flammable, but no use taking chances.

3. DON'T drill the purchase hole in an armed shell too deep or you could enter the powder chamber and set the shell off. I have not heard of any shells exploding because of this but there is no use being the first victim.

4. DO try to have the explosive shell unloaded BEFORE the electrolysis process - not because the electrolysis procedure might explode the shell, but because the process of unloading may ruin the wax finish on the shell.

5. DON'T TRY TO UNLOAD A SHELL YOURSELF! There are several experts around who can do this for you. They have the proper equipment to do it safely. Loaded shells have a tendency to deteriorate from the inside because the powder causes a reaction with the iron. Although this process takes many years to accomplish, it is advisable to have the shell unloaded, especially if it has an airtight fuse.

6. DON'T worry about the copper lines turning green. This happens quickly and it is caused by the action of the electricity and baking soda. I scrape the coil with a steel wire brush after every third projectile cleaned just to remove some of the corrosion scales.

7. DO change the water/baking soda solution periodically depending on the number of projectiles being cleaned. The water will become "heavy" from the debris removed from projectiles, corrosion of the copper lines, and the action between the baking soda and the electricity.

8. DO check the copper lines periodically for signs of corrosion. That is the beauty of using them instead of a metal tank - it is much easier to replace the lines and you do not spring a leak. When the lines have so many holes in them that they are in danger of breaking apart, replace them with new lines.

9. DO clean the copper wire and brass screw between each use. These items will present a burned appearance and need to be wire brushed in order to make good contact on the next projectile.

10. DON'T heat the wax up - heat the projectile instead. Hot wax is dangerous and highly flammable.