SURFACE RESTORATION TO ANTIQUE METALWORK

A Paper by Peter Hatchett

As antique furniture restorers, we often tend to think of ourselves simply as specialist craftsman in wood and forget that we frequently need to be involved with the surface restoration of the metal items which will invariably form an essential part of the whole piece which has been entrusted to our care.

Restoration to some antique metalwork, often badly damaged and with parts missing or completed corroded by rust, will require specialised metalworking skills beyond the scope of this paper, which is concerned with various aspects of restoration to the surface finish. In the hope that it will be of interest to readers, I should like to share my thoughts and experience of some of the traditional methods of rust removal and simple chemical colour enhancement, to simulate age or blend an area of over abraded or new metal with the existing colour or patination adjacent.

Let us consider the basic requirements for the removal of surface rust, without deep erosion, from antique surfaces. Firstly, it is fundamental that the oxide be removed without affecting any integral brass or bronze work. Secondly, any precipitate formed by the chemical action of the derusting agent must be easily and completely removable without causing abrasion damage to the item. Thirdly, the existing patination, if any, should be affected as little as possible with little discernable colour change taking place. Fourthly, further oxidation should at least be inhibited, positive protection is not a practical possibility if the visual aspect of the item is to be considered. No protective precipitates are either invisible or truly metallic in appearance.

The metalwork to be restored is likely to fall into one of three main categories:

- Various hinges, handles and knobs, escutcheons, lock plates and facings. All to be found incorporating or partly formed in brass or bronze and often engraved or surface etched.
- Engraved and inlaid plates and mechanisms mounted on antique gun and pistol stocks. Also hilts of edged weapons and parts of their scabbards, again often inlaid with brass.
- The many and varied parts of antique clock mechanisms and some early engraved clock dials and other parts.

Commercially available derusting fluids differ in their chemical approach to the problem. There are those containing dilute phosphoric and hydrochloric acids, which dissolve the ferrous oxide chemically, leaving a matt-grey precipitate and those containing styrene-acrylate, co-polymers, which stabilize the oxide forming it into a blue grey precipitate of appreciable thickness.

For the average user wishing to derust general hardware or car parts, the derusting fluids offer an efficient solution to a rust problem. But in my opinion, they are quite useless for treating antique metalwork and can cause irrevocable harm to the surface in many cases. The chemical action produces well bonded precipitates, only removable by quite heavy surface abrasion, an undesirable, lengthy and difficult task should the item be small or of a delicate nature. Yet this will be necessary whenever a metallic finish is required. In the unlikely event of the precipitate removal being successful, the item will then have to be burnished and chemically treated to produce a suitable antique finish. Unfortunately these derusting agents will etch and corrode brass and bronze unless the contact time is brief, thus making their use on multi media items open to serious doubt.

It will consequently be abundantly clear that restorers need to look elsewhere for suitable methods of removing rust from any antique metalwork. It should not come as a surprise when I suggest a glimpse into the past to see how traditional methods dealt with the problem. I have always used such methods in my workshop and over the years, by trial and error, I have adopted two derusting methods, used as separate treatments, dependant on the type of item and the type and degree of oxidation. It will be subsequently noted that these methods follow quite closely the guidelines set out in the opening paragraphs.

To any restorers used to the rapid chemical precipitation, common to the derusting fluids of today, the traditional methods may seem a little slow, but since this allows a greater degree of control over the method's effect on the surface of the metal, it is no bad thing, especially when working with very small or delicate items or those which have worn very thin with the passage of time.

If at all possible the metalwork should be removed from contact with any show wood or delicate surface finish. This will obviate any possibility of extraneous damage and make the task so much quicker and easier. Should such separation be considered impractical for whatever reason, it is essential that all areas adjacent to the metalwork be very carefully masked off with masking tape, thin card and adhesive tape, plastic type insulating tape or similar. In some cases, as a mask or resist, wax can be rubbed over the adjacent surfaces, this being easily removed with white spirit before final re-assembly.

Light even oxidation, even with patches of superficial etching or pitting, present few problems and its removal is simplicity itself. Immerse the item completely in paraffin oil for 30 to 60 minutes. Using a soft toothbrush, rub the oil vigorously into the oxidation several times. If the item is still attached to the adjacent work, rub the surface with a cotton bud wrapped in a scrap of cloth. All well soaked in paraffin oil. This way there is less chance of the oil splashing onto adjacent areas. Make sure that the item is kept visibly wet with oil for the whole of the time to ensure adequate penetration.

Paraffin oil does not dissolve the oxidation, but it penetrates deeply loosening its bond to the ferrous base and reducing the oxidation to a dark grey sludge. Rub off this sludge with a soft toothbrush well damped with clean paraffin. Use a cotton cloth pad for its items still attached to adjacent work. Repeat several times until all oxidation sludge is removed. Any areas still showing traces of oxidation may be gently rubbed with 0000 Grade wire wool or fine grade textured nylon pads, both well damped with paraffin. When the surface is clear, wipe clean as before. I do not recommend the use of any coarser abrasive materials as there would be a risk of removing the original colour, particularly if the item has any brass or bronze portions not adequately masked off.

The resultant finish should be free of rust, except perhaps for a few dark pin pricks, where minor rust pitting has occurred. Wipe the whole item several times with a cotton cloth pad, well damped with white spirit, dry thoroughly and leave for 12 hours in a dry atmosphere. Do not attempt to remove the oily residue with methylated spirits or acetone. It will work well and obviate the need for a 12 hour final drying, but if the item is attached to wood which is French polished and the masking off is not quite perfect, the adjacent finish will be drastically affected! Best to let the use of white spirit become habitual and instinctive. Always consider carefully the use of any solvent adjacent to existing work to ensure that it will not affect it adversely.

Before the final wax polishing, check carefully on the colour and its match to any similar existing metalwork adjacent. If any colour change or enhancement is required, this is the appropriate time. At the end of this paper, I have described a few basic treatments which may be of interest when considering colour changes. I have used these treatments many times and can vouch for their effectiveness. Finally polish the whole item, including any brass or bronze portions with a micro-crystalline wax (such as Renaissance Wax), use sparingly and then burnish with a non fluffy cotton cloth. Use a soft shoe brush or similar to burnish and remove excess wax if there is a textured, engraved or moulded surface and them finish off with a cotton pad. If a semi glass finish is required, use brush and cotton pad as above, but omit the wax polish. This is my own preferred treatment and finish.

When the oxidation is well established, probably with extensive areas of minor etching and pitting, indicative of exposure to very damp conditions, a technique using dilute acidic elements to dissolve the oxidation will be required. Such a method, which has been a favourite of mine for many years, is an old one owing nothing to modern technology. An example of its use in specialist restoration is that it has been recommended for work on delicate clock mechanisms by a senior instructor at the British Horological Institute. The method involves the use of dilute tannic acid to convert the oxidation to a non-bonded powder type precipitate. The action is very gentle and non invasive, however this method is really only suitable if the metalwork is separated from the adjacent work, as a total immersion in the acid for several hours is required. To apply the acid, keeping it moist over a long period whilst in situ, is in my opinion somewhat impractical. I have actually done this on one item that could not be removed without damage. Remember any show wood adjacent must be very well masked for tannic acid can have an alarming effect on some woods, although it is naturally found in a number of species. I would say in summary " Can be done, but not to be generally recommended!"

The procedure presents no problems, the metalwork item should be cleaned with a little soap and hot water to ensure the surface is free from oil or grease, as this would hinder the acid reaction. Since tannic acid does not affect brass or bronze, any such portions require no special attention, however if the item is to be treated in situ and the surround is show wood, remember tannic acid will discolour wood and affect French polish, so mask off very carefully. To start, boil a pint of water and leave boiling for 2 to 3 minutes to ensure that all dissolved oxygen has been expelled to prevent any rust forming during the precipitation period. Pour the water into a non-metallic container, add 4 to 8 tea bags, stir well and allow to brew for at least 5 to 6 minutes, stir well again and remove the tea bags and allow the liquid to cool for 10 minutes. Completely immerse the item and leave for 1 to 8 hours, depending on the amount of the oxidation. Inspect regularly and when an even blue-grey-coloured precipitation has formed, remove from the liquid and whilst wet, polish very gently with 0000 Grade wire wool or a fine grade textured nylon pad or if the surface is moulded rub gently with a soft tooth brush to remove the precipitate. It will wipe off quite easily as it is a non-bonded powder. Rinse with clean warm water, distilled (de-ionised) for preference, and immediately thoroughly dry. A hair drier is useful if the shape is complicated or deeply chased or etched.

The surface will remain free from rust for a considerable period if kept in a warm, reasonably dry atmosphere. Since no etching of the ferrous surface occurs, this method is ideally suitable for use on engraved or decoratively etched surfaces. Due to the ease with which the precipitate can be removed, it is a sympathetic treatment for very delicate items, especially if brass or bronze are present.

If a large number of items need to be treated at regular intervals, or if the precipitation times need to be reduced, I would suggest making up a stock solution of tannic acid which can be diluted as may be required or used as a saturated solution for treated badly rested items. Tannic acid crystals can be purchased from most chemists, to special order. Add to near boiling water, kept such for 2 to 3 minutes as mentioned before, as many crystals as will dissolve in the non-metallic container, without affecting the clearness of the solution. Allow the saturated tannic acid solution to cool for 10 minutes or so and decant into dark glass bottles, in my case red wine bottles! Cork tightly and store in a cool dark place until required. Logical safety precautions require such bottles to be clearly labelled and marked poisonous. A reasonable strength for the solution in use would be such as to produce an evenly coloured blue grey precipitation in about 2 to 4 hours, no further build-up of precipitation is necessary for the reaction to be complete.

There is one other method of rust removal which, although it has several limitations, merits our consideration. It is surface abrasion, in its simplest and most controllable form, the use of 'wet and dry' abrasive paper, hand held, usually in 400,600 and 1250 grades with a thin mineral oil such as '3 in 1' as a lubricant. In most cases, subsequent chemical patination will be necessary.

This treatment removes light surface oxidation very well, but has little affect on any etching or pitting unless coarser grades of abrasive paper are used as a preliminary stage in the treatment. When this becomes necessary it is best to lay the paper on a thick sheet of float glass (12mm) as a surface plate, oil damp the paper surface and rub the item firmly on the abrasive. This method allows the item to be evenly abraded and will prevent its edges being rounded over.

Care should be taken carefully to wipe the item thoroughly with a cloth and clean oil to remove all abrasive sludge between paper grade changes, to avoid scratch marks as the surface abrasion becomes lighter and more even.

If the surface oxidation is very slight without pitting, a fine grade textured nylon pad soaked in oil will be found to be quite effective in the majority of instances. If used with a light touch, the original colour and patination will not be removed. Although possibly a slight surface sheen may be produced.

In my own workshop, I have tended to reserve abrasion derusting for restoring antique woodworking and engineering tools. Over the years I have restored many such tools and have found the described technique produced excellent results, especially after colouring the metal to simulate an aged patination, in keeping with two hundred year old items.

Abrasive methods, by their very nature, remove both the surface oxidation and the original finish. This, in my opinion, makes such methods generally unsuitable for use on the metal items as may be found on antique furniture and other items of like age, except in the few cases when the oxidation is very light and non-intrusive.

Some while ago I was given a most interesting abrasive block, called Sandflex, specifically for hand removal of surface rust. I had in the workshop some early 19th Century woodworking tools awaiting restoration and it occurred to me that they would make excellent test items as they were quite heavily covered with surface oxidation. With no preparation except a wipe with acetone to remove loose particles and surface oils, I rubbed the oxidised areas with the block using a firm but not heavy pressure. After a very short time the rust was easily removed, cleanly and with scarcely any sign of surface abrasion, leaving an excellent finish with a semi matt polish whilst still retaining an antique 'used but well cared for' appearance. Sandflex can be used dry or lubricated with water, but I found no discernible difference in the finish whichever method was used.

I was most impressed with this product and well pleased with the resultant finish. I most certainly would use it on any antique metalwork where the oxidation had not become intrusive.

The block appeared to be moulded from a firm but slightly resilient plastic material and was impregnated with fine abrasive grades from 240, 120, 60 to 40 grit. I used 120 grade which felt like a 240. On this basis, the 240 grade would be suitable for fine work and matt polishing.

The Sandflex blocks are imported from Germany by an American firm, Klingspor Abrasive, but are obtainable from P.W.F. Welding Supplies, 84 Polcroft Street, Bedford MK42 9BF. Tel: 01234 345111. Price about £2.25 each.

In conclusion, I should like to describe a few well proven methods of producing an antique colour finish to ferrous metal, similarly to brass, bronze and copper. It often becomes desirable to produce such a finish to new metalwork or after derusting items to achieve a visual balance to existing metalwork. The degree of artificial aging required generally can be achieved by adjusting the duration of the treatment and/or by gentle abrasion with textured nylon pads.

Ferrous metalwork

Method 1: Clean and degrease the item with a detergent and warm water or methylated spirits, dry thoroughly, using a hair dryer if the shape is complicated. This

method, involving acid fuming, is not suitable if the item has not been removed from its original background. Mask off any brass or bronze components with a coat of shellac. Place the item in a fuming box with a little ordinary strength sulphuric or hydrochloric acid in a glass container. Support the item so that all visible areas are clear of contact and wear latex gloves to avoid greasy finger marks. Leave in the fuming box for 24 to 48 hours, inspecting regularly to ensure the oxidation is being evenly distributed, when an even grey brown colour appears remove the item. Remove excess oxidation by gently rubbing with a cotton cloth and then wax or finish with a semi matt lacquer to produce a warm grey patination of apparent considerable age.

If the item is in situ, prepare as described above. The metalwork can then be painted with either of the acids, diluted with distilled water, using a cotton bud in lieu of a brush for obvious reasons. The oxidation will appear within a few hours, depending on the dilution of the acid. Thoroughly remove all traces of the acid with a damp cloth, dry and finish as before. In my experience such oxidation is not so deep as when produced by long fuming, though perfectly satisfactory if lacquered.

Method 2: Prepare the item as before. Prepare the oxidising solution of 16.3g of Sodium thiosulphate dissolved in 0.5 litre of distilled water. Dip or brush on several applications of this solution until a uniform deep black tone is achieved. Remove any remaining solution with water and cotton cloths, dry thoroughly using a hair dryer if necessary. Gently burnish with a textured nylon pad to lighten the colour and achieve an uneven, more natural appearance and finish with wax or lacquer as before.

Method 3: This method is only applicable to items which have been removed from their original background. Prepare the item as before. Prepare the oxidising solution of 11.6g of lead acetate and 11.6g of Sodium thiosulphate in 0.5 litre of distilled water. Carefully brush the whole item with the solution and heat to approximately 90°C to achieve a light brown to black colour. Burnish and finish as before.

Method 4: This method is only applicable to items which have been removed from their original background. Prepare the item as before. Coat the item with clean mineral oil either by brushing or immersion. Then heat the item evenly and very slowly with a small blow lamp until all the oil has disappeared. The result will be a semi matt, dark grey, slightly blue patination. Burnish with a soft cotton cloth. If the shade is too dark, burnish with a textured nylon pad as previously described and finish as before.

When applying the finishing lacquer, best results are obtained if the metalwork is gently warmed to comfortable hand holding temperature with a hair dryer and then the lacquer applied with a soft brush. Remember to work out before hand how to hold or support the item without touching the face side during application. Easily forgotten, but essential.

I have always been of two minds regarding methods of protecting simulated colour finishes. Almost all have little resistance to abrasion or general wear. Unprotected, they will feel right in use exactly as an original. With a wax finish, the feel is not much altered, but the protection is limited. Lacquer, even when matt or semi matt, always tends to feel artificial. However when applied very thinly, I think there is a reasonable compromise between protection and ‘original feel’.

Brass and Bronze generally.

Brass is an alloy of copper with tin or zinc. The proportions vary, usually about 2 parts copper to 1 part tin or zinc. Over the centuries the proportional changes have given rise to a wide variation in the colour of antique brass ware. For instance 18th Century brass had a much greater proportion of copper than later alloys, producing the characteristic greenish patination colour so difficult to simulate. Bronze is also an alloy of copper, usually with tin in the proportion of 8 parts copper to 1 part tin. Once again the proportions have been varied over the years, often to produce alloys suitable for specialised uses, producing subtle colour changes, though much less than those found in brass.

Brass and Bronze ware.

Both these metals have an affinity for solutions of Ammonia and most colouring methods involve its use in some form or another.

Method 1: Clean and prepare the item as previously described. Apply slightly diluted ammonia, 3 parts to 1 part distilled water, either by quick immersion or brush application which will produce very quickly a cold black oxidation. Ammonia diluted up to 1 part to 1 part distilled water may be used for a much slower and controllable reaction. Repeat if necessary to achieve the depth of colour required. Wash with clean water to stop the reaction. Whilst still wet, burnish with oooo Grade wire wool or a textured nylon pad, using a light touch and press slightly harder on raised portions to produce natural wear highlights to leave an aged patinated appearance. If over- burnished, simply repeat the oxidising process. Always wear latex gloves when working with ammonia and use plastic or wooden tongs to hold items when possible. Finish the item with wax or lacquer as previously described.

Method 2: An old traditional method of colouring new brass or bronze was to immerse the item in warm urine, producing a fine aged appearance in ½ to 1 hour. The reaction can be controlled to some extent by the temperature of the urine. Horse urine was commonly used, as their hay and oats diet produced a much greater ammonia content. After immersion wash in clean water and finish as previously described. This is one of the best methods of producing a realistic patination of age on these metals, simple, controllable and effective.

Method 3: The mineral oil and applied heat method, described for ferrous metal (method 4) can be used for brass and bronze, leaving a warm brown grey colouration, a very natural looking patinated appearance. If a more even colour is required, the metal itself should be heated and then plunged into the mineral oil. In this case remove the oil with a cloth and methylated spirits, and burnish selectively, finishing as before.

Method 4: Another old traditional method, which produces a fine aged antique patination appearance, especially if the item is selectively burnished to produce wear highlights. Clean and prepare the item as before, ensuring the surface is completely free of oil and grease. Prepare the colouring solution by mixing 1 part of copper sulphate with 2 parts of hot, but not boiling water in a glass container. Apply the solution generously with a cotton pad filled with absorbent material. As soon as the brown colouration appears, wash off in warm water and thoroughly dry, using a hair dryer if necessary. Burnishing the rich golden colour as suggested above before finishing with wax or lacquer will produce a most satisfactory result.

Method 5: Prepare the item as previously described. Prepare the colouring solution by dissolving 5.8g of Barium sulphide in 0.5 litre of distilled water. Heat the solution gently to handling temperature and immerse the item. Remove when a brown colouration appears, wash and thoroughly dry. Selectively burnish and wax or lacquer finish, all as previously described. This method can produce an aged patina quite satisfactorily and is very simple to prepare and carry out.

Method 6: It is not often that it becomes necessary to colour these metals green or to simulate a verdigris type staining, however when required this method will be found quite satisfactory. If the immersion is of very short duration, the greenish patina of early brass ware can be simulated, especially if subsequently one of the other patination methods are super-imposed. Prepare the item as before. Prepare the colouring solution by dissolving 47g of common salt, 47g of Sal ammoniac and 35.5g of 880 Ammonia in 0.5 litre Vinegar or 10% solution of Acetic acid. Mix well in a glass container and immerse the item, remove carefully when the required shade has developed and dry slowly in room temperature. Burnish as required and superimpose a brown patination if desired. Burnish again and finish with wax or lacquer as before. If just a green finish is required, the traditional protective finish was beeswax in turpentine plus a little olive oil, all applied with a chamois leather. On an inlaid embossed panel this colouring method and finish looked magnificent.

Finally a comment about the cold patination products manufactured by Liberon Waxes Ltd, which are probably the best commercially available and I believe, are widely used. There is Haematite, which gives a blue black colouration to ferrous metals and Tourmaline Black or Tourmaline Brown, both of which produce an aged patination effect to Brass, Bronze and Copper. The name gives an indication of the basic patination colour.

All these products are to be diluted with water and applied by immersion or with an absorbent pad. The depth of colour can be, maybe too easily, varied by selective burnishing. The patination depth to metal surface is minimal and would be removed by normal wear unless protected by several coats of lacquer, to the detriment of natural feel when used. Not good news for a serious restorer.

I have used these products from time to time. On balance, they are capable of producing an acceptable aged appearance to the appropriate metalwork, but the very thin colour deposit is a positive disadvantage.