

# Leatherworking in the Middle Ages

Compiled and edited by [I. Marc Carlson](#)

Revision 3 March 2003

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This site is divided into two areas: **What we know was actually done in the Middle Ages**, and **20th Century leatherworking done by Reenactors and Recreationists**. No criticism or editorial comment is intended by this separation. It is intended to make things easier for people looking for different things.

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# Credits

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# Introduction to Leatherworking FAQ

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I would like to point out here, as the compiler of this document that it makes no pretence to be the "Last Word" on anything; that any of the people who contributed to it are world-class scholastics. They are just people who are trying to reconstruct the European Middle Ages as best as they can. Most of them \*do\* have a very good idea of what they are talking about, while still willing to listen to other possibilities. If you have information that either conflicts with the material in this document, or can supplement it in any way, please feel free to speak up.

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# Period Leather-working techniques

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1. [Tooling](#)
2. [Painting and Dying](#)
3. [Tools](#)
4. [Styles](#) - Under construction

(With the help of Carolyn Priest (Thora Sharptooth [priest@vaxsar.vassar.edu](mailto:priest@vaxsar.vassar.edu)); Ron Charlotte (al Thaalibi [afn03234@freenet.ufl.edu](mailto:afn03234@freenet.ufl.edu)), John Nash (Madoc [NASH.JOHN/HPBRIT.C6@hpcpbla.bri.hp.com](mailto:NASH.JOHN/HPBRIT.C6@hpcpbla.bri.hp.com))

## Tooling

Leather "tooling" or ornamentation can be divided into the following specific categories:

- **Applique:** This refers to the techniques of attaching other things to the surface of the leather, to decorate it. These can include paper-mache, other pieces of leather, decorative riveting, plaster/Gesso, etc. According to [Cennini's](#) *The Craftsman's Handbook*. When making helmets and crests of leather, the leather was to be gesso coated and treated as any other material.
- **Combinations**
  1. **Impression/Incision:** There are few instances of combining techniques such as Incising and Stamping, such as is done in much modern leatherworking, however, that should not be taken as a solid statement that such was not done. It is quite possible for such tooling to be done only using stamping tools, but the edges of such work are usually not as sharply defined as the cut and tooled work.
    - Belts -- *Dress Accessories*. Catalog nos. 22-23. These use both Incising and Stamping for decoration
    - Leathercovered Box (14th C - Italian) -- Newman, Thelma. *Leather as Art and Craft*. This box, which is currently in in the Metropolitan Museum of Art, has a overall design that could easily pass for a modern tooling style. There is an Elizabethan example of Cutting that is vaguely reminiscent of the modern "American Floral" designs that *could* be such a case (Citation forgotten).
  2. **Impression/Paint:**
    - Stonyhurst Bible binding (7th C.) [plate II; Waterer's *Leather and Craftsmanship*, Faber & Faber LTD., London, 1950.]
    - E. Diehl, *Bookbinding*, Vol. 1, Dover Books, NY, c.1946,1980, p. 109.
  3. **Cutting** (or often referred to as Carving)/Cuir cisele' - This is a method of decorating leather in which the design is cut into dampened leather instead of being tooled or blocked. The design is first outlined with a pointed tool and then dampened.

Sometimes it is then brought into relief by depressing the background, usually by stamping a

succession of dots into the leather very close together by means of a pointed tool. Certain parts of the design are sometimes embossed from the flesh side of the leather, and in such cases the decorating must be done before covering.

Some sources state that this technique was really only practiced only during the 15th century and then only in certain areas such as Southeastern Germany and Spain. There are no English and Flemish and practically no Italian examples are known.

1. Incising -- Taking a knife, or in modern tooling, a swivel knife, and inscribing a design into the surface of the leather. Note that a dull knife can leave a much larger "line" than a sharp one, and will not weaken the surface strength as much. This is \*possibly\* the most common method of ornamentation for leather during the Middle Ages. Numerous examples can be found in *Knives and Scabbards*, *Shoes and Pattens*, etc.
  2. Carving -- Technically, this is the technique of undercutting the leather surface and making it physically stand out from the general surface of the leather.
  3. Cutout -- Creating designed by punching holes in the leather. There are examples of this in *Shoes and Pattens*, as well as the various fields on the burial shield of the Black Prince (shown in *Leather and the Warrior*).
  4. Sgraffio or Scraping -- Scraping away parts of the surface to create an overall effect. There are examples of this in *Shoes and Pattens* and *Leather and the Warrior*.
  5. Embroidery -- Doing needlework on the leather itself. There are examples discussed in *Shoes and Pattens*.
4. Impressing
1. Stamping/Punching/Cold Stamping -- Using a hammer and unheated metal "Irons" to create a pattern, or set a single image. There are a few examples of examples of these in *Knives and Scabbards*, most often to create a repeating motif of a single design element.
  2. Blind Stamping -- Impressing by means of heated metal stamps, touched to the leather. This is the method of ornamentation used on books, and other items using very thin leathers.
  3. Creasing/Veining. -- This is referred to a single or double line, often used to create a decorative border edge on leather. It is done with either heated metal irons, or by friction with wooden tools. It is essentially similar to blind stamping in that it uses heated metal to create a design.
  4. Cuero Gofrado -- Rather like "Blind Stamping", this rather lays the leather atop a heated metal design, and pressed down onto it, creating a multilayered effect. It seems to have not been common beyond Spain and Italy.
  5. Poker Work/Pyrogravure/Poker Art -- This also uses a heated tool, but rather than to impress the design into the surface, to burn the surface with a very hot metal, in much the same way as a Branding Iron or a Running Iron works. [On light leather you can burn, using a soldering iron with a sharp tip, a series of dots and lines that are black. They last for a very long time and you can create some very complicated designs (including some of the really difficult ones from the book of kells) This method of

decoration is authentic for the period 800-1100 (see sheaths in the Yorvik viking centre) and probably before and after those dates.]

6. Gold Stamping -- This is a means of imbedding gold leaf patterns into the surface of the leather. Judging from bookbindings, leather tapestries, and some of the nicer items described in inventories, they used gold, silver, and tin leaf on many items, and often faked up the tin to resemble gold or silver.
5. Modelling -- Creating a bas relief in the leather using a number of techniques, including carving.
  - Dublin piece (13th c) -- This could just as easily have been a combination of stamped work and embossing. The basic design (animals and vegetation) would have been laid out and rough worked by pressing or modeling, then the background would be stamped with a small round stamp before the main design is finished. Additionally, the background dots in the piece appear to have been worked in rows; they follow the rough lines of the main design rather than being the smooth all-over pelleted background
6. Molding or Moulding -- May include molds and/or counter molds to create the design. A design that has been engraved on a piece of wood can be pressed into a piece of leather stretched over the form. It would appear that many molds for Bottels, etc. rather than having the leather go around the mold, often have the leather pressed in TO the mold. Many period leather bottles were made in this fashion, as well as a number of examples of materials shown in Waterer's books. It is my suspicion that the "Arms of Henry VIII" found on the bracer recovered from the Mary Rose, is an example of this, but I may be in error, since all I can see are photos.

## Painting and Dying

1. Paint -- The acidic content of vegetable tanned leather doesn't seem to be very friendly to a lot of the pigments and mediums used in period, especially over long time spans. There are few examples of painting on leather that have survived. A number of painted artifacts housed at the Cloisters, in NYC, etc.
  - Leather Cover (14th C.) -- *Der Katalog des Deutschen Ledermuseums und Deutsches Schuhmuseums*, color plate ("Tafel") III, (Universitätsdruckerei, H. Stürtz AG, Würzburg, 1967). The item is has figures of ladies and minnesingers cavorting about under four gothic arches.
  - Roman Scutum -- Waterer, J.W. *Leather and the Warrior*
  - The Scabbard of St. Maurice, c.1200-500 -- *Arms and Armor of the Medieval Knight*
  - Tapestries -- Waterer, J. W. *Spanish Leather*. There are a few of these surviving that either show traces of paint, or were described in inventories as having been painted.
2. [Dying](#) (by Ron Charlotte (ska Al Thaalibi))

# Tools

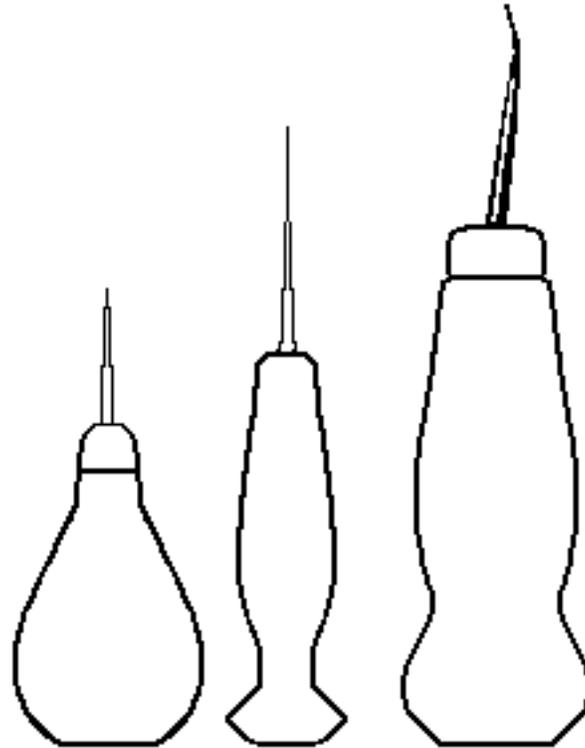
- **Awls** -- Many Awls are "S" shaped. The cross-section of the Awl must be less than the diameter of the thread in order to achieve a water-tight grip.



Sewing	●
Stitching	■
Closing	●
Stabbing	◆
Sailmaker's	▲
Scratching	◆
Saddler's	◊

- *Sewing Awl* - A flat oval cross section.
- *Stitching Awl* - A flat rectangular cross section. You may have to sharpen the point, but there is no need to sharpen the edges, as the blade is designed to spread open the hole for taking the thread, not for cutting the leather.
- *Closing Awl* - A curved blade, flat oval cross section.
- *Stabbing Awl* - A round cross section
- *Sailmakers Awl* - A Triangular cross section
- *Dull/Scratching Awl/Round Awl* - A round cross section, blunted tip. This is not intended to punch a hole in the leather, and therefore should not be sharp. It is meant to mark the leather, or, perhaps, to widen a previously made hole. It is also entirely probable that some form of Marking Scriber, or Scratch Awl was used in the Middle Ages, but I have no solid documentation for it (although the "horn" on the half moon knife might serve such a purpose).
- *Saddler's Awl* - A diamond cross section. This seems to me the most commonly used form of awl in modern leatherworking, and according to the *Shoes and Pattens*, and *Knives and Scabbards*, Diamond blade awls were available from quite early. Those found at the Lloyd's Bank excavation are somewhat corroded, and consist of 2.25" and 3.5" long wooden handles, and 1.75" long blades. When you use an awl such as this, you may have to sharpen the point, but there is no need to sharpen the edges, as the blade is designed to spread open the hole for taking the thread, not for cutting the leather.

- *Pricking Awl* - I suspect that this is a term for any awl, such as a "Stabbing Awl" that is used for making holes to stitch with, and should not be confused with the other "pricking" tools of leatherworking and shoemaking (the Pricking Iron and Pricking



wheel).

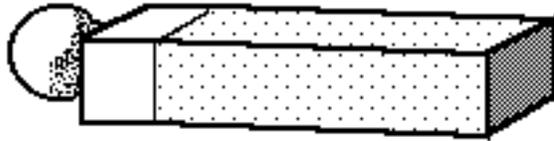
- **Hand-Leather** -- (A.k.a., a Shoemaker's Mitten) A piece of leather wrapped around the left hand to protect the hand when drawing the thread tight.
- **Irons** -- As I know of no evidence for a Pricking Iron, or "overcast wheel", for measuring the holes to be made for stitching, it is possible that some scale might have been used.
- Knives and Shears:



1. **Round/Head knife/Half Moon Knife** -- Used to "click" or cut out the leather, and to skive the edges.
2. **Shoe/Sole-trimming/Square ended Knife**: --This is a more square headed blade, kept very sharp.
3. **Paring knife/Trenchet** -- A paring knife is used to trim away excess leather, particularly in places where the Half Moon knife would be difficult to handle or manage. THE most important aspect though is that this knife must be **sharp**. Note that in modern parlance, a Trenchet is a specific sort of knife totally different from the Paring Knife, while in the Middle Ages it seems that they were synonymous.



4. Pattern Knife
5. **Shears** - A large pair of scissors, made from a single strip of metal, used for cutting thread and leather. There is some disagreement about whether you should ever use scissors or shears to cut leather as it does not cut evenly, but there they are.
6. **Stropping stick/Sharpening Bat** -- Used to keep awls, shears and knives sharp, when you feel that they have begun to dull.



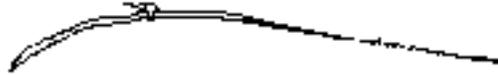
- Stop working. Start by stropping your blade along the edge of the stropping your blade along the edge of the stropping stick across the grain of the wood, or along the leather. A four sided bat can be covered with a variety of grits, from nothing but the surface of the wood, or leather through jeweler's rouge or similar substance. Stroke the blade firmly and smoothly and evenly. Do both sides. Carefully run your thumb along the edge, checking for burrs, checks or rough edges.
  - If the stropping doesn't make the burrs go away, use a [stone](#).
  - Be patient.
  - Keep doing this until you can't feel a burr and your knife cuts smoothly again.
7. **Whetstone** -- Used to keep awls, shears and knives sharp. They are also known as *oilstones*, *honing stones*, and *sharpening stones*.
  8. Use a light lubricating oil, or water. Other forms of oil may have drawbacks for the unwary. Water produces a keener cut on the stone, as does oil mixed with paraffin.
  9. Don't be stingy with the oil, since it is not meant as a lubricant, but serves to keep the pits in the stone from becoming impregnated with metal as you sharpen. This is what forms the grime black slurry that forms as you sharpen, and what must be wiped away before it can clog the stone.
  10. Notice the bevel your blade forms, and try to keep this angle. You can get a sense of the bevel by lying the edge of the blade on the stone.
  11. Sharpen in smooth, firm strokes, as though you were trying to take a slice from the stone with each stroke, or else move the blade in firm, circular strokes (opinions vary). Often only a single pass with a stone is enough to produce a clean edge that can be resharpened by stropping.
  12. Keep doing this until you can't feel a burr and your knife cuts smoothly again.
  13. Be patient.

14. After using a stone, you should probably finish with a final stropping.

- **Bucket of Water:**

- **Needles** -- Hog's bristles (aka Sow-hair, Boar's bristle) became used in the shoemaking industry because of their flexibility in pulling the thread through curved holes. It is not known when they became common, but they were at least in use by the 14th century. Other needles were also used,

however.



- **Paste Horn** -- A cup made from horn, used to hold a simple paste of flour and water, used to tack leather in place during sewing.
  - **Sample Paste** -- 1/4 cup White Flour; 1/16 tsp Alum or Salt; 1 cup water. Combine the flour and the alum or salt. Add the water, eliminating lumps. Bring to a boil for a minute, constantly stirring. If it thickens, add water.
- **Pincers** -- Pliers are sometimes needed to pull reluctant needles through the holes when stitching.
- **Polishing Bone** -- For flattening and smoothing. (Note that the Polishing bones portrayed are also usable as Drawers/Channelling Tools, and for "Pricking", or marking the spaces for punching the



holes along a seam.

- **Rubbing Stone** - Often a piece of agate, used to burnish the edges of a piece of leather.
- **Tacks** -- This might refer to the metal nail like objects currently referred to as "tacks", since by the time the poem was written, these had become more commonly used in assembling heels; however, it might also refer to some method of "tacking" (or Basting) the leather pieces together for assembly. This is done either with paste or bits of thread looped and tied, spaced around the item.
- **Thimble** -- Used to protect the thumb from the needle.
- [Thread](#)
- **Tooling Materials** -- While I do not know of any examples of stamping irons, or a dull knife for "incision tooling", but it is probable that these were, in fact used.
- **Thumb-Leather** -- (A.k.a. Thumb stall) A piece of leather wrapped around the thumb to protect it when drawing the thread tight.

## Styles

(Under Construction)

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# Leather Bibliography (in Progress)

by Kendra of Hollyoak, with some additions by I. Marc Carlson

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This bibliography was originally compiled by Sue Hallock (SKA: Kendra of Holly Oak (East Kingdom))(94 Berlin St. Clinton, MA 01510) email:hallock@banyan.com.

It has been edited somewhat by I. Marc Carlson (SKA: Diarmuit Ui Dhuinn (Ansteorra)), and so if there are any errors, they are more likely to be his fault.

If you know of any resources that are not included in this bibliography, please email them to me so that I may continue to improve the bibliography. Thanks!

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# Leather -- General Finds From Excavations

(Note: The best sites for finding intact leatherwork are waterlogged or waterfront sites. The site reports for these types of sites usually contain the word "waterfront" or "lowland". Example: "Excavations on the Thames waterfront at Trig Lane, London.")

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# Medieval Leather Dying

Originally compiled by Ron Charlotte (ska Al Thaalibi)

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Dying leather was done, but these appear to be limited to green, red, blue, black and brown. During the Middle Ages, as with today, they also seemed to think in terms of dying whole hides and skins, frequently in concert with the tannage or tawing process.

1. [Alexis of Piemount](#)
  2. [Gioanventura Rosetti](#)
- 

## ***The Secretes of the Reverende Maister [Alexis of Piemount](#), ANNO 1558***

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- To Die Skynnes Blewe, or of the Colour of Asure

Having fyrst well washed the skinne, and than wronge him, take the berries of [walwort](#), and elderberries, and seeth them in water, wherin Roche Alome was dissolved, pass him once thorowe this water and let him drie, than pass him again thorowe the same water, and being wiped and dried againe, wash him with cleere water, than scrape out that water with the back of a knife, and once again pass it over with the same colour, and let it dry so that it be of a very blew or Asur colour.

- To Die Skinnes in chickweede, called in Latin Rubra Maiore, or Rubra Tinctorum, into a Redde Colour.

Having annointed, washed, wronge and layed abroad the skin, as is aforesaid, wete it with water that white wine lees and baye salt hath ben boiled in, and than wring him. Take than creuiles or crabbe shelles (be they of the sea or of the river) burned into ashes, the whiche yon shall temper with the said water of the lees and salt, and rubbe well the skinne therwith, than washe him well with cleere water, and wringe hym. This done, take ruddle tempered in water of lees, and rubbe the skinne well over and over with it, and than with the foresayde ashes, wasshinge, and wringing it thre times. Finallye, after you have wasshed him, and wringe him, if you thinke it not be well ynoughe, you shall geue him one dienge with brasyll. The paste or masse of Rubia Tinctorum, must be made with water that lees or tartre hath bene boiled in, and the sayed water must be luke warme, and whan you make the paste of ruddle, than leave it fo the space of a night. After this, put upon the sayd Rubra Tinctorum, a lyttle alom, dragges, or lees, or Alome catinum, staped in water. You maye also adde to it the colour of the shearing of scarlet, whiche hath been taken oute boylinge in lye, which is a goodly secrete.

- To die Skinnes Greene

Annoint the skinne, and wash him well with cold water, and than in hote water, and so wipe & drie him. This doen, take of the [graines](#) wherby men make the sappe (the

decotion wherof shall be put in thende of this boke, with them of all other necessary thinges) and the sayde graynes or berries muste be verye rype, than put them in cleare water, covered a fingar height, put therein also Roche Alome, and geve them onelye one wawlme on the fyre. This doen, strayne them out into some vessell, than take the skinne, and folde him in the middle, rubbing him well on both sides, with the said sodden graines, or berries, whiche remaine in the pan, and after with rawe Alome poulder. This doen, take the ashes of shepes donge burned, and wete it with the saied coloure that you strained into the sayde vessell, and rubbe the skinne wel on every side, than cleere him again of the sated graines, and washe him with cleere water, and set im to drie withoute wiping him. Fynally cast on him two glassefulles of the sayde coloure, and it will be a perfecte greene.

- Another waye to dye Skinnes Greene.

Lette the skinne be annointed, well washed, wronge, and stretched oute as before, than take of the same graines and berries ye toke before, which you shall stampe and seethe in Roche Alome water, and geve the skynne twoo wypes over with this coloure, and so let it dry. After this you shal geve him one dying or colouring of yellowe, made with the graynes or berries of Nerprum, sodden in water and Alome, and a lyttle Saffron, and you shall have an excellent greene.

- To die the said skinnes greene another waye.

Take the skinne, being annointed, washed, and spredde abroade, dye and coloure him with the coloure made of sap greene, and put it a few asshes wette in water, and so rubbe the skinne all about. And whan you have washed and wyped hym againe, geue him one wype ouer with and Indian coloure sodden in Roche Alome. and whan it is dryp, lay on it of the foresayed yellow, and you shall have a fayre and lively greene.

- Another waye to dye skinnes of Asure coloure, and fayre.

Take the skinnes of blacke grapes, and rubbe well your leather with all, untill it ware somewhat blewe, and alsoo rubbe it well with, the poulder of Indicum, then washe it drye, and polyshe it. Than stiepe the Indicum in thicke redde wyne: and whan the skynne is washed, annoinct him with it, and you shall have a fayre asured blewe.

- Another maner to dye skinnes Greene.

Take rype elder berries, and the berries of walwort, and of sappe greene, and this well stamped, you shall put into it Roche Alome, as mucche as you shall thinke good, but rather to mucche than to little: than take the lye, and put into it the saied berries of sappe greene, and seeth them one wawlme. This doen, put in the berries of the walwort, or elder, and make them seeth also one wawlme, than take them from the fyre, and let them coole, and after rubbe the skinnes with them. Finallye, ye shall cast upon them, the ashes of sheepes donge, rubbing them well eith it. After this, geve them the couloured water water that the saied graines or berries were sidden in, than take of the water with a curryers knyfe, and let them drye. And yf you nede to geve them more coloure, than you maye put in more Indicum boyled, and wyll be the better.

- To die neates leather into a greene colour, as well in galle as in leaves.

Polyshe well the leather with a pomineyse stone, annointe it well with oyle, and washe it: than take an once or two of galles stamped, and put in hote water, leaving it so an hour, than straine it thorow a linen cloth, and put the leather into the same water, rubbing it well with your handes, and leave it so the space of an houre: and havinge taken it out, wring it, and stretch it abroad & tight it. Than take the graines or berries of Nerprum, gathered in July, whan thei be yet greene: drie them, and stampe them well, adding therto for every skinne, two onces of Roche Alom beaten in poulder, and mingled with the poulder of Y saied berries or graines. Than powre upon the sayd poulder boylinge water, and let it coole, this doen, poure of the sayd water with the said graines upon the skinne, rubbing it well over with the palme of youre hande, than stiep the ashes of goates donge, in the water of the said graines, and with the same water rubbe likewise the the skin well with youre hande, after this washe him, and scrape out the water with a tanners paring knife, than tight him out, and take other ripe graines of sap grene and set them to seeth, hole, in water with Roch Alom, and afterwarde let them coole. Than take of the sayde sodden berries or graines, and rub the skin with them with your handes, and put of the ashes upon it, which you shall stiep in the same greene water, that the sayed berries were sodden in, Finallye, you shall wasshe the skin, and take out the water with a scraping knife, that you shall geve it a course over of the saied grene water with a brush or clout meet for such a purpose: And than lay him to drie, and trim him, and you shall hae a fair grene. If you will have the coloure darker, or fadder, whan you set the said graines to seethe with the Alom, you hsall put to it a little Indicum well brayed. And you must note, that the water must be hote whan you sctepe the ashes in it, with the water of the graines of Nerprum.

- To die skinnes greene with the flowres of Ireos.

Take the fresshe flowres of Raphanitis, or Ireos, and stampe them well, than take the drie graines or berries of Nerprum, and with them stampe roche Alome, a reasonable quantitie, whereof a greate deale can do no hurte: put to it a little raine water, and mingle all this with the foresayd flowres stamped. Kepe this colour in some clene vessel, and than take the skinnes, being annointed, and washed as is aforesaid, and put to them the graines of sap grene with the poulder, in the same manner that we have spoken of the other: washe them, and scrape of the water with a knife, and so let them drye, and geve them one wipe over finely with the sayed colour that you kept, let them drie again, than dresse them according to the science, and you shal have fair leather.

(Note in margin: "Ireos, also of floure luce called in latin Raphanitis")

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## Notes

Based on this and a few other sources, I'd have to speculate that those three colors, and black were probably the most common dyes used for leather. All but one of the dye methods involve immersing the leather/skin. Yellow and brown might not have been mentioned since some tanning methods yield these colours, and in any case, there are many commonly available plants that will

dye these colours.

### **The Plichto of [Gioanventura Rosetti](#)**

-- This contains a section on leather dying. I would recommend the 1969 reprint/translation by Edelstein and Borghetti, put out by MIT press (sorry, don't have the ISBN handy). It has a facsimile of the original (1548?) manuscript and translation. Rosetti was a guildmaster of a dyeing guild in Italy.

- Graines -- The "graines" mentioned are almost certainly buckthorn berries (also called French berries, Grains of Avignon, Turkish berries, etc.) that are used to make 'sap green'. Unfortunately, like most berry dyes, this one fades in bright light.
- Walwort -- Walewort is an old name for the Dwarf Elder (European, NOT American). It's interesting to note that that this is the first period recipe I've seen for blue leather that involves berries rather than woad or indigo. Most berry dyes fade quickly when exposed to light.
- Chrome tanned leather has the advantage of being easily dyed using synthetic dyes. Any suede dye (is there really anything special about suede dye as compared to regular leather dye???) sold for shoes, etc. should do the job. If you're talking natural dyeing, there are numerous period dyeing methods. Although they are typically oriented towards dyeing alum tawed or vegetable tanned leathers, they will probably work on chrome-tanned leather.

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# Thread

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- [Needles](#)
- [Thread](#)
- ["Making" the Thread](#)
- [Waxing the Thread](#)
- [Threading the needle](#)
- [Threading Bristles](#)
- [Stitching](#)
- Miscellaneous

## Needles

While it is clear that the use of flexible needles such as Hog's bristles (aka Sow-hair, Boar's bristle) became used in the shoemaking industry because of their ability in pulling the thread through curved holes, it is not known when they became common. They were at least in use by the 15th century, according to a Cordwainer's will referred to in Swann, and regularly used in the 17th century, it is clear from that poem that other sorts of needles were in use as well.

Some leatherworkers have suggested that all stitching can, and should be done with harness needles, or ball pointed needles, and in all honesty I prefer to work with these myself. What is important to remember is that when working with all but the thinnest leathers you should be punching holes for the stitches with an awl rather than with the needle. This is not strictly true for glover's needles, which have an awl built in to each needle.

Needles are often gauged with zeroes through higher digits to indicate size. You should find a package of large and package of medium size needles sufficient to last you for quite some time. I have not found the leatherworking needles found in fabric and sewing stores to be durable to work with, but there opinions vary.

With some careful bending, harness needles can be bent sufficiently for use with curved awls.

## Thread

- For the discussion at hand, the following terms will be used: **Cord**, or the "thread" as it comes away from the spool or skein. Cord comes in plies of three, four, five, six, seven, or eight **Threads**. These are sometimes numbered to indicate their size or gauge, or referred to by their "weight" in Ounces. Most of the leather working thread, waxed or unwaxed, comes in Five or seven ply.
- **Prewaxed Thread**  
Some people are fussy about using pre-waxed linen threads. Personally, I think that for most general work, this is unnecessary, although I do understand WHY most such purists would feel

this way, and have the greatest respect for that. The symmetrical, rope-like look created by pre-waxed thread goes away when you unwind it.

- **Synthetic Thread**

DO avoid the synthetic threads. since I have yet to find any that don't look fake and won't break under the stress of sewing \*I\* place them under (weakling that I am). I shudder to think what they would do under the stresses of wearing. If you can't tell the difference between the synthetics, and real linen thread, you are just going to have to take someone's word for whether or not there is a real difference between the two. I think there is, but in the end, you do what works for you.

- **Cotton Thread**

Conversely, don't feel bad about using cotton thread sold in fabric stores. Just get the heaviest gauge available. We're going to show you how to work with it and strengthen it. It can be strengthened in the [thread making](#) process, treating the cotton threads as already separated threads.

- **Linen Thread**

Linen cord comes in two varieties, waxed and unwaxed. Plain white is best for historical recreation work. Cord comes in plies of three, four, five, six or eight threads. These are sometimes numbered to indicate their size or gauge. They might also be referred to by their "ounce". I believe that 2 oz. thread is the basic single strand.

The cord can be added to or separated into thicker or finer threads. Unwaxed thread must be pulled through a cake of wax (usually beeswax) or rosen

- **Wool Thread**

Ok, wool thread is ridiculous to use, because it breaks so easily. However, it can be spun tightly enough to use for thread (although you may have to spin it yourself for that). The best thing I can find SHORT of learning to spin thread myself is a form of wolle thread used for darning socks. It can be strengthened in the [thread making](#) process, treating the woolen threads as already separated threads. Most importantly, though, it is an authentic material to use in recreating early medieval leather goods.

- **Artificial sinew**

The use of artificial sinew is debated among some historical recreators, from the fact that the cords are sometimes too strong for the leather and will cut through it, to the fact that artificial sinew is not authentic for Medieval leather working. On the other hand, finding sources for real sinew is quite difficult, and since I have never used it, I am unqualified to just the merits of the real material.

Artificial sinew can be separated into its individual strands in a process called unwinding the ply, as with the linen threads.

## "Making" the Thread

- This is the process by which one reduces the cord into its individual threads, and binds together larger numbers of thread into larger ply cords.
- Pull out a length of thread. By holding it firmly, in one hand it can be unraveled by rubbing it along the leg (pushing your hand over the thread away from you). This takes practice and patience. This will separate the cord into its individual threads.
- Rather than cutting the cord, the single linen threads can be further unwound (n.b. threads are

wound in the opposite direction of cords) until with a gentle tugging they can be separated (I personally prefer to use scissors, but this is one of those traditional things).

- Try and make all your lengths of cord/thread the same (which REALLY takes practice if you are tugging the threads, rather than cutting them)
- If you separate them properly, you can wind up with a very thin end on each thread.
- Keep this up until you have the desired number of threads.
- I should mention that I have recently discovered that if you dip the cord in water before unraveling it, it comes apart more easily, and all the kinking will come out of the threads as they dry. They will dry in a matter of minutes.
- [Wax the threads.](#)
- Taking the individual threads (or for that matter, individual threads of cotton or wool thread), wind them back together by rubbing them along the leg (pulling your hand over the thread towards you). The more threads, the stronger the cord.

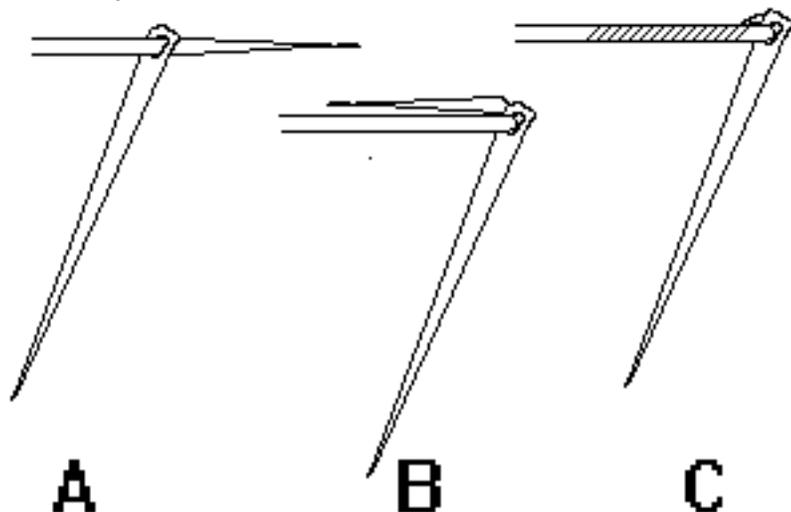
## Waxing the Thread

- According to later era shoe makers, the individual thread strands were waxed, by drawing across a block of beeswax, and then rolled against the cordwainer's leather apron just prior to use. (Note that this allows you to rub the thread along your leg, to wind it, without getting any wax on your clothes).
- Unwind the threads in a length of cord. The threads should be should be stacked with their ends spaced about a half inch apart. Separate these and holding them separately run them through the cake of wax, forming a waxed ribbon. Rolled the waxed ribbon into a round thread, by rubbing it along the thigh with one hand, while holding the end sightly tense in the other hand. Wrap the rolled thread around the hand that was holding the end, as you continue to roll the ribbon every three inches or so. You should manage about 15-20 twists per inch.
- It is important to note that waxing the threads makes it a LOT easier to rewind the cord.

To be honest, there is an easy way of doing this, one which many re-enactors do. Find a cord size you like, and rub the entire cord through your beeswax. Unless you have a need for a specially sized cord, or want some extra protection for the thread, no one will ever notice.

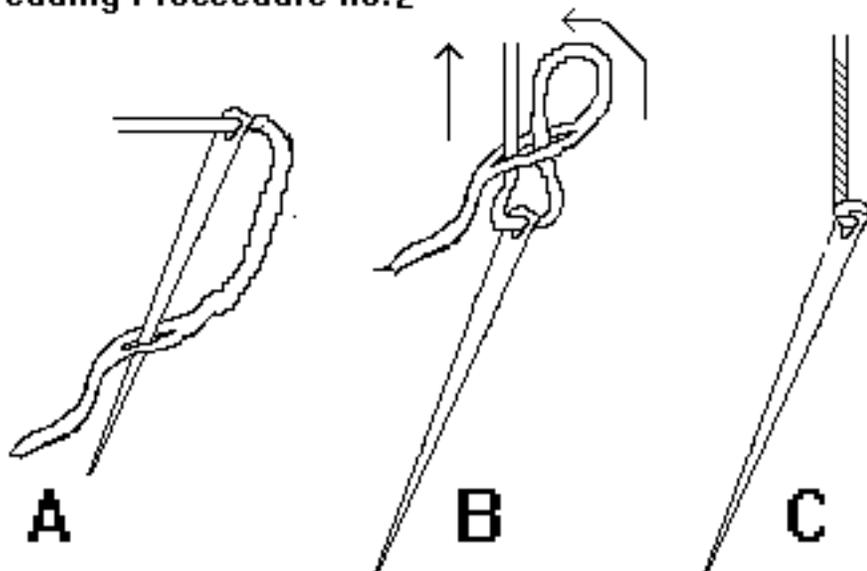
## Threading the needle

There are several methods for threading the needle that I have seen, the most simple being shown here:

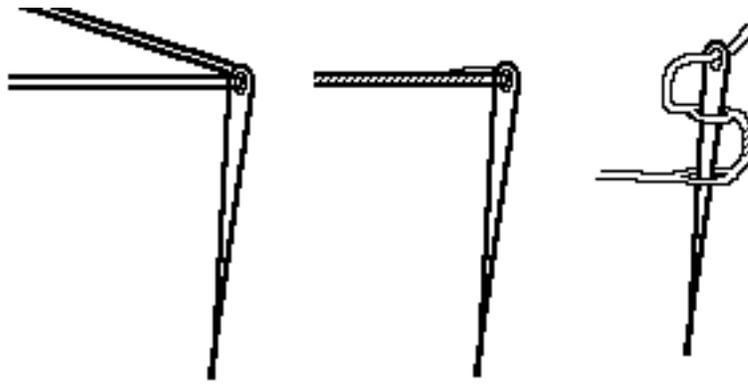


The thread is wrapped back around the thread to hold it firmly in place. The second method,

### Threading Procedure no.2



involves running the needle through the "tail" of the thread that has passed through the needle, after tightly twisting the end of the tail. The thread is pulled back while the needle is held firmly. If this is done properly, the needle will be "locked"



into place. The third method, starts by taking the thread and twisting it about an inch and a half from the end. Poke the needle through the thread twice, and then thread the needle. Pull the thread over itself and the eye of the needle. This method will also lock the needle in place.

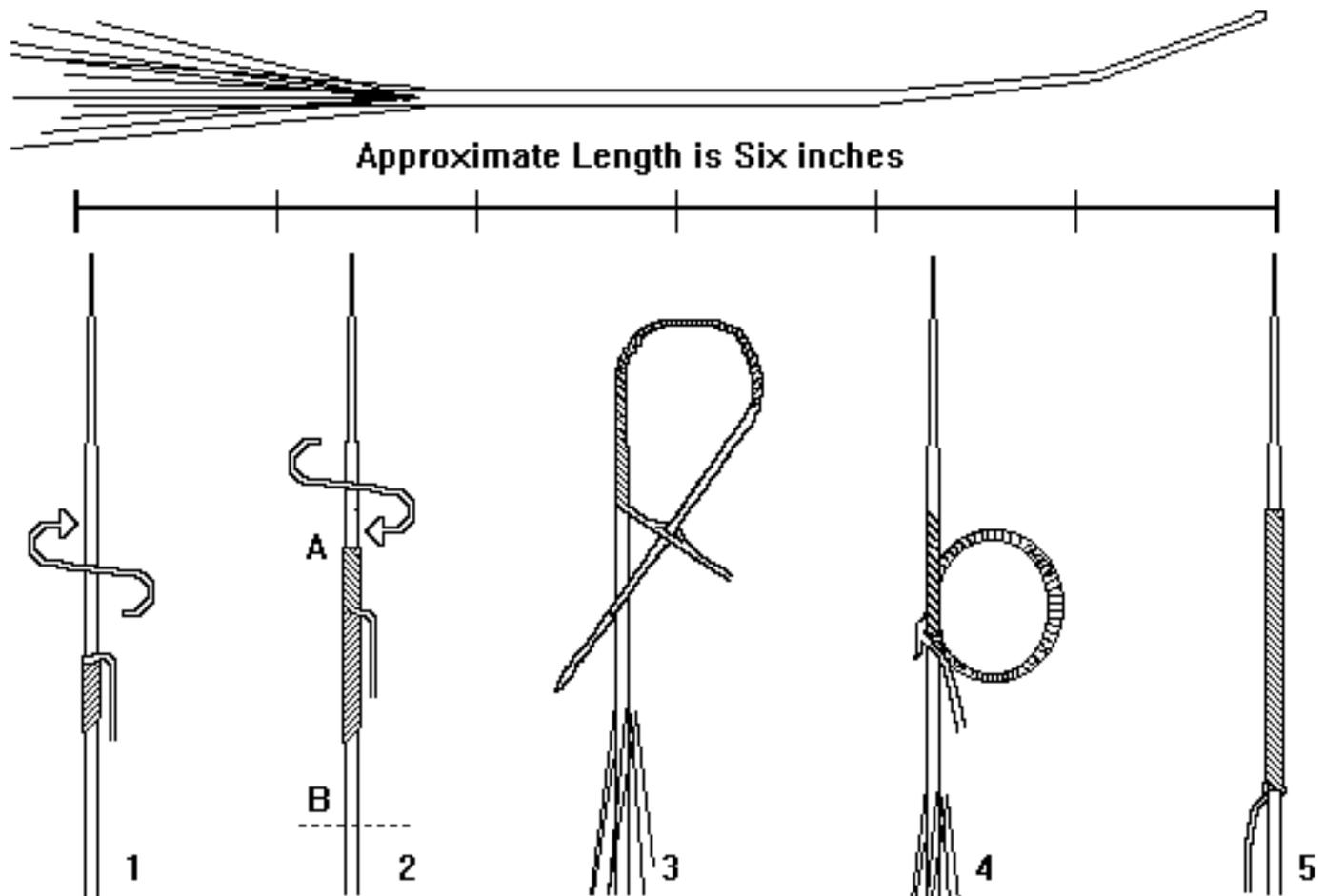
There is a fourth method that begins by threading the needle, and pulling the thread through so that it can be pulled to two even lengths with the needle in the middle. Then unravel the cords and rewind them into a single cord, with the needle sealed in place at the end.

## Threading Bristles

Since the use of bristles appears, based on their appearance in a cordwainer's will referred to in Swann, to be historical, it would be appropriate to describe their use here as well. I have been hesitant, as I have never personally used them, so that the best I could do is describe the technique as well as I understand it.

Hog's Bristle, Boar's Bristle, etc. is the stiff, course, hair of a swine. It is used, because it is flexible enough to make it ideal for some of the tight curves needed for some of the stitches referred to. Any form of flexible material is, theoretically, usable (as long as it is thin, stiffish, and durable).

To begin with, you must use some form of shoemaker's hand wax (which is black or brown), since bee's wax will not hold the thread to the bristle. The wax is warmed in the hand and fingers and then rubbed on the long tapered end of the thread and on the Bristle.



1. Tightly wrap the thread upwards towards the point, beginning at about the middle of the Bristle.
2. After wrapping the thread about half an inch (to Point A), reverse the direction of the thread so that you are now tightly winding back down the other direction (to Point B).
3. After spreading the strands of the thread apart, turn the point of the Bristle back through through the thread.  
Pull the Bristle through the thread.
4. Keep pulling the bristle through.
5. Pull the bristle through until it reaches the hole in the thread. This should lock the thread into place, along the body of the Bristle.
6. Rub the bristle and thread down with beeswax, to cover the hand wax.

## Stitching

A common misconception among leatherworkers is that the waxed thread sold in leather stores needs a rotary hole puncher and a big fat lacing needle to get it through a gaping hole made by the punch. Moreover, that punched holes were generally slammed home with a hammer and chisel-like tool. Neither of these is true. Stitching holes are made by an awl, which is run through the leather, by hand. Then the thread is pulled through by a needle. Using a chisel to make holes **cuts** the leather, weakening it, while using an awl pushes the leather apart without cutting it.

Try not to stitch with thread lengths longer than two feet. The temptation is to make a long thread and needle set up because the seam is long, but you're better off with short lengths and knots. For one thing, if the thread gives out the whole seam won't go with it and for another thing you can lose a lot of time trying to untangle long lengths of thread.

Don't dig your awl in too deeply. Get the feel of pushing it just deep enough to let the needle and thread pass snugly through. Many people feel that you should never have to use pliers, but that if the hole is too small, you should back the needle out and use the awl to make the hole a little larger.

When punching the hole, the line of the stitching should run across the diamond of a diamond-shaped awl. This is sometimes called a harness stitch, and is mostly used with stiff leather. The loop, or whip stitch, which goes round and round the edge up the length of the seam, needs an awl hole which has its length run parallel to the edge. The idea is to get the thread to pull across the width of the awl hole because it gets to grab more leather.

The whip stitch would be used on center seam or one piece shoes, and when it stretches out each stitch seems to run across the line described by the seam.

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# Cuir Bouilli/Hardened Leather FAQ

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Updated 21 July 2001

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Just a few words on this, if I may. This document is not intended as "the last word". To be blunt, I don't think at this time that there **can** be a last word on what "Cuir Bouilli" is or was. The term may have undergone change changed in meaning depending on when and where it was used. What this started out as was a compilation of a discussion by several people back in 1996, just shooting the breeze, sharing sources and experimental information. This has been expanded by more information uncovered by other people since then. If you have information that's not in here, please feel free to let me know. Yes, the name up there is mine, since I'm the guy bringing this all together - but it's not just me speaking here. If you contribute, you will be acknowledged.

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**Cuir-bouilli** (From the Oxford English Dictionary, 2d Ed.) Forms: 4/5 quir-, quyr- boilly, -boily, -boyly, -boile, -boyl(l)e, quere- boly, qwyrbolle, coerbuille, -boyle, 6 Sc. cur-, corbule. [F., lit."boiled leather."]

Leather boiled or soaked in hot water, and, when soft, moulded or pressed into any required form; on becoming dry and hard it retains the form given to it, and offers considerable resistance to cuts, blows, etc.

The word was in common English use from 14th to 16th c., after which it is not found till modern times, when it appears as borrowed from modern French.

**1375** Barbour Bruce xii. 22 On his basnet hye he bar Ane hat off qwyrbolle.

**1386** Chaucer Sir Thopas 164 Hise Iambeux were of quyrboilly [v.r. quereboly].

**1400** Mandeville (Roxb.) xxvi. 123 ai hafe platez made of coerbuille.

**1413** Lydg. Pilgr. Sowle iv. xxx. (1483) 80 A feyned hede formed of playstred clothe other of coerboyle.

**1513** Douglas ?neis v. vii. 77 Thair harnes thaim semyt for to be Of curbule corvyne sevin gret oxin hydys.

**1880** C. G. Leland Minor Arts i. 1 Solid or pressed work, known as cuir bouilli, in which leather after having been boiled and macerated, or rendered perfectly soft, is moulded, stamped, or otherwise worked into form.

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Basically **Cuir Bouilli** is a means of making hardened and stiffened leather. Although there is some disagreement among some leatherworkers as to how this is accomplished, there is a significant amount of evidence to think that it was done by molding wet vegetable tanned leather. This leather can be formed into any number of forms, which, on drying, will retain that shape. The wet leather can be set more firmly by drying it under moderate heat, the degree of rigidity obtained being determined by the drying temperature. A faster method, which produces extremely hard and rigid shapes, is to dip the molded leather into boiling water for anywhere from 20 to 120 seconds. This technique causes the partial melting of the fixed tannin aggregates in the leather, making them plastic, causing them to flow and redistribute themselves throughout the fiber network of the leather. On cooling, the fibers become embedded in what can best be called a tough, three-dimensional, polymer network or resin, somewhat similar to the materials made by condensing formaldehyde with substances such as phenol, urea or melamine.

The molding of leather was known in Saxon times in England, and was widely practiced during the middle ages in both England and on the Continent.

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## 1. **How do I make Cuir Bouilli?**

There are a number of suggestions for how to do this, and none of the following discussions are any more authoritative than any of the others. Essentially, it seems to require the proper sort of leather, carefully applied heat, and possibly some form of liquid. The final answer, is for you to use the method that **you** think is more appropriate, based on your final goals.

There is a great deal of confusion about the term "cuir bouilli" in the literature about leather. Some sources seem to think that it was shaped/hardened with wax, others by wetting, shaping, and drying. The best sources seem to be R. Reed and Waterer (Leather Craftsmanship, Leather and the Warrior) who seem to agree that cuir bouilli was formed by wetting and drying.

I would like to stress something that is often insufficiently stated, if stated at all, during the various descriptions of leatherwork in general, and in this case, specifically of the various ways to make Cuir Bouilli. Since we are dealing with an organic substance, and I refer to "organic" in more than its merely having once been alive, each piece is unique and will handle differently. Two otherwise similar bits of leather can react quite differently. What this means is that you can do

**everything** described hereafter perfectly and still have your project fail, or at least come out with a finished product that is not up to what you had hoped. Don't be discouraged. Leather hardening is not always a "cut and dried" science when dealing with the levels of technology we are working with.

A. **Simple Soaking**

The first, and the easiest, is to soak the leather in cold water (as long as you want to, suggestions range from 15 minutes to 12 hours or longer) then form it and let it dry. This may not seem all that great, but if you've seen a vambrace after it's been sweated into after a summer, you know it can harden up quite a bit. If you [tool the leather](#) while it is wet, you will make it even harder.

Soaking leather to make it harder is really more appropriate for vegetable tanned leather.

Some people have suggested soaking the leather in lye or urine, but I have no idea if these actually work any differently than using normal water.

B. **Hot Water Soaking**

The hotter the water you soak it in, the harder it will be when it dries. However, each bit of leather has it's own point at which the water is TOO hot, and will be cooked by it. If this happens, your best bet is to keep it hot, and stretch it out on a form and let it dry. It becomes very hard and brittle, but that's the penalty for over ambition.

I tend to get it about as hot as I can stand to put my hand into, and maybe a trifle hotter, but as long as it doesn't burn me, I assume it shouldn't burn the leather.

**Sue Hallock (Kendra of HollyOak)**

"Reed goes into detail about the physical/chemical makeup of leather and the effects of wetting/heating. Leather which is simply soaked in room temperature water and then shaped and dried gets harder (not that hard) and retains its form. The hotter the water, the more structural changes you get which results in harder leather. Experiment with scraps to find the right temperature."

C. **Boiling Water Soaking**

If you decide that you want to place your leather into boiling water, and be warned that many people consider this a patently silly thing to do, you will want to be prepared to have your leather shrink and harden very quickly. I would advise actually placing the whole form you are working with and keeping it in the boiling water for not more than about 2 minutes. What this does is to cause chemicals in the leather to liquify and polymerize (see later discussion below) until it shrivels into plastic hardness.

I wish to specify this since I, at least, try to **avoid** having my heat treated leather shrivel up into a plastic mass because it's more difficult to manage.

**Do not** dip leather in to **Boiling** water - UNLESS you know what you are doing!.

## D. **A Variation on Boiling Water Soaking**

If you take cold formed leather and while it is still on the form and pour REALLY hot water over it, letting it drain off (say fresh from a coffee maker), it will scald the surface of the leather and harden the outer layer without altering the inner layers at all. By the time the water's soaked the rest of the leather, it has been cooled (by having to heat the leather) sufficiently that the temperature's dropped back down to the 120-140F range.

You can also presoak the leather in water, then pour the boiling water on top. This either heats up the water inside the leather, so you don't have to wait for it to soak in, or the cooler water slows the soaking process, letting the outside of the leather harden more fully. I've tried it both ways and I couldn't tell you which worked better.

## E. **Baking**

According to J.W. Waterer, Cuir Bouilli is made by soaking **vegetable tanned** leather in water until it is thoroughly water logged, then molding it to form and drying it in a constant temperature of 50C (or 122F).

Baking the wet leather can make it even harder, say in an oven, but you run the risk of steam scalding it and making it shrink (as per C, though see below).

Play with scrap pieces until you get the temperature about what you feel is just right, and then bake your pieces, tied to the forms with string, stitched, or nailed in place.

Reed goes into a bit of detail about the structural/chemical changes involved, and why it must be vegetable tanned leather. The key factor is the heating, and the presence of water may play a part. As far as I can remember, neither author mentions the use of wax or oil. Unfortunately, neither author mentions anything about the basis for these descriptions. Since cuir bouilli was still in use until fairly recent times, these descriptions may be based on methods of the recent past which they assume to be carry overs from medieval methods.

Page 79: "Some of the properties of vegetable tanned leather have already been mentioned. If the tannage is sufficiently long, the leather tends to be full, with a round and generous handle: i.e., it is a filling tannage. It shows high resistance to perspiration fluids (accounting for its use in various parts of shoe construction, e.g. the insole), whilst it can be embossed easily to allow designs and art work generally to be applied to the surface of the leather. It possesses strange thermal properties and one disadvantage is that wet, vegetable tanned leather begins to shrink above 75 degrees C and so lose its shape. Nevertheless this property has been widely exploited. The moulding of this type of leather was known in Saxon times in Britain, and during the Middle Ages both here and on the continent of Europe it was extensively practiced. Chaucer, in the fourteenth century makes frequent reference to the peculiar form of moulded leather known as *cuir bouilli*. After thorough softening in water at ordinary temperatures, the leather can be formed or moulded into the most remarkable shaped which on drying retain a fair degree of permanence. The wet-moulded leather shape can be set more permanently by drying under a moderate heat, the skilful choice of temperature determining the degree of rigidity obtained. A quicker process which produces extremely hard and rigid articles is to dip the moulded shape into boiling water for about 20-120 sec, a practice which gave rise to the name cuir bouilli. Such a process involves the partial melting of the aggregates of fixes tannin in the leather. near 100 degrees C these become plastic and can be made to flow and redistribute throughout the fibre network. On cooling, the latter becomes embedded in what is virtually a tough three-dimensional polymer network or resin, not unlike the more modern materials made by condensing formaldehyde with substances like phenol, urea, or melamine (e.g. Bakelite and the aminoplastics)."

If I read this correctly, and I would **love** to entertain discussion that I am not, then in order to make something of "Cuir Bouilli" I can place my wet leather on or around its form when wet and either heat it until it shrinks (say in my oven: since 75C is about 167F), or immerse said form into boiling water (100C = 212F) until it shrivels into plastic hardness.

### **Rick Cavasin (Balderik)**

"As Reed says, the choice of temperature determines the degree of hardness. I think the trick is to not heat it to the point of 'shrivelling'. At this point, I think the finished product will start being too brittle to be useful for armor. I think the trick is to stay right around the 75C mark so that the leather is on the verge of shrinking, so you get the hardness without the shrivelling. I hardened my armor plates by the soaking/baking process. They were quite hard **before** I waxed them, but had remained true to their molded shape (ie. not shrivelled). The dipping in boiling water probably requires a bit more practice to get the duration just right so that the leather hardens without shrivelling."

NOTE: When heating the leather, do NOT touch the leather to any hot metal (Since using heated tooling materials is how book leather is embossed). Sitting it on newspaper works just fine to stop the heat though.

John Waterer's *Leather and the Warrior* has a complete chapter on Cuir Bouilli, and its history.

### F. **Hammering**

Hammering dampened veg-tanned leather will harden it up a lot. This is why sole leather is harder than belt stock. It has been compressed between rollers. The old fashioned method (in the recent past at least), was to hammer the leather you were going to use for shoe soles.

### G. **Wax**

See Below.

### H. **Sun Burning**

I have recently discovered that leaving leather out under the Summer Oklahoma sun will burn it hard as well. However, see the discussion under [OIL](#).

### **LATE ADDITIONS:**

By **Other Volken** (From the [Crispin Coliquy](#), 26 May 2000)

"I just stumbled across some old info on cuir bouilli in: Louis Figuier, *Les Merveilles de l'Industrie*, Paris, 1873, chapXX, pp.446

Here a translation:

"We will finally note a curiosity in leather fabrication specially made in Turin, Italy. Once the leather is tanned and finished it is deteriorated as follows, under pretension to ferment it. The leather gets wetted and then piled up; and that the leather heats up easier, the wetted hides are covered with straw. The hides are turned once or twice a week and then brought to the drying rack. One obtains this way a blackish, breakable leather, which is called **\*\*cuir lissé bouillis\*\***. (Litt. slicked boiled leather) It is a very bad preparation, because on almost burns the leather, and we obtain a bad product.

A cuir bouilli is a nearly decomposed material. Its fibers are disintegrated and don't have the firmness and elasticity produced by our excellent French tanneries. Luckily the good slicked leather replaces little by little the cuir bouilli."... end of citation

I found this part in the section where Figuier talks about finishing the tanned leather. I guess we added one more mystery to the boiled leather enigma."

## I. **Tooling the Hardening leather**

**Jackalope** Also - When you say that you feel the examples you've seen of historical cuir bouilli can't have been totally polymerized due to their degree of tooling - might it have been possible to actually do the tooling after the shrinkage, but while the leather is still wet?

**Marc Carlson (Diarmuit)** While I am fairly confident in that statement, I have some thoughts that it might be possible to place formed leather in a press to do the tooling, even if simply soaked and baked dry (since tooling takes so long). It might be possible to do this as well when "overcooking" the leather by boiling. I haven't tried it myself.

## J. **Experimentation**

Experimentation is a good idea, since what we seem to be dealing with is a range of "hardness" imparted by the various treatments used:

### **Somewhat Stiffened:**

Caused by simply soaking in water and drying. (Examples: Most things that have been merely tooled, but not much else. For those unfamiliar with the tanning process, this is simply reversing the 'Staking' process. When leather is tanned and is in the process of drying, it must be worked or 'staked' to prevent it from drying stiff. The amount of staking, to some extent, determines the final softness. Soaking the leather and letting it dry reverses the process).

### **Stiffened:**

A quick soaking in water and baked. (Example: Armor that has been sweated into and dried in the sun).

### **Hardened/Polymerized:**

Soaked for a LONG time in water and baked dry. (Example: Cuir Bouilli as Rick Cavasin (Balderik) and Waterer have been describing it. This \*may\* also include the attempts that have been soaked with oil and baked hard in the sun).

### **Totally Polymerized:**

Boiled in Water until it shrivels and shrinks. (Example: Marc Carlson (Diarmuit)'s wrist brace experiment described below).

**Marc Carlson (Diarmuit)** ...I went home and began to experiment with a variety of things. The first batch of experimentation was with a variety of pieces of leather, each sewn to a shaped frame (a wooden dowel) and the dipping them into water at a rolling boil, and holding them there for 60 seconds. (For the precision fiends out there, while I'm not certain about the elevation of Tulsa, Oklahoma, but I'm close enough to sea level that my 3 minute eggs take about 3 minutes to cook). Afterwards, I let them sit for 24 hours. The results were about what I expected.

The 8-10 oz Veg. Tanned Cowhide turned dark brown, shrank and hardened.

The 5-7 oz Veg. Tanned Cowhide turned black, shrank a LOT, and hardened.

The 2-4 oz Calfskin turned dark brown, and shrank to fit beautifully.

The 5-8 oz Latigo Cowhide had no noticeable changes at all.

Elk hide (tanning method unknown, but probably oil "tanned") Darkened slightly, and only stiffened VERY slightly.

The Latigo calfskin, Horsehide and Buckskin had the same results as the Elk hide.

Heartened by the success of this, I took an old tooled wrist band (10 oz Cow hide), wrapped it around a bottle and dropped it in the boiling water for 2 min. Most of the tooling vanished, but it is currently harder than anything I've yet made.

My second experiment was to take tooled leather (8-10 oz Cowhide) soak it down, hammer it to shape on a piece of wood and to stick it into an oven at 225 degrees. It darkened slightly, only part of it shriveled, and the rest looked like a 2-3 mm thick Bat-a-rang (However the tooling remained intact : ) ).

**Rick Cavasin (Balderik)** Your differing results with the different weights of veg-tanned leather probably reflect the greater amount of time required to heat thicker pieces of leather....

**David Friedman (Cariadoc)**

1. Using leather (8 oz., Veg. Tanned) that had been soaked for several hours:

If you boil it for 20 seconds, it shrinks to about 7/8 the original size in Both directions, becoming correspondingly thicker. It also hardens a little. The result is comparable in strength to wax hardened 8 ounce leather. If you press it between two flat surfaces for ten minutes or so after boiling it ends up flat--the curling at the edges is negligible. If you boil it for 40 seconds or more the shrinkage is more substantial (to about 2/3 the original dimension) and the hardening (and associated thickening) much greater. Pressing it still gives you a flat piece.

If you boil it for 40 seconds, it shrinks to about 2/3 the original size in both directions, thickens to about the equivalent of 16 oz leather, and becomes quite hard--oddly enough, the complete hardening process seems to take several hours after cooling. The final result is comparable to 16 oz wax hardened leather.

Boiling for more than 40 seconds results in very little additional shrinkage, some additional hardening.

2. Using dry leather (8 oz., Veg. Tanned).

The result seems to be somewhat faster hardening, but also a lot more curling, distortion, etc.

From these experiments, it seems clear that one could make scale or lamellar by taking your scrap, soaking it, boiling it 20-40 seconds, pressing it between two boards to make sure it hardens flat, then cutting out the individual lamellae or scales.

3. Shaping the leather (8 oz., Veg. Tanned):

It occurred to me that one could take advantage of the shrinking produced by boiling. One of the problems I have had in making bazubands and greaves is the difficulty of making the portion that covers elbow or knee sufficiently convex. This is basically done by stretching the middle part of it. Shrinking the edge should have the same effect.

In making things such as knees and elbows out of hardened leather, one problem is that it is hard to stretch the leather enough to get the piece as convex as you would like it. It occurred to me that boiling could help with this problem. The technique works as follows:

First cut out an oval piece of leather, soak it thoroughly. Then stretch it over a small bowl to give it a somewhat convex shape (more details on how you do this available if people are interested). Then stick a pin through the middle of it, with the head on the convex side. Then lower the piece slowly into boiling water, holding it by a pair of pliers gripping the pin (do you have an easier way of constructing a handle in the middle of a piece of leather?), and steadying it with a large spoon. The idea is to hold it for about 10 seconds with just the outside periphery of the piece

(which is the bottom, since you have it convex side up) in the boiling water, then lower it for another 10 seconds so the area intermediate between the edge and the center is also under the boiling water, then finally submerge the whole piece for another twenty seconds. The result is that the periphery has boiled for about 40 seconds, the intermediate area for about 30, and the middle for about 20. The longer you boil it the more it shrinks, so you have just shrunk the periphery relative the center, which makes the piece more convex--also thicker and harder. Now you put it back over your bowl (or a smaller bowl if it fitted well over the old one before boiling). Let it cool. Let it dry.

I have now done this several times successfully. One piece I also successfully waxed--the others are still drying. I think waxing is necessary if you are using 8 ounce leather and the piece is supposed to be an elbow. 8 ounce leather boiled for only 20 seconds (the center of the piece) is not hard enough for me to trust it to protect the point of my elbow. Such leather both boiled and waxed is.

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## 2. Wax

I've been told that I should use wax to make leather hard, is this true?

### A. Basics

The other way to make leather hard is to take a piece that has been formed previously, place it into an oven, and dry heat it to about 200 degrees. Then take melted wax (bee's wax is traditional, but I have gotten just as good results from melted candles). Remember all the safety precautions you learned in art class as a kid for melting wax because it can be dangerous. When the wax is hot, and the leather is hot, take the leather out of the oven and paint the wax onto the leather (which will then soak it right up). Keep this up until the leather cools enough to not absorb the wax any more. Reheat the leather, and repeat until you are satisfied that the leather won't absorb any more wax (a good clue is that it's all the same color). Then let it cool. It will be extremely hard when it's done.

NOTE: When you are heating the leather for this you will be up at temperatures that will polymerize the chemicals in the leather in the presence of water. What this means is that if you get ANY water on the hot leather it will shrivel up and harden.

### B. A discussion on other views of Wax and Hardened Leather

#### Ron Charlotte (Al Thaalibi)

"In my own experience with wax hardening of leather, 200 degrees is -way- too hot. I normally melt my wax in a "double-boiler" arrangement in a pan set in another pan of water. Try water shaping the leather first, then, when it has dried and set into the shape you want, immerse it into the melted wax. High heat isn't needed just enough to keep the wax liquid. If the piece is too large for your melting pot, heat the piece with a hot hair dryer/heat gun or place it in the oven long enough to get hot then "pain" it with the melted wax, reheating the piece as needed.

"You really need to stay away from "oil-tanned" or treated leathers for this purpose, use an alum or veg. tannin tanned leather. Only these will absorb the wax properly to decently harden. "

#### Rick Cvasin (Balderik)

"To the best of my knowledge, this is somewhat misleading. For an excellent description of the chemistry involved, see *Ancient Skins, Parchments, and Leathers* by R. Reed, but the gist of it is that it is not the wax that is hardening the leather, but the heat. Cuir Bouilli can be made WITHOUT WAX (although using wax helps by making the leather denser, heavier, and resistant to water). The chemical/structural changes responsible for the cuir bouilli effect are only possible with veg-tanned leathers. Other leathers may be stiffened somewhat by heating and adding wax, but it will not be cuir bouilli.

"Given that a good deal of hardening can be achieved without resorting to the use of wax (by simply drying under heat) and that waxing

provides some enhancement, my argument was that those who wax the leather directly are probably getting most of their hardening from the heating needed to apply the wax, not from the waxing itself."

I would have assumed that the hardening was more due to the wax infiltrating the fibre matrix (as Reed suggests that the Tannin Polymers do) and then hardening there. Also there is some concern about the weight added to the leather for the amount of strength given.

**Ron Charlotte (Al Thaalibi)**

"I've used both the cold water/wet molding and the hot water methods of shaping leather as well. I simply find that the addition of wax produces pieces that stand up to the rigors of SCA combat abuse, especially here in the humidity and erratic weather of Trimaris (Florida), far better than the other options."

**Rick Cavasin (Balderik)**

"Oh, there's no doubt that wax \*helps\* by increasing the density and water resistance. The point I was trying to make is that the majority of the hardening is related to the heating. Much of the hardening many people achieve may be a result of the heat they apply in order to get the wax to soak in, not from the wax itself (people who use wax hardeners excepted). While I hardened my armor without wax, I added the wax afterwards to enhance the effect."

The reason that I suspect that it is the wax that is the prime factor, as opposed to the heat thickening of the collagen, etc. is a combination of the reports I have of wax impregnated leather re-softening to an extent in the summer heat, and the use of wax as an emollient in leather (also reported in Reed). I may be in error here, but it's just an opinion.

**Rick Cavasin (Balderik)**

"The cuir bouilli effect, (ie. hardening by heat), is, as far as I know, non-reversible. The softening in the sun would be the removal of any enhanced stiffness imparted by the wax. If the softening is substantial, I would suspect that little heat hardening was achieved. My own armor does not soften much in the sun. In cases where peoples' armor does soften appreciably, I would say that you are correct, that the wax is in fact providing the stiffness.

"My own feeling is that the added stiffness, density, and water resistance is well worth the increase in weight (but then my life doesn't hang in the balance, as it would for the medieval warrior).

"Another factor to consider is that the wax may have been a significant expense in Medieval Europe. Bees wax was in high demand for candles. Waxing leather that could be adequately hardened without it might have been regarded as extravagant. Unfortunately, I must plead ignorance regarding the relative market value of wax in period.

"Perhaps water resistance would have been achieved using something more economical like tallow which would, I suspect, have had little additional hardening effect."

**Master Duncan Saxthorpe of Alnwick from the Kingdom of the West:**

"You are welcome to include this in future articles, if you wish: Use a mixture of half pure white beeswax (it smells a bit less sweet) and half pure Grade I carnauba wax (the really, really hard stuff). I use a large commercial roasting pan which barely fits on my gas BBQ and do this outdoors... having some concerns about fires and some real trouble removing the wax mixture from a even stainless steel counter top! I gentle heat the wax over medium heat with a barrier of heavy duty tin foil between the grill and the pan, to ensure more even heat distribution. When the wax is fairly hot (a scrap of heavy sole leather forms numerous small, well-distributed bubbles on the rough side within one minute) I "boil" my cut, dried (and dry) leather pieces for about 2 to 4 minutes. As you pointed out, the leather can be cooked and ruined by too much heat, but this heavy grade of leather seems to be more forgiving than even 10-12 ounce leather. Anyway, when the leather appears to be well soaked I remove it from the waxing pan, wipe it clean with a towel I never want to see again, and shape it under running water. The leather

sets up nicely within a few minutes and takes about 12 hours to completely cure. This wax mixture holds up very well in our California summer sun with minimal softening (about twice as firm as bees wax armor) and can be re-softened and re-shaped by heating in an oven."

C. **Molding**

Cliff T. Wilkey

"From what I have heard, the leather was placed into a "mold". This mold consisted of two \*large\* blocks of wood, and the shape of the leather armor was carved into these two blocks. The leather was put into the mold and boiling wax was poured in. Then it was left to cool."

D. **What are the relative melting points of beeswax vs paraffin etc... would it make more sense to use a higher melting point wax in favor of a lower one?**

As far as I can tell, the Beeswax and Paraffin will melt at about the same temperature (and mix very well, if you want to stretch the beeswax a bit). Personally, I can't find a wax with a melting temperature hot enough to keep it from softening while worn outside in the sun (in Oklahoma), however, there is a form of crystal (styrene?) but that are available at hobby shops) that, when melted into wax raises the melting point. Good results can be had using about a 2:1 ratio of paraffin to beeswax.

Unfortunately, the hotter the melting point of the wax, the hotter the oven needs to be to get the leather hot enough to readily absorb the wax. I've had too many pieces suddenly shrivel up to be eager to risk the extremely hard waxes (although I suppose I will give in eventually).

E. **Is there any evidence for waxed leather in period? Do we speculate that the evidence has rotted away? Or is it unlikely that hardened leather was ever used for armor?**

**Speculation:** It is conceivable to me that, after introducing an organic waste product, such as wax to leather, it might rot away faster than ordinary leather. It is also conceivable that after more than four hundred years of burial, there is no way to distinguish the waxed forms.

It is, however, also reasonable to assume that waxed armor was not used either in period, or during any of the classical periods for armor, either because it was too expensive to waste, to difficult to get a regular temperature from an oven that was low enough not to destroy the leather, or some other reason.

I would have suspected that the Mediterranean Civilizations might have had trouble with it due to the sun's heat, but I have been informed by the people I have armored in the stuff that fighting under the Texas/Oklahoma sun hasn't posed a problem and that while the leather softens a bit after an all day thing, it rehardens very quickly.

Please Note that there is NO Evidence that I know of that Waxed Leather was used for anything other than some Elizabethan era bottles, cups, knives scabbards, etc.

**LATE ADDITIONS:**

By **DR OBUV** (From the [Crispin Coliquy](#), 21 January - 27 January 1999)

"The cuir bouilli is the leather of ox or cow 'bouilli' in wax mixed with various gums, resins, and pastes, which are kept secret by the sheath and scabbardmakers. Article 13 of the statutes of the sheath and scabbardmakers of Paris, which are dated 12 September 1560, allows that it is forbidden for the trade to make leather bottles with any other leather than cow or ox, because other leathers are not suitable, and that the above-mentioned bottles must be 'boulues' with only new/fresh wax and nothing else, and stitched with double-seams from both sides [i.e. double-looped hand stitch, not a running stitch-ED], strong and durable." -- Roland de la Platiere, 1788 in '*Encyclopedie Methodique*' [Paris,1790]

Key here are the various ways in which "bouilli" and "boulues" are used. Literally "boiling" the leather, as in dunking it into a vat of hot waxes is the immediate and easy assumption, but upon removing the object and its "last", the waxes would rapidly cool and leave an object encased in a mess solidified waxes.

"The Shoemaker uses several kinds of wax. [...] Bootmaker's jacking/wax is made from two pounds of colophony [NB -- highly refined/brittle pine rosin from Colophon, Lydia. The German edition has 'pitch' or 'black pitch' here] and one pound of yellow wax [NB -- raw beeswax] with lampblack [NB -- powdered carbon from oil fires] to suit, all melted together. This jacking/wax is used by Bootmakers to penetrate the leather of jack boots and to make them stiff as wood... The Shoemaker uses this wax for certain heavy shoes that the lower sort and peasants wear, but while making it he reduces the amount of colophony."

"Having one pair of boots... over their boot trees and previously wet, but now dry, take a coarse wood rasp, which is rubbed over the whole boot-leg to remove the fluff which stands up on the flesh; after this you proceed with the jacking/waxing... The place for jacking/waxing must be a room with a chimney, paved or tiled [NB-- "...where there is no fear of fire" in one edition]; near the top of the chimney, outside, is attached an iron chain which dangles to within six inches of the floor or thereabouts. You ready yourself for jacking/waxing by putting a small portable stove or lit brazier on a table to your left, on which you place a kettle containing the following recipe: One pound of yellow wax, two pounds of colophony, which is pine rosin, and lampblack to suit. You also furnish yourself with a swab, this is the name of a large dauber formed from a bundle of linen rags bound together, and have on your right, on the ground, some loose straw... Begin your task by lighting a little straw, which you wave under the bootleg to singe it, in other words to burn the rest of the fluff from the leather that the rasp did not remove; afterward dip the swab in the BOILING [NB -- emphasis added] jacking/wax with which you coat the entire bootleg. Then continually rotate the boot-tree with your hands over a steady straw fire so that the heat makes the jacking/wax penetrate. You put on six successive coats in the space of an hour, being very careful to occasionally moisten the bootleg so it will not scorch, and so it takes two hours time to jack/wax one pair of boots. The bootleg now jacked/waxed, leave it to cool... When the bootleg has been jacked/waxed, and once more is thoroughly cold, it is full of lumps caused by the boiling jacking/wax with which it was coated and saturated; to remove them take an old knife, and using the blade as a scraper, scrape off all these lumps, then rub with a piece of cold wax that you spread very evenly with a stiff brush or burnishing stick, etc., and you finish-off by polishing and shining with the palm of your hand". -- M. de Garsault, *'l'Art du Cordonnier'* [Paris, 1767]

"Lacquered [NB -- literal translation from German] Boots -- A type of stiff boot with or without tops, which are made with the flesh out in the same manner as the jack-boots, and which are given a glossy finish with the following lacquer:

Powdered gum mastic... 1/2 oz.

Powdered ivory-black.... 1 oz.

White poppy oil... 1 oz.

Spikenard oil... 1/2 oz.

Asphalt... 1/2 oz.

White wax [\*]... 1/2 oz.

Add the ingredients separately, mix in the oils."--D. G. Schreber, *'Der Schuster'* [Leipzig, 1769].

While not necessarily a jacking/wax, this formula is interesting. Schreber discusses the superiority of all English boots, and the polishes for them, but says they can't quite get it right. [\*, this usually denotes highly refined beeswax that has been rendered and filtered to the point of being nearly pure white--harder than raw yellow beeswax].

"For Jacking The Flaps of Cartridge Boxes

Let the flesh side of the leather be shaved smooth, & put outside. When 'tis well dried & warmed, rub it with the following composition, of: 6 pounds of rosin; 1 pound of beeswax; 1/2 pint of spirits of turpentine } all dissolved together and put on hot. Frequently hold the flap to the fire till enough of the stuff enter the pores of the leather, rubbing well. When cool, size it... with a size made of rawhide, rubbing it well. If spirits of turpentine cannot be had, beeswax will answer; but it does not penetrate the leather so quick... To save the jacking stuff, the flaps should be cut out before they are jacked; but it is said that the jacking should not come where the leather afterwards to be sewed as it will be too hard; ... You will try the jacking, both before and after the sewing, and determine which is the best way." -- *Timothy Pickering on Jacking cartridge box flaps*, Vol. 56, p. 5 [No date, c. 1775]

"We would go to a turner or wheelwright, and get head blocks turned, of various sizes, according to the heads that had to wear them, in shape resembling a sugar loaf; we would then get some strong upper, or light sole leather, cut it out in shape, close it on the block, then grease it well with tallow, and set it before a warm fire, still on the block, and keep turning it round before the fire, still rubbing on the tallow, until it became almost as hard as a sheet of iron... We made the scabbards of our swords of leather, by closing on a pattern of wood, and treating it similar to the cap." -- *Recollections of a Revolutionary War Soldier* [reprint 1854 edition]

Now then, as we have before us an accumulation of descriptions of the process of hardening leather with heat, pitch, rosin, etc., let me launch a question... since "bouilli", in Abel Boyer's *'Royal Dictionary Abridged'* [London, 1700] gives, in addition to "boiled", "warm, boiled, seething, or bubbling up", "to gush out", and even "baked" in connection with "boul"--derived words, what are we led to believe? Under "cuir" he gives "visage de cuir bouilli"; a wainscot face. P. Faire de cuir d'autrui large courroye, To be free of another man's purse." Now wainscot seems to be a stretch, but the connection with wood [as in Garsault's "hard as wood"] is tempting..

...Firstly, just because Chaucer mentions leg-guards of "quirboily", how/why do we assume it was heat and water only, rather than heat and "bouilli" painted-on? Why not dope-hardened leather? Waterer's assumptions aside, why couldn't Chaucer's "quirboily" be doped-hardened leather in the 14th c. as well? Post 1560 in England and France, the suggestion is saturated with rosin, etc., just that the Brits start calling it "jack"ed by the 17th, and drop the Franco-ponic "quirboily" from the vocabulary all together.

Any confusion here regarding "waxed leather", which I agree is NOT "cuir bouilli", is purely accidental I assure you. The problem is in the French use of "cire" for bloody everything vaguely resembling a waxy substance. A bit of care, however; in my translation from Garsault [above] I carefully wrote jacking/wax, where in the French text it's just "cire" [wax], though the French author seems to use "cire" for everything from currier's dubbing, shoemaker's "coad", and "machine" [white coad], up to and including what Pickering just calls "jacking stuff". Garsault also discusses "heavy waxed shoes", [gros souliers cire's]. In this case he says that the un-dyed and un-curried shoe uppers are smeared with a wax [cire] composed of "mutton tallow, a little wax [cire again -- beeswax presumably] and a little more lampblack". This mixture is applied with a dauber dipped in "le cirage chaud" [the warm wax-mix]. Nothing in the text suggests that this form of "wax" stiffens or hardens anything. Quite the contrary, it loads it with warm tallow. As a matter of fact, the English term "waxed leather", as in waxed calf, etc. merely refers to a heavily grease-stuffed, blacked on the flesh, uppers leather. In fact, elsewhere Garsault says that blacking on the flesh is more "English", and the French usually blackened their uppers on the grain with dye or stain rather than sooty grease. In French, "waxed leather" is clearly NOT "cuir bouilli".

Finally, why are Chaucer's "quirboily" leg-guards NOT dope-hardened leather? Shouldn't leather armour be hard? I suppose all I'm at here is this, since "cuir bouilli" meant doped-hardened leather from 1560 on in France, and became "jack"ed leather in 17th c. England, why must it mean something different in Chaucer? Are we just trying to leave room for Waterer to be "right" about the heat/water only theory? Impregnating items with rosinous substances to alter their texture hardly seems out of keeping with the most ancient leather-work

Oliver Baker makes a case for all hardened "jack" type leather vessels being essentially British in origin.

F. **Would it be possible/effective to wax the leather piece from the inside instead of outside?**

In fact, it works better since the wax doesn't have to soak through the skin to get to the flesh. I don't know if heating it will loosen the fur at all, or do other weird things to it.

G. **Waxing Oiled Leather**

I have never used the alcohol to work oiled leather, however don't be surprised if residual alcohol doesn't mess up your wax (since that's how you strip wax off of shoes). Waxing the oiled leather may make a horrible mess, but if you are patient it will eventually even out (I have a cup that oozed oily wax for months, but is now a prime example of hard leather).

## H. **Can I wax tanned hides with fur intact?**

They may be chrome-tanned, essentially using mineral salts. The wax *\*should\** harden them, but I've never tried it on pelts, and if you use too much you may get waxy fur.

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## 3. **Oiled Leather**

Some people feel that there should be NO boiling in oil AT ALL. Oil is used to soften leather, and all boiling it has gotten me is a soft squishy mess better left undescribed and buried, not to mention this is how one deep fries meat.

### **Rick Cavasin (Balderik)**

"Boiling oil is way too hot. I've never tried the boiling water method described by Reed, but he does specify that the immersion be very brief (depending on thickness, etc.). The hardening only works with vegetable tanned leathers. "

### **Ben Rondeau**

"One word of warning: do not immerse any leather into the (presumably hot) solution while the leather is cold. I did this once with a lame for a pauldrin. I got to watch it deep fry. It came out looking like a piece of bacon. Not something that was terribly useful. Perhaps stitching to a form, then boiling in oil?? Any ideas?"

Now that you mention it, I have a leather bottle that I made last year that, for reasons better left unmentioned, I soaked to the brim with Neatsfoot oil, and then left in the window of my spare room to let the oil settle. I forgot about it, and after three months of the Northern Ansteorran summer sun on it, the puppy had baked hard. I had a similar experience with the front flap of a map case I left in the rear window of my conveyance. It too had been heavily oiled with Neatsfoot oil.

## A. **Linseed Oil as Varnish**

### **Ron Charlotte (Al Thaalibi)**

"We've all heard the mistaken notion of boiling leather in -oil- to harden it. It was recently pointed out to me that boiled -linseed oil- is a varnish. Has anyone tried this as a medium. I'm going to give it a try with some sample pieces once I'm done with my current slate of projects, but if anyone else has come across this and tried it, I'd love to hear."

### **Rick Cavasin (Balderik)**

"Boiled linseed oil has additives to make it dry faster. Not sure what these will do to the leather. If the varnish dries stiff, you may have problems with cracking. I have dressed leather with unboiled linseed however. Because it oxidizes at a lower temperature than other oils, it yellows the leather much more quickly than neatsfoot oil. The end result is that you end up with a partial oil tannage. I'm not sure about the long-term stability, as the leather I dressed was some alum-tawed, hair-on, moose hide from which I made my first suit of armor (candidate for one of the most offensive suits of armor of all time - both in looks and smell). It hasn't been used in ages, and the leather is falling apart. Not sure if it's because of the linseed, the tawing recipe, or the repeated cycles of being soaked in sweat and then dried. I give away bits to people who tie flies"

I hadn't considered it, since Linseed Oil can be (I am informed) somewhat explosively flammable. [of course, that's while it's wet. When it's dry it stabilizes, unless fire is applied directly.]

### **Ron Charlotte (Al Thaalibi)**

"True enough, the commercially prepared stuff has drying agents (without reading the can, probably alcohol or mineral spirits). Based on

Cennini's *The Craftsman's Handbook*, Theophilus's *On Divers Arts* and Alessio Piemontese's *The Secretes of Alexis of Piemont*; and their instructions for boiling linseed oil down into a varnish, both with and without the addition of lac resin, starting with the raw stuff and adding the leather to it or vice versa might work. In fact, the place where Cennini discusses rendering the oil down by sun-cooking makes me wonder if applying the raw oil to a piece and subjecting it to slow heat (sun or low oven). I think that I need to pick up a gallon and start tinkering...preferably outdoors on a hot plate or propane stove, all of the period writers mentioned above make a point of pointing out the flammability of the stuff.

"As far as the stiffness factor, I've used tung oil varnish for a finish on a couple of belts, and it made for a nicely flexible finish. I'm hoping that linseed oil will behave in a similar fashion."

I would like to point out that oilskin is made from UNboiled Linseed Oil.

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## Rawhide

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2. [Tension and Rawhide](#)
3. [Other Problems with Rawhide](#)
4. [What happens to Wet Rawhide?](#)
5. [Variations in Raw Hides](#)
6. [In Situ Self Tanning?](#)

### 1. **A short discussion on uses for Rawhide**

After thinking about it, I can think of a number of historical applications for leather, such as shield facings, where rawhide might make more sense, but there is no indication in the texts I can find.

A number of experiments have been made using rawhide as shield facings and armor. Knives didn't even cut or pierce them, and they REALLY tried to. We talked about shooting at them with arrows but never did. Maybe next year. Rawhide could be a good material to make armor of.

Waterer suggests that in a quick examination of rawhide in a site, it is often mistaken for Cuir Bouilli, and has been found used in knife scabbards, etc.

#### **Rick Cavasin (Balderik)**

"Remember that Parchment is a form of rawhide."

#### **Tibor**

"...Don Tivar, as part of his study of the rapier, has done studies of how much force is required to pierce human skin. His research lead him to use rawhide soaked in water, which he was told most closely matched human skin's behavior. (Some coroner research, I gather. Memory dims). It cut with about 5 pounds of pressure, and pierced with substantially less. So, dry rawhide is relatively impervious, but thoroughly soaked rawhide is barely impervious. Try not to leave those shields out where the dew might get them. And, don't make armor of

it if you perspire..."

**Rick Cavasin (Balderik)**

"The ease with which a piece of dry rawhide can be soaked depends on how much it was stretched while drying, and how much residual oil is left in the hide (ie. parchment is easier to wet than rawhide because it has been stretched more and has less residual oil, generally)."

**Matt Richards**

"Native American tribes would take buffalo rawhide and deliberately heat it to the point that it shrink and thicken for use as a shield. This is well documented and I could find the sources if you are really interested. Another technique commonly used was to coat their rawhide containers with 'sizing', which would increase the water resistance. Typical sizes included prickly pear cactus juice and hide glue. And while neither of these is 'water proof' they are both slow to absorb water. I think your statements about how rawhide would not significantly wetten under normal use unless left soaking in a puddle are quite accurate. While rawhide does absorb enough moisture from rain or dew to bother drummers, it takes a very long time for it to get 'wet'."

2. **Tension and Rawhide**

"Rawhide changes tension radically with humidity and moisture, far more than tanned leather. This would tend to limit rawhide in a structural application."

**Rick Cavasin (Balderik)**

"The problem with rawhide is that it can become dimensionally unstable if it becomes wet and is then dried. Parchment/rawhide can generate an impressive amount of tension when it dries (I've had goat and deer hides warp and break the frames I use for parchment making). Tanned hides are much more stable, and are much less prone to rot.

"A piece of rawhide, left to dry on it's own, will shrivel up to become tough, hard, horny, and semitransparent. Usually, in making rawhide/parchment, it is customary to stretch it on some sort of frame so that it dries into a flat sheet.

"If it is subsequently soaked in water, and allowed to dry without tension, it will shrivel up more or less like a fresh piece of rawhide. And parchment/rawhide can generate an awful lot of tension when it's trying to shrivel up."

3. **Other Problems with Rawhide**

Finally from other information I have received, it would appear that since rawhide is more susceptible to rot than tanned leather, it might have been used for other things, like shield facings, and we wouldn't know. It would also be susceptible to rot in use, while on campaign, etc. This may have restricted it's use in damp climes. (Rotting Rawhide Stinks!)

#### 4. **What happens to Wet Rawhide?**

This may seem like a naive question to some, but what happens to rawhide when it gets wet? Doesn't it get soft and pliable?

As a rule, you have to soak rawhide for some time to get it to soften at all, and quite some time to make it pliable. When you stretch it while wet, it shrinks as it dries.

On the other hand, while certainly rawhide will become "soggy and stretchy" after emersion in water for an extensive length of time, it has not been my experience that rawhide, simply exposed to moisture, will be made malleable. Granted, changes in humidity can make it not entirely suitable for things like knife scabbards, as it can swell up slightly, although this can be planned for by making the scabbard slightly larger than needed. I assume the same can be done for armor.

In Waterer's *Leather Craftsmanship* (1968), page 116:

"Shields have long been made in India of layers of raw skin. The most prized were those in which, by careful selection of almost flawless skin, the resultant laminated material was nearly transparent."

"The Somalis made a shield of an untanned hide in an unorthodox form but in this case the outer surface is roughened to make it completely opaque and resistant to moisture."

Waterer's *Leather and the Warrior* (1981) page 5 shows a photo of the Somali shield "made from layers of untanned hide". Page 47 shows a picture labeled "Body armor (Shupenpanzer) covered with scales of untanned hide with hair remaining." "And just to give some support to David Friedman (Cariadoc)'s suggestion:

Page 53: "...But in wet or damp conditions it will quickly revert [to a more softened condition], putrefaction will commence and eventually destroy it. Therefore for any purpose likely to be involved with changing atmospheric conditions, the surfaces must be protected; the traditional way of doing this was to lacquer it, as was done in China and Japan. Rawhide scales would have been very tough, light in weight and long lasting if properly looked after. They were used for lamellar armor in the Far East..."

#### 5. **Variations in Raw Hides**

Also some sources suggest that different forms of raw, or undressed, or green, hides have different properties, although I have not been able to experiment with this yet. It is suggested that buffalo hide (parfletche) when raw is in fact softer and more pliable than cow, which is why it was used for so much more by the Native Americans.

On the other hand, this may have had a lot to do with the methods used for making the rawhide. Native American methods may have depended on bacterial action to remove the hair from the hide, although it is known that by the time of contact they generally used alkali to depilate their skins for rawhide, especially on the Plains where the rawhide culture was strongest. Wood-ash lyes were most frequently used but lime was used by the Comanche. This is documented to the very earliest descriptions of Plains rawhide. See John D. Hunter (1823), George Catlin (1838) and Colonel Richard Irving Dodge (1883). It is arguable whether bacteriological depilation would have had more of a softening effect on the hide than the alkali depilation practiced by the Europeans and as described above, or whether the reverse would be true (I've never tried either myself, so I can't say for a certainty. However, more experienced leatherworkers have told me that hides depilated through bacterial action may in fact be harder, since the mucopolysaccharides -- a mucus, are removed or broken up by the alkali. Alternatively, another Native American method of depilation was by scraping, which would have removed the upper or 'grain' layers of the hide, which are more tough and compact than the underlying layers. Without them, the rawhide would be softer and more pliable.

There is a difference of opinion about the differences and variations in methods used and whether they would have any

impact than the species of animal in use (particularly when considering animals as closely related as the buffalo and cattle). Others, including Waterer feel that differences in age, species, and even gender of the animal can make a difference in how the leather turns out.

6. **In Situ Self Tanning?**

Is it possible that some of the period examples of leather we've dug up have some how "Self tanned" over the centuries to be harder to distinguish from mere leather? I'm not sure what you mean by 'self tanning', but rawhide/parchment, with time undergoes a natural oil-tanning process whereby residual oils present in the hide oxidize to produce aldehydes that 'tan' the hide.

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# Period Leather

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(This section was written almost entirely by Rick Cavasin (AKA Master Balderik [cav@bnr.ca](mailto:cav@bnr.ca)) and is copyrighted by the him. Its use here is with permission)

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1. Types of Leather
2. Classifying/Identifying Types of Leather
3. Tanning Your Own Leather

## Types of Leather

Here's a quick tutorial on the different 'types' of skin/leather products that were available in period:

- *Rawhide*: little or no chemical treatment of the hide other than that used to remove the hair. Parchment/vellum falls in this category, but the physical treatment in this case can be extensive.
- *Mineral Tannage* or '*Tawing*' In Period, Alum Tawing would have been about the only form of mineral tannage available. Produces a soft, stretchy, and \*snow white\* leather. Due to it's poor resistance to water when not combined with other tannages, this leather would probably have been used more for indoors applications in temperate climes. Not widely available today, but is used in conservation bookbinding because of it's long term stability. Alum tawed leather is a poor choice for military applications (except perhaps in very dry climates) as the alum tends to be poorly fixed and is easily washed out if the leather becomes wet.
- *Vegetable Tannage* or '*Tanning*' This, strictly speaking, is the only form of true 'tanning' since it uses tannin leached from vegetable matter. Contrary to popular conception, a wide variety of leaves, barks, etc. were used to perform this task, not just the 'oak bark' commonly quoted. The vegetable tanned leather commonly available today is made specifically for tooling, but this is not necessarily the only form veg-tanned leather can take.
- *Oil Tannage* or '*Chamoising*' This form of leather is produced through the oxidation of oils that are applied to the hide. The leather tends to be flexible and readily absorbs and expresses water. Today, chamois is one of the few true oil tanned leathers still available. In period, heavy oil tanned leathers would have been available (for example, the "Buff" leather used for coats in later period was an oil tanned leather). 'Brain' and 'Buck' tanning are forms of oil tanning. Some leathers marketed today as 'Oil Tanned' are not, and are merely veg or chrome tanned leathers impregnated with oil and/or wax to make them water resistant. (**Diarmuid** Note that most modern forms of "chemical tanning" are NOT period, but rather the development of the 19th Century.) Commonly available 'buckskin' is really chrome tanned leather that has been dyed to give it the golden color of real buck-tan. Real buck-tan is harder to get, as I don't think it is done on a large scale. It is usually done by hand, using traditional methods, and is A LOT of work. The price usually reflects this. Real buckskin is an oil tanned leather, and almost always smoked. If it doesn't smell like smoke (no mistaking it, the beautiful odor fills a room in short order), it's probably not real buck-tanned leather. Buck-tan, like other true oil tanned leathers, will almost always have the grain layer removed (to facilitate penetration of the oils). If it's not suede-like on both sides, and if it don't

smell like smoke, it may not be buck-tanned.

(It should be remembered that in period, the three types of tannages were sometimes used in combination.)

## Classifying/Identifying types of leather

If you've got a whole pile of leather scraps from somewhere, how do you tell whether it's vegetable or Chrome or some other kind of tanned? My immediate guess, since it comes in a wide variety of interesting colors, is that it's NOT vegetable leather, but how do you tell? (Boil it, and see if it gets hard?)

**Balderik** As I mentioned earlier, about the only type of true oil-tanned leather widely available today (to my knowledge) is chamois of the type used in garments and for washing cars. As this type of leather is fairly easily identified (light brown, stretchy, suede-like on both sides, may smell like whatever oil was used) we can probably rule out oil tanned. Veg-tanned leather is usually tan to light brownish. Although it is usually sold undyed, even if it is, cutting it and examining the cross section should reveal the characteristic color. Because of the applications for which it is typically prepared, commercial veg-tan is fairly stiff and not very stretchy.

Alum tawed skins are fairly rare these days due to their sensitivity to moisture.

Chrome tanned leather is probably the most common leather nowadays. Used for everything from garments to shoes. Unless it is dyed straight through, you can usually detect it by cutting and looking for the characteristic light grey blue color that the chromium sulphate imparts to the leather. The leather can be quite soft and stretchy.

As different types of leathers tend to be rather distinctive, once you see the different types identified, it's usually pretty easy to identify leather. There are oddball leathers that can be hard to peg, but most of the stuff that is mass-produced today falls into one of a few categories. Go to a place that sells leather, and look at some veg-tan, and then look at some chrome-tanned. See and feel the difference. Works for me. Well, the color of the animals fur can contribute to the color of the underlying skin, but it depends on how much of the pigment/hair fragments are removed in the unhairing process. Modern methods of hair removal are pretty effective, especially on calf.

More important is where the tannin came from. Different plant materials will give different colors. Leather tanned with oak bark will be different from that tanned with sumac leaves, which is different from that tanned with Acacia pods. This is especially true of leathers tanned by period methods. Today, there is incentive to remove as much of the coloring matter as possible from the tanning liquors so that the leather will be pale, and therefore easier to dye (at least in lighter shades).

**Diarmuit** If your leather is "flesh" tone (Caucasian) or something in that visual range, dry and stiff (depending on how thick it is) like cardboard, it is vegetable tanned. Examples include unstained Baseball Gloves, Saddles, and most SCA armor. Vegetable tanned leather absorbs water fairly well.

**Balderik** I'd sprinkle a few 'probably's and 'usually's in there. These leathers are like that because they are, to some extent, made to be that way. Veg-tanned leather can be soft, greasy, etc. It just isn't usually made that way. High quality bookbinding leather is often veg-tanned, but it doesn't have quite the same feel we usually associate with veg-tan.

**Diarmuit** If it has hair, it's probably NOT vegetable tanned. If it's soft, thin and flexible, it's \*probably\* not v-t, but rather "oil tanned", but I'd be careful here. Some leathers that are called 'oil-tanned' are really just chrome and/or veg-tanned leathers which have been heavily fat liquored (all leathers are fat-liquored to some extent). True oil tanned leathers are leathers that are impregnated with oil (the grain layer is typically removed to facilitate penetration from both sides), and then the oil is oxidized (by smoking in

the case of Native American tradition), and the residue is often washed out. Chamois, of the sort used to wash cars is about the only true oil-tanned leather manufactured commercially these days (to my knowledge). Buck/brain/smoke tanning, the Native American variant of oil-tanning, is not performed on an industrial scale as far as I know.

Note the best calfskin (IMO) is V-t, but is soft and flexible and thin.

If it's chromium Tanned (or Latigo) it will often have a thin white layer if you cut it in half. That line is the chemicals that remain in the leather. Sometimes, though, they're dyed right through so the characteristic (White, Gray or Blue Gray) color is hard to spot. Veg tanned scrap is generally thicker 4 oz>, and either oiled or waxed if finished at all.

I'd say that most hides are chrome-tanned these days. Most garment leather is Latigo. DO NOT make knife scabbards out of it since it *can* corrode the metal that it comes in contact with.

If it's got plastic on one side, the Gods only know what it is, and has few uses in historical recreations anyway :) If it's got what appears to be a fabric pattern the flesh side, it may well be the skin of the sacred Nauga.

**Ceallach** You could try wetting a piece and then stamping or pressing a mark into it. If the mark has a crisp impression afterward, the leather is veg. If the impression is *just* discernable, it is chrome tanned. Also if its' a chalky white color, it is probably alum tanned. Chrome tanned, undyed leather is a pearl grey, faintly bluish tint.

## Tanning your own leather

**Unofficial commercial note:** Tandy carries two sorts of tanning kits. One is a tanning paste, the other is a more complete kit with lime for removing hair, etc.

There are also various companies that will tan hides and does a beautiful job at a very reasonable price. Some people who use them pay about 1/3 of what a commercial hide would cost.

## Removing the hair

1. Remove large chunks of fat/flesh from the flesh side of the hide (if the hide has dried out somewhat, do this after soaking for a couple of hours as part of step 2).
2. Soak the hide in cold water, changing the water frequently, for a period of about 2 days. This is to wash out blood, soluble proteins, etc.
3. While soaking the hides, prepare your unhairing solution:
  - Take about 2 cups of builder's lime (slaked lime = hydrated lime =  $\text{Ca}(\text{OH})_2$ ) for every 5 gallons of unhairing solution (you'll want about 10 gallons for the average deer hide - maybe more for an elk).
  - Mix the lime with hot water (lime is caustic - exercise appropriate precautions)
  - and set it aside to cool for a day or two.
  - DO NOT PUT THEN HIDES INTO THIS SOLUTION WHILE IT IS HOT. It is inadvisable to unhair the hides using lime if the ambient temperature is much over 75F.
4. After the soaking, place the hide in the lime solution in some sort of tub. Stir as frequently as possible (at least twice daily), and drain the skin over a horse every day or two, returning it to the lime solution.
5. When the hair at the neck can be rubbed off easily, it is ready to unhair. The hair can be rubbed off

with a gloved hand, or scraped with a blunt edge. Depending on the state of the hide when the process was started, the species, thickness, ambient temperature, etc. it will take 1-3 weeks for the hair to loosen. Draping it over a cylindrical 'beam' can facilitate the unhairing process.

6. Once the hair is removed, the hide should be thoroughly fleshed to remove any residual fat, flesh, and connective tissue.
7. Wash the hide thoroughly to remove residual lime. Change the water frequently, for about 2 days. To be double sure, you can 'delime' the hide after washing in a weakly acidic solution (eg. very dilute vinegar). In the Middle Ages, deliming would have been achieved by soaking in a fermenting vat of bran after thorough washing.
8. Your hide is basically ready for tanning at this point.

## Salting

If you have cleaned the skin well (no fat or meat) and have it salted the skin will last for a while. I have two hides in that condition that I have had for a year with no signs of deterioration.

## Deterioration

Deterioration can be more subtle than outright petrification. Residual blood in the hide may set permanently, leaving blotches in the finished hide. Fat/oils oxidize, leaving discolorations. There are some organisms that can attack the salted hide, leaving various discolorations. Some of these things may not be as big a concern for someone making leather, but for parchment, I like to get my hands on the skins as soon as they're off the carcass. Unfortunately, that rarely happens. Even freezing, though better than salting for prolonged storage, can lead to problems in the long term.

### References:

- Churchill, James E. *The complete book of tanning skins and furs* (Harrisburg, PA : Stackpole Books, c1983).
- Reed, R. *Ancient skins, parchments and leathers. Studies in archaeological science.* (London, New York : Seminar Press, 1972).
- Vivian, June. *Home tanners' handbook.* (Wellington : A. H. & A. W. Reed, 1976), (Vancouver, B.C. : Douglas & McIntyre, 1981, c1976).

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# Basic Leather Carving

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## Basic Leather Carving

The embellishment of leather goods via cutting, stamping, and tooling date back into antiquity, and though these techniques have been simplified by modern tools and automation, the medieval leatherworker's craft has changed little in the intervening centuries. The techniques and patterns used to decorate modern saddles are repeated on specimens in European museums and, if I am any example, can be learned by artistic Neanderthals with a bit of hard work.

## Basic Carving Technique

The amount of time devoted to detail and perfect carved edges depends entirely on the application. A leather coronet, bible cover, or tooled pouch would be small enough, and sufficiently scrutinized to be worthy of full detailing as described below. Larger projects, intended to be viewed from a distance (such as a shield, belt, or sign) might omit several of the edging and finishing steps. The resulting project will have less terrain, rougher edges, a non-uniform background, and take one-tenth the time to finish. Furthermore, none of these deficiencies would be visible further than a foot away. Ultimately, the level of detailing depends on the purpose, scale, and price of the piece.

An early example of the cut, bevel, and backgrounding work is the [satchel of the book of Armagh](#). It was carved sometime in the 8th century to carry a much larger book, but later found use with the smaller book now at Trinity College Dublin. The satchel lives in the special collections room of the new library, and you can see it if you ask nicely (and pretend to be a graduate student in art). To give you an idea of the scale of the pattern, the interlacing stripes are about 6mm in width.

1. Obtain a piece of naturally tanned leather. Vegetable and oak-bark tanning will work nicely, while modern chrome tanning will not (it waterproofs and softens the hide too much to retain tooled designs). If possible, try to work in the center of a piece somewhat larger than your pattern. Meanwhile, copy your pattern onto waterproof tracing paper (wax paper works).
2. Both sides of the leather are wetted, either with a sponge, quick dunk, or running under poured water. Attempt to wet the surface without allowing water to pool and saturate the piece. Overly wet leather gets mushy, and dry leather can crack under the increased force needed to form it (some folks prefer dry leather for stamping).
3. Secure the traced pattern onto the leather (tape only to the back of the leather!), make sure the inked side of the paper is facing up (!) and transfer the pattern by pressing on the paper with a rounded stylus (ball-point pen). Smooth any mis-tracings with a modeling (or ordinary) spoon. Remove the tracing paper, and let the surface dry a bit.
4. Carve the lines you have just transferred, about 1/2 the hide thickness deep with a swivel (an

Exacto results in non-uniform lines, but can be substituted) knife. Carving is the critical step to creating striking, non-stamped designs. When done well, it creates enough contrast to skip one or more of the following steps in a lower-detail project, or ease the remaining steps of a higher-detail project.

5. Bevel along the carved lines, by placing the deep part of the beveler into the groove, and the shallow part toward the side to be depressed. With each mallet stroke, overlap the previous stamping by 2/3 of the tool's length, trying to tool to at least half the thickness of the hide. This step is the most dull and time-consuming (a 40" knotwork belt required 25 hours of beveling, 5 of design & tracing, 3 of carving, and 4 of finishing!), but results in smooth, finished edges which collect dye and produce an automatic graded-shading effect. Also, beveling down the edge pattern creates deeper patterns and simplifies the next step. However, its use, except for small sections, may not be justified or reasonable for larger projects.
6. Most modern designs use a raised foreground and a flattened background to maximize topographic contrast (the opposite, inverted tooling, is also common). A flat tool, either textured (which collects dye and automatically darkens the background) can accomplish this, overlapping profusely (as with beveling) to avoid individual too-marks. The degree of overlap, again, depends on how much time the artisan wishes to devote to "perfection," as does the effort expending in pounding down exactly "inside the lines" (and beveled edges provide a large margin for error) Alternative backgrounding techniques involve stamping a repeated pattern, filigreeing (cutting away the background leather completely), or poking a nail the leather to create a speckled pattern.

Another technique, used as extensively in period as today, is stamping. Once the stamp is created, the above sequence is limited to wetting the leather, transferring some alignment marks, and pounding away. This demands a pattern be used numerous times, as modern custom stamps can quite expensive, and period stamps were often painstakingly carved from wood (and incidentally didn't last very long). The hybrid technique of using common stamps (crescents, ropes, circles) in creative ways to augment a hand-carved design can save immense amounts of time, while still producing one-of-a-kind projects.

## **Shopping List for Basic Carving: (\$75ish including the marble)**

Tooling Mallet:

PVC (cheap, durable) or rawhide (not yellow, less bouncy) are best.

Stamping Surface:

Nothing beats marble (though pouno board works) with rubber underneath.

Swivel Knife:

The \$10 model works fine, if you keep it WD40'd and sharp.

Make a strop:

Glue a piece of leather to a wooden base. Rub it with white jeweler's rouge.

Textured Bevelers:

B936 (small), B701F (medium), F976 (pointy)

Backgrounders:

A104 or A104 1/2 (teardrops), A105 (small rectangle)

Other:

Waterproof tracing paper, modeling spoon/stylus combo (or ball-point pen & spoon)

## Paints and dyes:

- Let one pigment dry (overnight if possible) before applying a different one.
- Paint with water-based acrylics. Leather paints are more flexible than normal ones.
- Water and spirit-based dyes should be diluted for a full range of effects.
- Oil based dyes are rich, deep, permanent, and rather cheap if you buy by the quart.
- Lacquers (like Neat-Lac) work well as resists for Antiquers (I like Tandy's browns)
- Leather sealers make the piece waterproof and shiny, but also less flexible.

## Basic Leatherworking Tools:

T-square, yardstick, compass:

Measure & shape your leather accurately.

Exacto knife and/or leather shears:

N.b. leather will destroy "cloth only" shears

Edge Beveler (#2):

Round the fresh edges for a more finished and durable piece.

Beeswax & Bone folder/wheel:

Finish the edges nicely.

Barge Cement:

Let set for 20 minutes before bonding two ROUGH surfaces. Ventilate very well!!

## Leather Tips:

- Vegetable-Tanned or Oak-Tanned only! Tooling chrome-tanned leather is a hopeless cause
- Choose light-colored leather in the thickness desired (one "ounce" is a 1/64" of thickness)
- Some leather is of a lower grade due to a few, bad defects, or small size.
- Depending on your project, this could be a good value for you...
- Scraps (anywhere but Tandy or Leather Factory) are cheap and ideal for practice and small projects.
- Try to select your leather in person, especially when buying shoulders and sides.

by Jonathan Getty, Lord Todde mac Donnell in the SCA

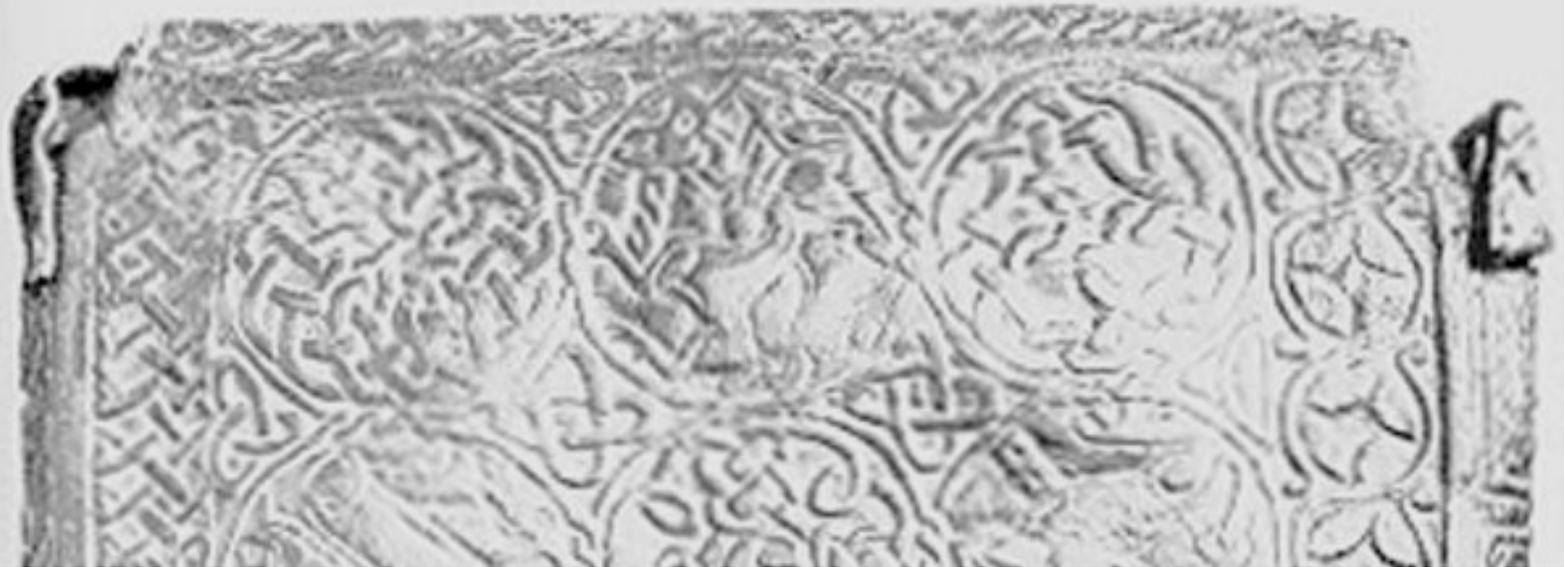
email: [jtg0@umail.ucsb.edu](mailto:jtg0@umail.ucsb.edu) (This email address is not current - 3 Mar 2003)

*Last edited 7/26/01*

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# Miscellaneous Leather Materials and Links

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## Some Leather Sources

- Arensberg sons, Inc. 1428 10th Ave Seattle WA 98122 1-800-537-5495 Pegs
- Barbour Campbell Thread, Ltd. (England)
- Charles Hardtke
- Dennis Kellett, Leather Specialists, The White House, Grundy's Lane, Malvern, Worcestershire WR14 4HS, UK. Phone: 011-44-1684-561851
- EC. Leather 1924 E. 6th St. Tulsa, Ok. (918) 583-0292
- E.J. Dailey P.O. Box 469 Cortland, IL 60112 (815) 286-3073 Tallow
- [eLeather Supply](#)
- [Footwear Findings](#)
- Fort Pitt Leather Co. 1840 5th Ave. Pittsburgh, PA 15219 (412) 281-7879 Pegs
- Goetz
- Goldberg (978) 745-3030
- Hochhauser Leather (713)670-9800 FAX (713) 676-1119
- International Advisory Service - Leather Imports?
- J. & F. J. Baker & Sons, The Tannery, Colyton, Devon, UK
- J.R. & Sons Jeff Robinson P.O. Box 603 Monroeville, Ohio 44847 (419) 465-2193 Tallow
- [The Leather Factory](#) 5710 Mobud St. San Antonio, Texas 78268 - 1-800-541-2031
- Leatherhead Inc. 1601 Bardstown Rd. Louisville, KY 40205 - (502) 451-4477
- [Leather Tools and Supplies](#)
- Mid-Continent Leather Sales Co.26450 East 111th. Coweta, OK 74112 - (918) 486-2900 (Fax) 486-4233
- [Oklahoma Resources](#)
- Rice Corp. 1-800-765-RICE(7423) Thread
- [Siegel of California](#)
- Sherman Shoe Supply (781) 598-9857
- Springline Last Mfg., Pondwood Close, Moulton Park, Northampton, NN3 1RT. Mr. Bill Saunders: 011-44-1604-644961
- Sterling Last St. Louis 1 (573) 898-2020
- S&T Leather Company 2135 S. James Rd. Columbus OH 43232 - (614) 235-1900

- Sun City Leather
- Weaver Leather
- Windmill Farm Saddle Repair, Thompson, Ohio (440) 290-3018 Diamond Awls

## Leather Links

- [WWW.Braintan.Com](http://WWW.Braintan.Com)
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