Viking Age Bucket (Work in Progress)

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SUMMARY

Buckets were a necessary tool in the Viking Age. The need to carry liquids and dry goods is constant, particularly in an encampment or on a farm. The basic form of the bucket has changed little over the centuries since the Viking Age; only the materials have changed. Buckets were commonly created from wood, requiring similar (but less advanced) skills as making barrels. Their shape, sometimes wider at the bottom and sometimes wider at the top, varied according to their intended use. The exact materials, particularly for the hoops and handles, also varied according to the wealth of the owner and intended use of the bucket.

I created this bucket as a prototype, using scrap wood left over from another project. In the fall of 2002, a friend of mine needed an article describing how to make Norse buckets, as part of a collection of instructions to help participants prepare for a 4-day experiment, the Real Viking Project. I wrote the article and built the bucket concurrently, figuring out the best way to accomplish each step, putting that step into practice, and writing what I learned as I went. The resulting document is very long due to the need for clarity and complexity of the project.

I was not able to finish the bucket when I made it two years ago because, at the time, my metalworking skills were inadequate to make the hoops and handle. In the past two years, I have done several projects in sheet metal and a small amount of rudimentary ironworking. I now have the skills I need to finish this bucket, and have installed the hoops. I intend to make a brass handle for it, but for now have a rope handle until I have time to make a brass one.

I learned a lot making this bucket. Until I made it, I had only theories about the process and possible pitfalls along the way. Now that I have acquired the skills needed to finish it, I look forward to finishing it and making more buckets as the need arises.

Historical Documentation

Bucket Basics

Buckets are similar in form to barrels, though simpler. The skill of making buckets and barrels, known as coopering, requires great skill and experience. The principles presented here might assist, but are not intended to teach, the more complex task of making barrels. The term "white coopering" is applied to making buckets and tubs, and requires much less skill than barrels ("wet coopering" or "dry coopering", depending on whether the barrel holds liquid).

Buckets are simple, with several parts. Shown to the right are a reconstructed bucket and washtub from the Viking Age Farm at Fyrkat fortress in Denmark, and show all the typical features. The side of the bucket is made up of boards called staves. The bottom of the bucket is a flat piece of wood that fits into grooves in the staves. Sometimes, two staves are longer and are used to attach a handle. The staves are held together by two or more hoops of iron or wood, holding the staves in place with tension

photo by Isabel Ulfsdottir

on the hoop which compresses the edges of the staves together. Sometimes the staves are shaved so the bucket is round, and sometimes they remain faceted.

Period Examples

Morris' book, *Wood and Woodworking in Anglo-Scandinavian and Medieval York*, describes the excavation, preservation, and classification of thousands of wood artifacts from the Viking and Medieval period, found at the Coppergate site in York. A majority of these artifacts were tools, waste, and products of woodworking, including many examples of buckets from Viking Age York and the surrounding countryside. They appear in a wide range of sizes, and varying degrees of skill and decoration went into their construction. They were made from oak, yew, willow, fir, and had chamfered (angled) edges to give a tight seal between staves (Morris 2228). Some buckets had staves of varying width, and the number of staves in a bucket varied from six to nineteen (ibid).

Metal hoops were made by riveting strips of metal into hoops, heating them, and placing them on the bucket, so that when the metal cooled it would shrink to tightly bind the staves. A few iron hoops were nailed in place. Records show that the iron-bound buckets cost twice as much as wood-bound buckets (Morris 2230), and were mostly used in well buckets, possibly for greater weight to sink and more easily scoop up water. Wooden hoops, which appeared to be more common, were made from thin strips of wood and nailed or pegged in place.

Handles were made from rope, wood, or metal. Often, the holes in the bucket through which the handles attached were reinforced with metal, particularly when the handle was made of metal.

The best surviving specimens were found in wells, due to the water preserving the wood. Well buckets tended to be smaller at the bottom than the top so that, when lowered into the water, they would tip easily and fill with water. This shape is the most common type of bucket found (Morris 2228), closely followed by buckets with parallel sides. This bucket shape has carried through into use today. The bucket shown to the right is made of yew wood with five brass hoops. The bottom consists of two pieces of wood, with 17 staves shaved so the bucket is round inside and out. The hoop on the rim also has the handle mountings integrated in it. The handle is brass, slightly flattened in the center and flanked by two simple animal heads. It was found inside another bucket, inside a barrel buried in the prow of the Oseberg ship. This bucket, finely constructed with brass fittings, is certainly the product of a skilled craftsman, and worthy of being buried with the queen. This bucket is believed to have been imported from England.

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Buckets used for carrying liquids or dry goods, on the other hand, show varying aspect ratios. Morris shows many bucket staves, some from buckets that were larger at the bottom. My theory is that some buckets were larger on the bottom because this shape makes them less likely to turn over, or to splash their contents when carried. The bucket shown to the right is typical of this type. It is made of 10 staves of pine and is widest at the bottom. The hoops, mostly gone now, were of beech and held in place by iron nails still visible along the upper left side. The bottom is one piece, caulked with resin. The handle is twisted iron with a wider plate at the center, attached to the bucket with simple bent iron loops nailed in

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place. It has a runic inscription "asikrir", which translates to "Sigrid owns [this bucket]." This bucket of simper materials and construction is more likely to be typical of the "everyday" bucket used by Norse people in the Viking Age.

Finishing

Finishing the bucket would require smoothing the surface sufficiently that it would not cause splinters, and sealing the wood to resist the materials being carried and the weather. A bucket is a tool, so decoration would most often be minimal.

Period abrasives include many different materials and techniques. For buckets, the likely method would be planing. I saw many wood planes in the Danish National Museum, whose form was not substantially different from the modern plane in my workshop. Planing would be followed by sand and cloth, or by scraping with the edge of a sharp knife or a tool called a scraper, which is similar in form to a blade held edge-wise. If the cooper wanted a bucket with smooth round sides, he could use a plane, spokeshave, or drawknife on the outside of the staves and a barrel-shave (a drawknife-like tool with a convex-curved cutting edge) to round the inside of the staves. Careful use of the plane and the barrel-shave would produce a smooth surface that would not require further finishing.

The bucket could be caulked with resin if it had to hold hot liquids, such as a washtub, or beeswax if it only carried cold liquids or dry goods. A good cooper could produce a barrel or bucket that was watertight without the need for caulking. The outside wood could also be sealed with an oil or wax finish to prevent moisture damage.

Materials and Tools

I made this bucket from scrap pine, which has holes drilled in it from the previous project, because it was a prototype. Any wood that you have is appropriate for making a bucket, though poplar is the best compromise of weight and strength and is readily available in period and today. If you buy the wood fresh from the lumber yard, you should let it dry, so that if it warps you can incorporate the warp into the bucket's shape. You will also need scrap wood to make the various jigs you will need. All the bucket parts can be made with 3/4" thick stock, i.e. 1x4, 1x6, or whatever width you like. If you were making the exact bucket described here, 1x4s are ideal if you don't mind wasting some wood. Wider boards will be less wasteful and will require fewer pieces for the bottom.

Tools consist of a saw (bandsaw, table saw, or hand saw), block plane, chisels, hand files, a router (optional if you have a table saw), and sand paper or scraper if you want a really smooth finish.

Method of Construction

Design Decisions

First, you must decide whether to make a bucket that tapers, how many staves to use, and the height and circumference of the bucket. The amount of taper will determine what jigs you will need. Finally, you must decide on a material and method for making the hoops and handle. A non-tapered bucket would challenge a novice woodworker, while a tapered bucket proved to be a challenge for an intermediate woodworker such as myself. The entire project takes 1-2 hours of planning and 3-5 hours for the woodworking, depending on your skill, tools, and level of care. I estimate the hoops and handle will take another 3 hours.

If you are using a hand saw, you will need a lot of guide sticks (straight sticks clamped on each side of the saw's path to ensure a straight cut) because a mitre box is not suitable for ripping. A table saw or band saw replaces the guide sticks with a table and angle guides. You will also need to get or make a taper jig if you want a bucket that tapers along its length. A taper jig is simply a long, thin wedge of wood cut at a particular angle. I will discuss making the taper jig later.

The method shown here will make a bucket or tub from staves that are identical in width, with two longer ones that will attach the handle. For this bucket, I chose sizes arbitrarily based on the wood I had and the approximate size bucket I wanted. This method avoids most of the mathematics and is probably the way things were done in period, given the varying sizes of buckets that have been found. I will, however, show a mathematical shortcut to determining one critical angle, which may or may not have been done in period. Then, if you want a wash tub or bucket of a different size, you can use the method shown to derive your own measurements.

First, I decided the bucket would be about 12 inches high. Such a bucket will hold a respectable amount and has pleasing proportions. I also decided that the bucket would have 10 staves. The number of staves should be an even number so that the handle will balance. More staves give more of a circular appearance but make assembly more difficult. I chose a circumference that can easily be divided by the number of staves so it is easy to calculate the width of each stave; I chose 40 inches. That results in a bucket about 13 inches in diameter (40 / 3.14 = 12.7), resulting in a pleasing proportion.

Before I talk about cutting the wood, I will review some general principles of woodworking. First, check all measurements, guides, jigs, and the direction you will cut at least twice before cutting. Second, keep in mind the width of the cut (kerf) the saw will make in the wood when measuring. Finally, once you set up a certain cut, make all cuts that require that setup. For example, once you set the blade at a particular angle, make all cuts that require that angle. Taking care with these principles helps ensure consistent results of which you can be proud.

First, cut the staves. If you want a tapered bucket, study but do not execute the next section on non-tapered buckets. If you want a bucket that does not taper, execute to the next section then skip the section after that on tapered buckets.

Cutting Staves for a Straight, Non-Tapered Bucket

Cut 10 staves that are 4 inches wide. Eight staves will be 12 inches long, and two will be 14 inches long, the extra two inches being for the addition of a handle.

Next, you must bevel cut the chamfer (bevel) edges of the staves. In period, the cooper may have found the angles with a diagram or by using his eyes and experience to achieve a tight fit. We will take a shortcut to make up for our limited experience. A bucket is a circle, 360 degrees. Geometry tells us that for any number of sides greater than 3, the angles for a polygon add up to 360 degrees (a square box has 4x90-degree angles). Since each angle on our bucket is the meeting of two staves, the chamfer angle on each stave is half the join angle (with the box, each 90-degree angle is where two boards with 45-degree chamfers meet). Therefore, the chamfer angle for 10 staves is 360 degrees / 10 staves / 2 sides = 18 degrees per stave side. This same formula works for any number of staves greater than 3.

Set this 18-degree angle on the table or band saw, set the fence 4 inches away from where the blade comes out, and run the stave through the saw against the fence. Using the fence this way ensures consistent angles and widths for all the staves. The drawing to the right shows the setup for a

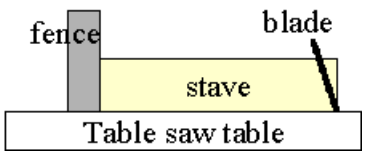
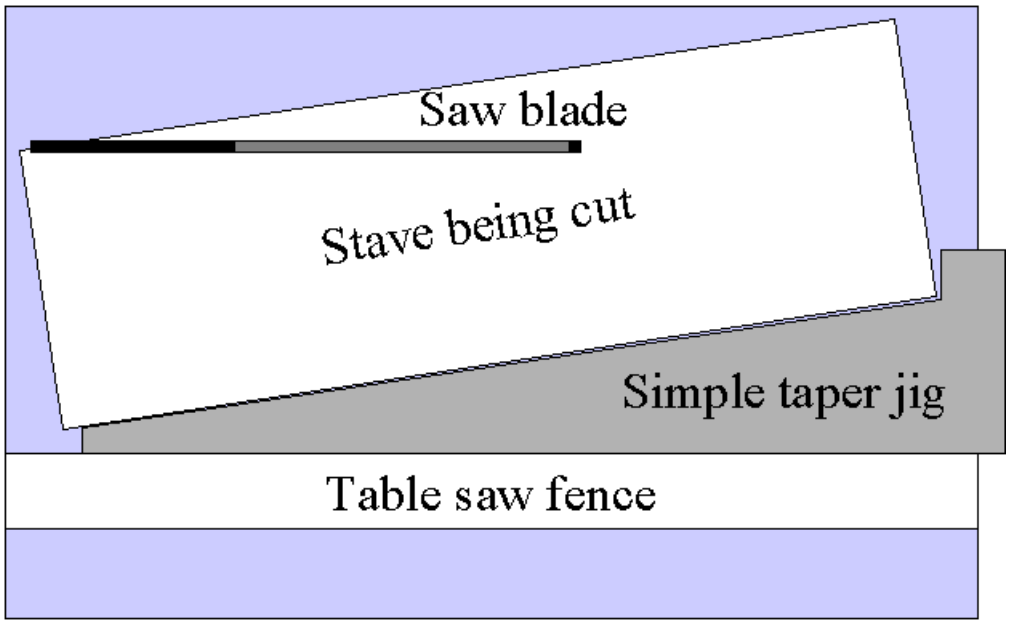


table saw. With a band saw it is the table that tilts rather than the blade, but the principle is similar. Pay particular attention when cutting the angle on the other edge of the stave, to ensure that both angles cut into the same side, and that you keep the chamfered edge against the fence. When you have chamfered all the staves, skip the next section and go to the Test-Fitting section.

Cutting Staves for a Tapered Bucket

The tapered bucket is made using the same principle as the non-tapered bucket above, but is more complex because the staves have no only chamfer angles as above but also a taper angle along their length.

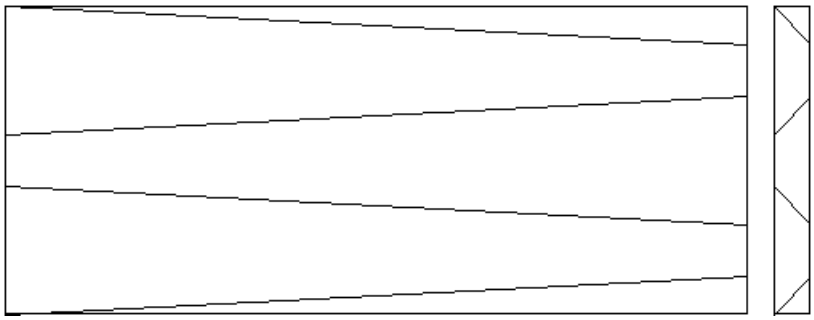
To make a tapered bucket, the staves must be tapered, and your will waste less wood if you cut the angles and the tapers at once.



all drawings by the author

Set the 18-degree angle on your table saw or band saw (study the section on straight buckets for discussion of the chamfer angles). The top picture shows a simple taper jig cut from a board, being used on a table saw. The taper jig is cut at an angle, with a protrusion on the back to ensure consistent placement of each stave and to push the stave into the saw. I recommend a very small angle on the taper -- three degrees per side gives a pleasing shape. Cutting each stave from a single narrow board wastes more wood, but is easier to measure and cut, and allows you to plan the direction the wood will warp if the wood is not fully cured.

This drawing shows how to get multiple staves out of a wider board with less waste. If you put an already-tapered side against the fence, no not forget to put the cut piece of wood back on, to restore its square shape, before placing it into the jig. Otherwise the angle will be wrong. Careful checking before each cut is crucial



to getting equally-sized staves that taper in the correct direction, equally tapered on both sides, and with the chamfers also going the correct direction. Do not use this method unless the wood is fully cured, or your staves will warp unevenly (some warping in and some out).

Drill small holes in the top of the two longer staves, centered and 1 inch down from the top, for later attachment of the handle. The holes should be the sized to fit your handle (or 1/32nd inch larger for a rope handle).

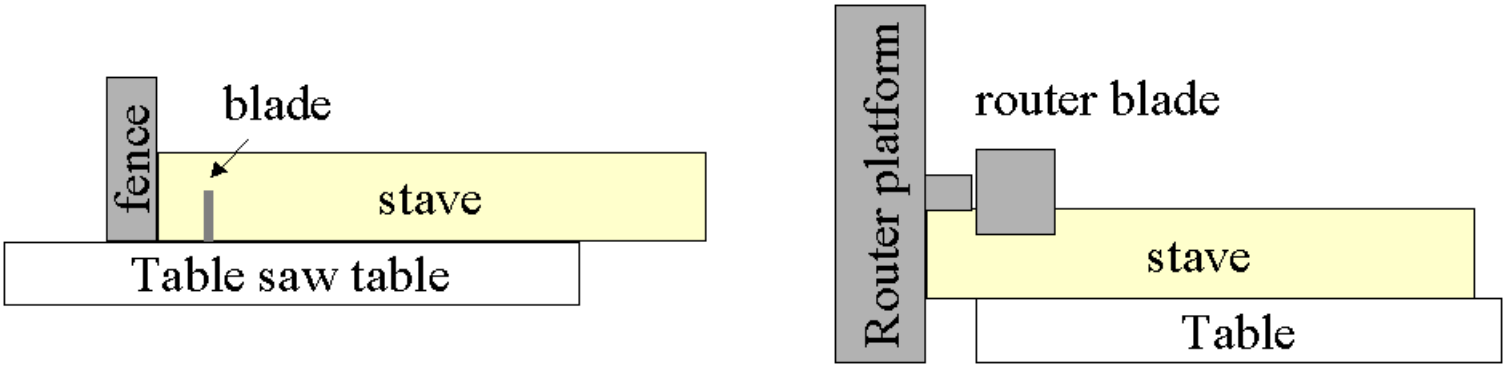
Test-Fitting the Staves

Assemble the staves together temporarily with tape, ensuring the longer ones are on opposite sides to balance the handle. Then, use a rope clamp or adjustable cargo strap to tighten the staves against each other. If you measured carefully when cutting, the ends should meet evenly and the joins should be tight, forming a circular shape. If your bucket tapers, carefully measure the angle at which it tapers, measuring between the flat of one of the staves and the vertical. This angle will be used later, and is referred to below as the "bucket taper angle." Set this stave assembly, still in the shape of the finished bucket, aside for the moment.

Measure the approximate diameter of the outside of the bucket and get a wide board of approximately that length and width. If you do not have one wide board, you can glue the boards together. Peg them with dowels, or make spline joints (long thin strips of wood, grain turned sideways to the boards being joined, glued into thin cuts made in the edge of the boards so as to be hidden when joined). However you join the boards, the method should not be visible when the bucket is assembled. Join, glue and clamp them so that they will dry into one strong wide board. For a bucket of the size described here, you can use a 1x12 so that the bottom will be one piece.

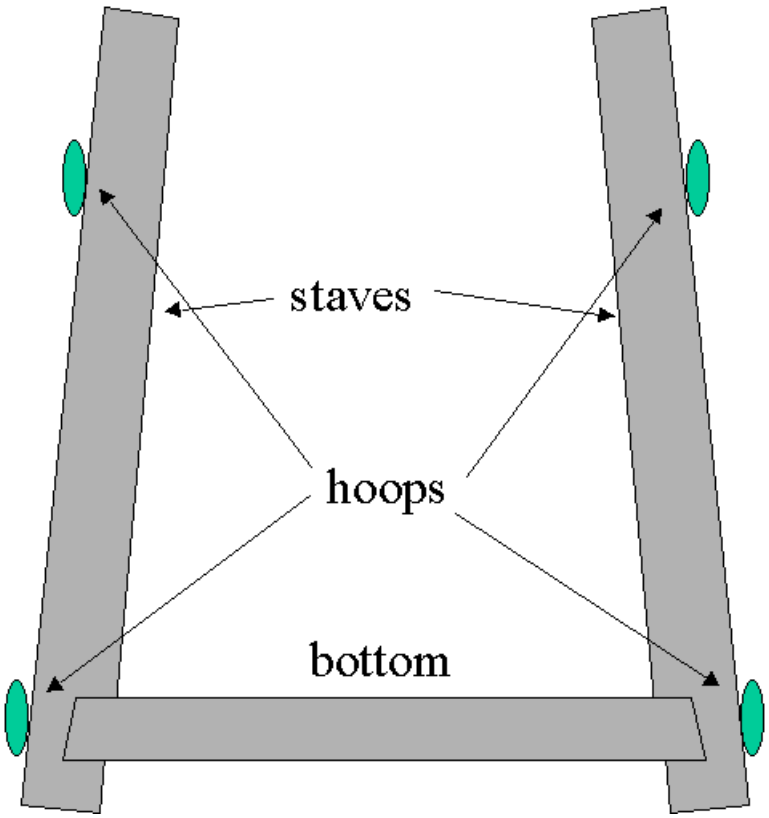
Set the assembled staves on the bucket bottom, as centered as you can make it, trace the inside bottom, and set the staves aside. The resulting tracing on the bottom is a polygon. If you made a non-tapered bucket, add a 3/8 inch radius to all sides of the polygon, making it slightly larger, and carefully cut along the lines of the larger polygon. If you made a tapered bucket, add 1/4 inch to the tracing on all sides, and chamfer the cuts at an angle equal to the bucket taper angle, chamfered **outward** from the outer line you drew.

Notch the staves to accept the bottom. This is easiest to do on a table saw. If you are making a non-tapered bucket and have a 3/4 inch dado blade, you can do this in one pass. Otherwise, set the blade to a 0-degree angle for a non-tapered bucket, or the bucket taper angle for a tapered bucket, and a depth of 3/8 inch. Set the fence 1/2 inch away from the blade. For a bucket that tapers toward the top, the blade should angle toward the fence, and for a bucket that tapers toward the bottom, the blade should angle away from the fence. As mentioned before, a non-tapered bucket will have a 90-degree blade angle. Run all the staves through sideways, with their wide ends against the fence, as shown in the drawing below left.



Reset the fence to 1 1/8 inches and run the staves through again, then again at 5/8, 3/4, 7.8, and 1 inch, to cut a series of kerfs that form a notch for the bucket bottom. You may have to vary the measurements to fit the kerf (teeth width) of your blade to get a notch (called a rabbet) 3/8 inch deep and 3/4 inch wide, starting 1/2 inch above the end, in each stave. For a non-tapered bucket, the rabbet can also be cut on a router with a 3/4 inch high, 3/8 inch deep square blade, set to a 1/2 inch depth, as shown above right. Take care to clamp the wood securely for safety and control.

You are now ready to test-fit the bucket to its bottom. The drawing shows a side cross-section of how the parts go together. Test-fit all the parts by holding the bucket together with the cargo strap or rope clamp, taking note of where the fit is not good, and trimming with a saw, plane or chisel if something does not fit quite right. This is the most time-consuming part of the construction if you exercise the proper amount of care, but well worth the effort to get tight joints. It is easier if you number the sides of the bottom so you can make notes of where to trim. As you find a stave that fits well on a particular side, number it to match that facet of the bottom.



Once you have finished test-fitting, assemble the bucket completely, using wire to bind it together temporarily. This is a final opportunity to test how the parts fit together and make any adjustments.

If you want a bucket with a round exterior, trim the stave edges with the plane, drawknife, or spokeshave, doing the sections not covered by the cargo strap, then moving the strap and doing the remaining sections. This trimming must be done while the bucket is assembled to ensure the joints are smooth, but before the hoops are installed. Once the hoops are installed they cannot be moved and trimming would be difficult.

Finish the woodworking by drilling holes in the top of the longer staves to attach the handle later. The exact size and shape of the holes will depend on the type of handle you desire. Finally, apply whatever protective finish (I used boiled linseed oil, a period finish) to the outside of the bucket staves and the edges where they will meet. You can finish the rest later, but you want to be sure the hidden areas are protected before you assemble the bucket and put the hoops on. Because I was using scrap wood for this bucket, I also had to seal the holes that were drilled through the staves with beeswax. I did this by pushing a plug of soft wax into the outside, then pouring molten wax from the other side, then scraping away the excess wax on both sides.

Making and Installing the Hoops

When you are satisfied that the parts fit together well, put the bucket back together using wire so you can measure it while making the hoops.. Measure the bucket where you want each hoop to go to get the circumference for each hoop. You need two or more hoops.

When you are ready to install the hoops, put a thin line of glue in the rabbet where the bottom fits into the staves, and on the chamfers where the staves meet. Wire the bucket together, so that the wires are holding the staves together but are not where you plan to put the hoops. I did not use glue for this bucket because I want to see if the joinery alone is enough; time will tell.

I have read about making wooden hoops but have not ever done it, so the following instructions are what I have read. Take a 4 foot stick of green wood (yew, ash, or osage orange are best), clamp it in a vise, and using wedges, carefully split it into 2 or more relatively flat strips. Carefully bend the strips into hoops the size you want, using steam to keep the wood flexible. Take your time and let the wood adjust to its new shape gradually. When the hoops have reached the right amount of bend, overlap the ends and tie them in place with glue and the inner bark from the stick, clamping it until the glue dries. For a non-tapered bucket, you can make the hoops right on the bucket. For a tapered bucket, make them off the bucket then, largest to smallest, and install them one at a time. As you put each hoop onto the bucket, slip it into place by pushing it down, tapping the edges gently with a mallet and flat stick. While you do this, look at the side of the bucket while it sits on a level surface, to ensure the hoops sit level. Be cautious not to tighten wooden hoops too much, or they will break.

Metal hoops are made from strips of metal. Non-tapered bucket hoops will be cut as long rectangles, while tapered bucket hoops will be curved strips. You can use paper wrapped around the bucket to determine the exact shape to cut, or you can do what I did: lay the bucket on a large sheet of cardboard, mark the top and bottom of the stave touching the cardboard, roll it one stave, mark again, and repeat until you have the entire bucket's top and bottom marked in a large

Wide arc, plus one stave width for overlap. Measure in from each end an inch or two, mark that as a line, then measure in another ¾ inch and mark another line. The result is two thin curved strips marked out, which you can cut out. Put the cardboard hoops on the bucket, mark where the corners are. Then use the cardboard strips as a template for the sheet metal. Cut out the sheet metal, bending it slightly at each corner. Rivet the sheet metal together to form hoops. For this bucket I used sheet brass.

To put on metal hoops, the period method is to heat them and let them shrink as they cool to tighten the bucket. Then, heat the hoop in a fire, oven, kiln, or outdoor grill, until the metal has a deep red glow. Do not let it get hot enough to glow orange; this can melt brass or bronze and will burn the wood too much. Put on thick leather gloves, and starting with the largest, take out the hoop with tongs or long pliers and drop it onto the bucket. Tighten it with a mallet and stick as described above while it is still hot. You have to nail them in place while they cool (either with small nails just above them, or nails through them) so they do not slip out of place. Continue with the other hoops. For this bucket, I put the nails through the hoops and left them there, one for every other stave, because the taper is steep enough that the hoops slipped.

Making and Installing the Handle

The handle can be made from a rope, wooden dowel, or metal rod.

A rope handle is the easiest to make. For a rope handle, use a natural fiber rope such as hemp or sisal. Take a rope, run one end through both handle holes, and tie a knot in the free end. Adjust it to give the amount of length you want, then cut the rope and tie a knot in the other end. Wrap the ends in string or dip them in molten wax so they do not unravel, and put some glue or molten wax on the knots to keep them from coming untied. For this bucket, I intend to make a handle from brass to match the hoops, but for now I made a rope handle as shown to the right.

You can install a wooden dowel for a handle simply by slipping it through the holes in the handle. Ensure you use a dowel sturdy enough to hold the weight of a full bucket, no thinner than 3/4 inch and maybe a full inch. Cut it at least 1/2 inch longer than it needs to reach through both staves. Secure one end flush with the outside of a stave with a nail, and leave the other end loose and protruding 1/2 inch so that the dowel can flex a bit under load without putting stress on the bucket staves. For a stronger wooden handle, find a branch that is naturally curved like a handle. Carve the ends to shape, then insert it through the holes while it is still green and flexible, and allow it to cure in place.

A metal handle can be made from a metal rod. The thickness of the rod should be 1/4 inch if it is iron or steel, or 3/8 inch if using brass or bronze. Hammer the ends round to fit the holes, hammer the center somewhat flat for a comfortable grip, and form the rod into the handle shape. You could also apply decorative stamping, twisting, or shaping of the ends. If the handle is metal, you should reinforce the holes in the staves to prevent the handle from wearing through the wood. In period, this was done with two simple metal rods, beaten flat at the ends and bent into a U shape the same

size as the hole. Nail them to the inside of the staves with the curve at the top, to take the weight of the bucket off the holes in the wood. Clinch the ends of the nails by hammering them over flat against the wood. Put the ends of the handle through the holes, then hammer them over to keep them from pulling out of the holes.

Paint the inside of the bucket with oil, wax or resin to seal it. Coat the outside with oil to preserve the wood. I used boiled linseed oil on the inside and outside, but will add wax to the inside when time permits, to ensure that the bucket will hold water. I learned a lot making it and will learn more finishing it. The bucket took a weekend for the woodworking, and half a day to make the hoops. I imagine a metal handle will take another half-day.

Bibliography

Morris, Carole A., *Wood and Woodworking in Anglo-Scandinavian and Medieval York*, from The Archeology of York, Vol 17 The Small Finds, Fasc. 13 Craft, Industry and Everyday Life, Council for British Archeology, York, 2000. ISBN 1.902771.10.9.

Roesdahl, Else and David M. Wilson, Editors, "From Viking to Crusader: The Scandinavians and Europe 800 - 1200" (1992) : Rizzoli International Publication, Inc., New York, NY 10010, ISBN 0-8478-1625-7.

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