

The construction of medieval “style” arrows

By Karsten von Meissen (mka Karsten Shein)

As in the medieval world, archery in the SCA is commonplace. However, the limited time and money of many SCA participants leads them to purchase archery equipment that may not be as “authentically medieval” as they would like. It is therefore the purpose of this paper to provide some background on what constitutes a medieval (circa 650 – 1650 AD) European arrow and how arrows of sturdy construction can be made by almost anyone for around the cost of a set of ready-made modern arrows.

Part 1 - The medieval arrow

What did it look like? What was it made of? How big was it? These are not the easiest of questions to answer as there are no complete surviving medieval arrows. This is because arrows were made from lightweight, porous woods that would deteriorate rapidly when exposed to the environment. Of the few examples that survive, the Mary Rose arrows have only the shaft and a few points. The Westminster arrow (ca. 1440s) contains only the point and glue fragments. There

are, however hundreds of depictions of archers shooting arrows, from the 8th Century up to the 17th (see figs 1-5). These arrows by and large appear to be of a fairly uniform composition. They are all under a yard long (given by the average draw length of a typical archer of the day) and have three feathers fletched to the base of the arrow. The shape of the fletching varies but does fall into three primary shapes, delta, shield, and parabolic. The arrow was fit to the bowstring by means of a nock, or groove, cut into the base of the arrow. The points, many of which do survive, vary widely based, it is assumed, on their purpose.

As arrowheads are the most commonly surviving pieces of medieval arrows (tens of thousands were shot in the course of single battles), we’ll examine them first. The most commonly found point is the bodkin point (figs 6 & 7). A simple needle-shaped point that could penetrate most anything the medieval world had to offer.



Figure 1. Lid of an 8th C. Franks' casket in the British Museum (note the barbed broadheads and fletching design).



Figure 2. Archers in the Bayeux Tapestry (note the similarity of arrows to those in fig 1).



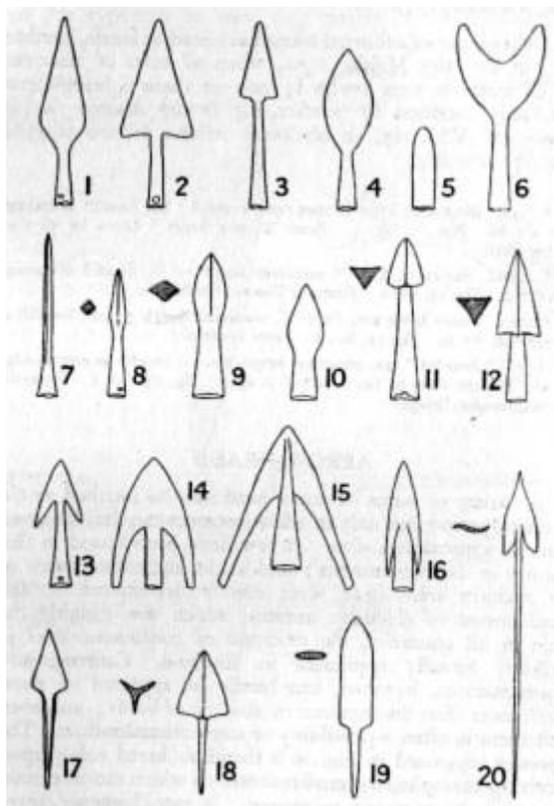
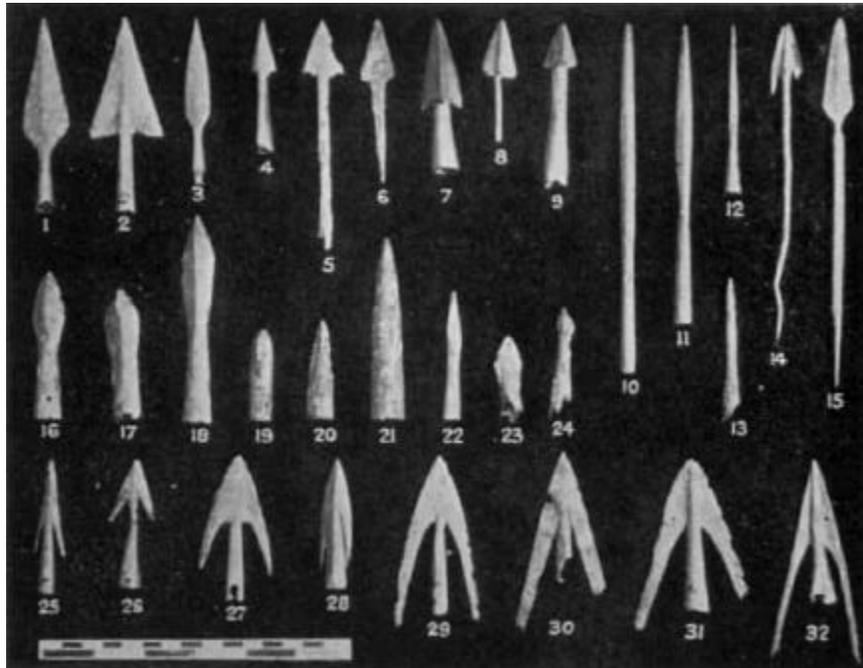
Figure 3. Archer in the 14th C. Lutrell Psalter. The arrows have parabolic fletching and target points. *British Museum*



Figure 4. Detailed depiction of a war arrow from Sippe's *Sebastian's Altar* (Wallraf Richarz Museum, Koln).



Figure 5. Soldier from the *Double Armed Man*, circa 1625.



Figures 6 & 7. A variety of medieval arrowheads from the Museum of London. The most common type depicted is the narrow broadhead (fig. 7) types 13 & 16, but the most commonly found is (fig 7) type 8 (bodkin point). The Mary Rose arrows had type 16 heads.

A common alternative was the broad head. The broad head could be leaf-shaped or barbed (fig 6 & 7). Barbs on arrowheads normally were rather short and could flare out or flare back, but could sometimes be forged out to several inches in length in a “swallow-tail” design. In addition, there are some more oddly shaped types that beg explanation. These include blunts, flat or bulbous shaped heads used primarily for target practice, small game or pelt hunting, and large crescent-shaped heads that experts theorize may have been intended for cutting ships’ rigging (but may also have been used to great effect in land battles). In general, points are not overly large. They tend to be between two and three inches total length, including the socket or tang. Most arrowheads used in England were of the socketed type, while arrowheads found on the continent are equally divided between tanged and socketed. Points, on average weighed around 14 grams (Hardy, 1992).

Although several medieval arrow shafts survive, we know relatively little about them. Most of what is known is derived from a few historical records and modern inference. In 1545 Roger Ascham wrote that the preferred wood for shafts was “asp” or aspen, but this most likely refers to any of the poplar species such as willow (Ascham, 1545). These trees grow quickly and can easily provide for the huge quantities of arrows. Medieval sources, Ascham included also refer to ash arrows, and, Ascham adds they are preferred to asp shafts for war “being both swifter and heavier.” The shaft found in Henry V’s Chantry Chapel in Westminster Abbey is most likely made out of ash, but the Mary Rose shafts are also in poplar (Hardy, 1992). Thus it is likely that when large arrow contracts were filled, any acceptable wood would do, because the idea behind the shaft was to deliver an arrowhead to the target without expecting it to be

recovered. Other woods that Ascham notes as being good for shafts include brazil, birch, oak, beech and elder.

The shaft was more or less a dowel, about an inch and a half beyond the drawlength of the archer. For mass produced arrows, such as those from the Mary Rose, it appears standard draw lengths of 28 and 30 inches were used (shafts 29.5 and 31.5 inches). The diameter of most, judging by the heads is between 1/2 inch and 3/8ths of an inch. The shafts recovered from the Mary Rose were estimated to have weights between 35 and 60 grams (suitable for bows from 70 to around 140 pounds respectively). The weight of the Westminster arrow was estimated to be roughly 35 grams (Hardy, 1992). The lighter weight shafts, not surprisingly, had smaller heads. Unlike most modern shafts, the most efficient shape of a war arrow was slightly tapered from point to nock. The Mary Rose arrows are both tapered (about 1/2 inch diam. at the tip to 3/8 inch at the nock) and parallel (Bartlett, 1999). The Westminster arrow tapers from 0.45 inches diameter to 0.33 inches at the nock. It is presumed that the taper would allow greater penetration due to the wide end entering the target first (Bartlett, 1999). In addition, the extra mass near the front of the arrow should help stabilize the arrow in flight and provide slightly greater energy transfer to the target. However, tapered arrows are more expensive to make, and so it is not unlikely that many medieval livery arrows were parallel shafted.

The nock is the notch at the base of the arrow shaft into which the bow string is positioned. Medieval images as well as surviving shafts all show the nock groove cut directly into the arrow. In many cases extra wood was left around the end of the shaft to support the energy transfer from the

string to the arrow (fig 3). In other instances, such as the Mary Rose arrows, a slit was made parallel to the grain and a two inch sliver of horn or bone was inserted (about 1/16" thick). The nock was then cut perpendicular to the insert about 1/4" deep and 1/8" wide (Bartlett, 1999). Alternatively, a hardwood dowel could be spliced to the base of the shaft and the nock cut into the harder wood. Because of the relative complexity of this method, it would probably have been reserved for more expensive target arrows.

Finally, the fletching. The fletching on the arrow is what, ultimately, makes an arrow look medieval (or not). Fletches were made of feathers (though it has been noted that parchment from looted books had been used to repair arrows in the field). The preferred feather was from the common (gray) goose, though in practice, the wing feathers from any larger bird would suffice. More expensive arrows often sported fletching from swan or peacock feathers. The feathers would be cut to shape prior to attaching them to the shaft. The predominant design of medieval fletching was a pointed triangular shape (fig. 4). This shape is the easiest for the fletcher to trim and hence are preferred when a large number of arrows must be produced. Parabolic shaped fletching is also seen in many contemporary illustrations as are delta or shield shapes (fig. 3). The fletching imprints left on surviving shafts are about 6 inches in length, but by measuring the length of arrows in illustrations and assuming a length of 30 inches, we can derive a fletch length anywhere between 5 and 10 inches. Again, using relative lengths, we can deduce the height of the fletching to be between one and three inches. Once the feathers had been trimmed to shape, they would be aligned with the nock and glued on with a 120 degree spacing between fletches. Because

the glue was not waterproof, it was generally necessary to wind fine silk or linen thread through the fletching to keep it tightly adhered to the shaft, about 5 turns per inch is documented. More glue would then have been spread over the thread. In western Europe, fletching would have been applied at least two inches from the nock to allow for finger room. Eastern European archers, who shot with a thumb ring, would require only about an inch of room. No medieval fletchings survive, but illustrations show that they often were fully or partially colored (Hardy, 1992). The *Hours of Catherine of Cleves* (ca. 1440; Pierpont Morgan Library) shows red and blue fletching. Most likely an off color fletch was used for the "nock" feather (the one perpendicular to the nock orientation) to aid the archer in quickly identifying the correct orientation of the arrow on the string. Barring that (most illustrations of war arrows show only white feathers), a mark may have been made, either on the shaft, or on the nock feather, to assist the archer.

One last item of note. To achieve the appearance of a medieval arrow, proper presentation is necessary. Most illustrations show medieval archers with their arrows stuck either in the ground in front of them, or stuck in their girdles, points forward. Some images do show archers with arrow bags slung over their shoulders, allowing them to draw arrows, point first, from under their shooting arm. Others show the arrows suspended from the belt in a small "quiver," open at both ends and not more than 6 or 7 inches long. Lastly, a small point guard pouch, made of leather or other stout material might have been suspended from the belt in order to protect the archer from the sharp points of the arrows stuck through his belt and to keep the arrows from becoming disorganized when the archer moved. There are a few examples of

quivers, as we know them today, in medieval illustrations, but they appear to be either early or late in the period. It is most plausible that quivers would have been used, as today, in hunting where arrows protruding from the belt may have restricted movement in a dense forest, or in war where mobility was needed. Surviving examples of quivers that parallel the modern leather side quiver first appear in a Tudor context (Hardy, 1992).

Part 2 - Constructing a medieval style arrow

Given the composition of medieval arrows in the previous section, it should be clear to the reader that although there are many options, the arrow itself is a relatively straightforward project once the components are selected. It is best if you make at least a dozen at a time. A medieval sheaf of arrows was 24, so two dozen will be most appropriate. Allow yourself at least a day per dozen if you are new at making arrows and are using ready made parts.

Step 1) The first item to consider is the shaft. Purists can find a willow, aspen, or ash tree and select a dozen branches of suitable thickness and straightness. First remove the bark and season the wood, then straighten and pare down the shaft to the right diameter by scraping and pulling the shaft through a series of holes in a block of wood. Finally, cut the shafts to the proper length. For the semi-purist, there are the dowels at your local hardware store. These are usually made of ramin-wood or white birch (and often sold as ash dowels). You'll need to select a dozen of the straightest, and try to get it so the grain runs parallel the entire length of the section you'll use for the shaft. You'll still need to run these through a straightening block before they are ready.

For about the same price or less, the rest of us can order a dozen ash or poplar shafts from a place like **Allegheny Mountain Arrowwoods*** (they cost about \$16/doz. parallel and \$24/doz. tapered). When you buy the shafts ready made, you can be more or less guaranteed of good straight shafts.

Step 2) Once you have your shafts, you should apply a clear sealant. It is likely that medieval fletchers waxed or oiled the shafts to preserve them in damp weather (this may also be one of the reasons the fletching glue didn't adhere particularly well). I recommend a couple of coats of linseed oil or beeswax. Shellac (Bulls Eye is a good choice) is a good alternative, but probably would not have been used on everyday arrows of the middle ages. Though not medieval, clear polyurethane works well too and allows the glue to adhere well.

Step 3) When the sealant has soaked in, hardened or dried, wipe down the shaft with fine steel wool, and then begin on the nocks. For light-weight arrows or arrows you don't intend to shoot frequently, an insert is not a necessity, but it is good insurance against the arrow being split by the string (and if you decide to include nock inserts read the next paragraph before this one). To make the nock, you will need a saw blade that is about 1/8th inch thick (you can tape together two or three hacksaw blades to achieve the desired width. Wrap the shaft with padding and place it in a vice with a few inches of the base of the shaft protruding upward. Draw a line down the center of the base, perpendicular to the grain of the shaft (and the insert) (fig. 8). Using the saw blades, gently cut down that line for about 1/4th of an inch. If you have a 1/8th inch file or drill bit, use it to round out the base of the slit you have just cut. Be careful not to splinter the shaft in the process. Use fine sand paper

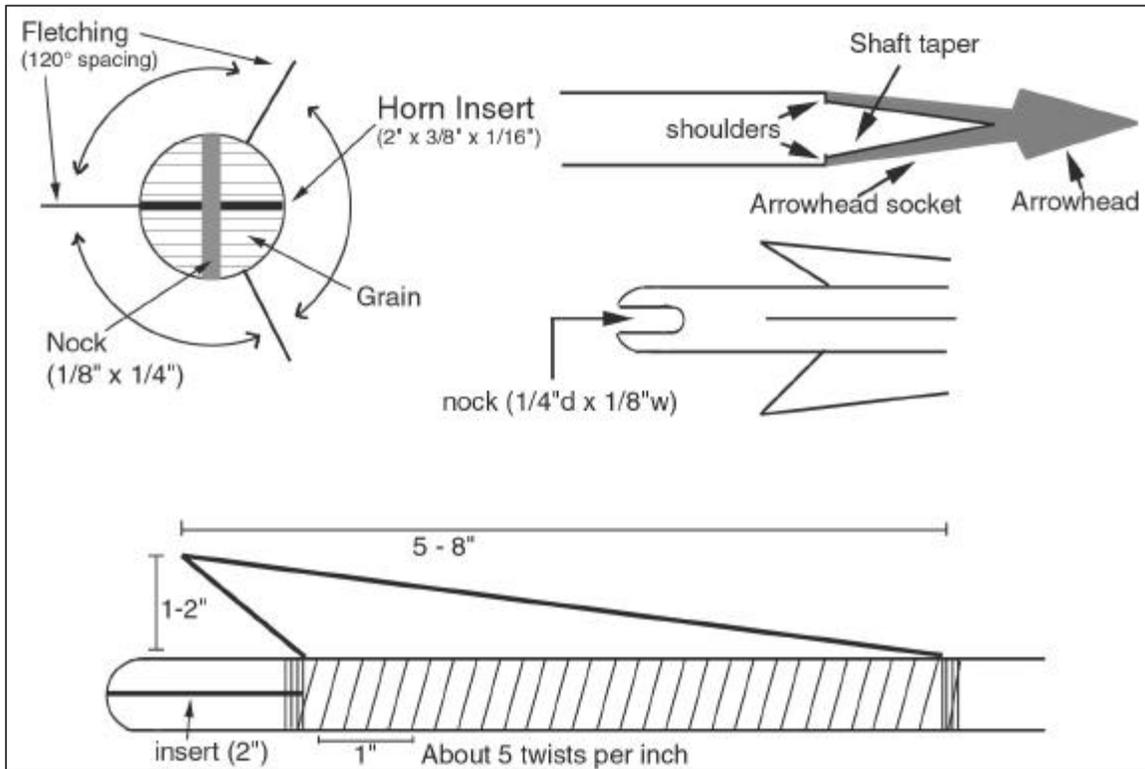


Figure 8. The basic design of a medieval arrow (adapted from Bartlett, 1999)

and steel wool to smooth the edges of the nock.

As I said before, nock inserts are good insurance. For the nock inserts, you can go with history and use bone or horn, or in their absence, use hard plastic (an old credit card can work wonders). You need to cut the insert down to a rectangular shape just a wee bit more than 3/8ths inch wide and two inches long (the ever so slight excess is so you can file it down to a gapless finish). The insert should be 1/16th inches thick. Once you have the insert prepared, you'll need a coping saw with a blade about 1/16th of an inch thick. Wrap the shaft in padding and clamp it in a vice with about three inches of the base of the shaft sticking out. Mark a line down the center of the base, parallel to the to the grain of the shaft, and make straight marks down the two sides of the shaft 2 inches long. Now, using only

gentle pressure, saw down this line until you have a 2 inch slit in the base of the arrow (fig. 8). Fit the insert in the slit to be sure it goes in all the way to the base of the cut without pressure (important so that the insert doesn't act as a splitting wedge later on). Extract it by pulling on the excess sides and coat the insert with a wood glue (I generally use Elmers). Insert the insert back into the slit and seat it against the base of the slit. Be sure the insert sticks out slightly on all sides. Wipe off any excess glue. When the glue has dried, take a small file or sandpaper (depending on how much excess you left) and remove the excess insert from the sides and base of the shaft. You are now ready to return to the previous paragraph and cut the nock.

Step 4) Now it is time to fletch the arrow. If you choose to go with parabolic, banana shaped (crescent), or shield shaped, you can

purchase these styles ready made from most traditional archery supply shops (Allegheny Mountain, Three Rivers, Kustom King, etc.).* To be as close as possible to medieval, choose the longest feathers available (but don't exceed the brace height of your bow). If you want to go with the triangular or delta fletch, there are two options. The first is to purchase shield shaped feathers and cut away the flare in the back of the arrow with an Exacto knife or sharp scissors (just cut the spine of the feather and the vanes will cut away with it. Alternatively, you can purchase full feathers and trim them yourself. Feathers in general, cut or uncut, cost around \$3 to \$5 per dozen. You'll need three dozen. Unless you are using a helical fletching jig, the choice of left versus right wing doesn't matter. You do want to make sure all your feathers are of the same wing.

If you've decided on full feathers to cut to size, you need to make a template out of moderate weight, non-corrugated cardboard (in fact, two work best). Once you have cut your template(s), lay them along the spine of the feather (where the vanes are attached) and secure them with one of those potato chip bag sealing clamps or a tiny binder clip (whatever works best for you without crushing the vanes). Make sure to get the fletching from the middle of the feather where the vanes are strongest, not the ends. Now, you can either trim the vanes with the template in place, or use a marker to draw the outline of the template (if you do this, make the outline about 1/4" larger than the template so you can cut away the marking entirely – cut 1/4 inch inside the line).

To trim the feather (with or without the template in place), use either a very sharp scissors or a flat bladed Exacto knife (I prefer the knife). If using a knife lay the feather on a cutting mat and secure it with

your fingers. If using a scissors, hold the feather securely in one hand and cut with the other. Start at the back of the feather and cut away the excess spine. Then work your way up the back and over the top, working your way to the front. With the knife, just press down on the vanes to cut. Because we are working against the direction of the vanes, the scissors will slightly raise the vanes before they cut them (as opposed to pushing them down). Slowly work your way to the front of the design until you cut through the feather's spine at the tip. Repeat this 3 times and you are ready to fletch your arrow.

Step 5) The easiest way to fletch an arrow is with a fletching jig. These can be purchased at most archery stores and cost between \$10 and \$100. Substitute the instructions from the fletching jig for this paragraph if you are going to use a store bought jig. If you have a slat of wood about 1/4 inch thick by perhaps an inch wide and that 1/16th inch coping saw blade from the nocking, you can make your own jig. Cut the wood to about 8 inches in length. Draw a line about 1/2 inch less than the length of your fletches down the middle of the board. Next, drill a 1/8 inch pilot hole at each end of the line. Now insert the coping saw blade through one pilot hole and saw to the other pilot hole along the line. Smooth out the sawn area and wrap some sand paper around a 3/8 inch dowel. Use the dowel as a sanding block to sand a slight groove in the wood on top of the sawn line. This will be where the arrow is seated. Finally, mark a line up both sides at the point of one end of the sawn line and a line up the back of the jig marking the center. Voilà, the jig is ready.

Step 6) Using a light pencil, take your shaft and mark a circle about two inches down from the base (1.5 inches with non-triangular styles). Make sure the mark

completely circles the shaft. Now place a mark at a point on that line that is perpendicular to the nock's orientation. This is where your nock feather will go (use another color feather or mark it in some way). Using a protractor or other angle guide (you may want to draw one the diameter of the shaft on a paper template), make two more marks each 120 degrees from the nock feather mark. Your shaft is ready for the feathers (see fig. 8).

Starting with the back of the feather, thread it, top first, into the underside of the jig (the side with the slight groove in it). Push the feather upward and backward into the jig until the spine seats flush with the bottom of the jig. Next apply a slight bead of glue. I have tried all sorts of glue and recommend Elmers school or wood glue as being the easiest to use and the one that adheres best to wood. Let the glue set for about a half minute or so to get a bit tacky, then place the shaft in the groove on the jig so that the feather matches up with one of the marks you made on the shaft. The lines on the side of the jig should correspond to the two inch line you drew around the shaft and the center line of the jig should match the feather mark you made on the shaft. Hold the jig in position for about 5 minutes (strong rubber bands may work here). After you feel the glue has dried sufficiently, slowly pull the jig up off the shaft starting at the front. The feather should remain on the shaft. Repeat this procedure for the other two feathers.

Step 7) Now that the feathers are glued in place, you'll want to wrap them (after all, this is how they really get that medieval look). The medieval fletcher most likely used either linen or silk thread because of their strength while being very thin. Both are available today in most fabric stores (unwaxed linen thread is slightly harder to

find). A modern alternative is either upholstery thread or (as I often have used), unwaxed dental floss (the stuff is indestructible). Whatever you use, don't cut the string from the thread until you have finished wrapping. Start at the tip of the feathers and secure the thread with a simple locking wrap (where the end of the thread is woven over and under subsequent wraps). Make about 5 wraps with the thread and place a finger over the wraps to keep them from moving. Keeping the thread taut, start inserting it from the top of the feather down the vanes. With each feather you should position the thread four or five vanes higher. As you continue, you'll notice a spiral developing (fig. 8). If the section of spiral you just laid down doesn't look right relative to the previous ones, no worries. Simply lift the thread out of the feather and move up or down a vane or two until it lays properly. Continue until you reach the end of the feathers. At the back of the feathers, wrap the shaft two or three times, then, holding those wraps in place with one finger, make two more loose wraps around the shaft and over your fingernail. On the third and final wrap, set down the spool and cut the thread to leave you about 6 extra inches. Feed those extra inches underneath the two loose wraps and pull tight. Use your fingernail to line up the wraps on either end of the feathers and trim the excess thread.

To secure the thread, medieval fletchers coated the threads with a glue. You should do the same. I have had great success with the brush on model cement made by *Testors*. It is very watery and soaks into the thread. Using this method, I have never had a feather come loose and if I need to replace them it is some effort to cut the thread away.

Step 8) The next-to-final step is to add the points. If target archery is your goal, simple target points or blunts are not far from their

medieval counterparts. You can purchase these points at most archery stores, be sure to get ones that will fit your diameter shaft and arrow weight. If you want something more medieval, there are several individuals that sell hand forged reproductions of medieval arrowheads. By far the best I have seen are offered by **Historic Enterprises**.^{*} They offer a variety, including broadheads and swallowtails. Their bodkin points are excellent and are relatively inexpensive for what they are (\$45-\$50/doz.). They are designed for a 3/8" diameter shaft and so may stick out slightly around the shaft. This can be fixed by filing the socket down until the proper diameter is obtained (usually very little must be shaved). If you have a forge, you can make your own socketed bodkins relatively easily.^{**} Because of the impact of the point on most targets, I would not recommend tanged arrowheads as after a few shots hitting the hard sides of the target, they tend to split the shaft.

To attach the points you need to shape the tip of the shaft to a cone shape. An old pencil sharpener with a large enough mouth works very well. If you don't have one of those, you can whittle and sand the tip to an appropriate shape (it will be right when the point slips on easily and to the base of the cone. If you made the cone too narrow, the point will wiggle and cover the entire cone. Fix this by cutting a bit of the cone off. If the taper is too shallow, the shaft won't fit all the way into the socket. Ideally, the cone will go **almost** all the way into the socket. If you flatten out the cone near the base to create slight "shoulders" on the shaft (fig), the socket should butt up flush against those shoulders and not wiggle around. The best way, however, to get an accurate taper is to invest a few dollars in a good taper tool (cheap ones cost around \$7, and the excellent *Tru-taper* tool costs around \$25).

This will give you a perfect taper every time.

When the point is set on the shaft, look down the length of the arrow from the back to be sure the point is sitting straight. Adjust the tip taper accordingly. When the point is straight and not loose, it is time to glue it in place. For this I recommend *Ferr-L-Tite* cement. To use this cement, heat the stick under a lighter or candle until it starts to grow soft, then while it is soft, smear it around the tip of the taper. It will quickly solidify, but don't worry, just keep resoftening the stick (not the stuff already on the shaft) and applying more until you have coated the taper on the shaft. Next, hold the point in a pair of pliers (wear heavy gloves) and heat the point over a gas flame (a candle will work but leaves messy carbon residue on the point). With the hot point still in the pliers, hold tight and push the point down on the taper. The heat of the point will remelt the glue and attach the point. If you need to adjust the point while still hot, use a cold wet towel and don't hold the point for long. Set the arrow down and let the point cool. The glue will reharden and a knife or lighter can be used with quick strokes to remove the excess glue around the point.

Step 9) The final step is finishing the arrow, that is, erase any pencil marks still on the shaft, wipe down the point with fine steel wool and then a rubbing with oil, use a sanding block to round the base of the shaft to a hemispherical shape (or just round the edges), stroke the fletches to seat the threads and then sit back to admire your work.

Step 10) Take it to the archery range, let all your friends drool over your arrows, and then shoot them with pride. Now about that bow ...

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* **Supplies (please frequent these places so they stay in business for many years to come)**

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About the author: Karsten von Meissen lives at the turn of the century (the 15th Century that is) in Norfolk, England. He is a retained archer captain in the household of Sir Thomas Erpyngham. Karsten Shein is a graduate student at Michigan State University and writer for Professional Pilot magazine. He has been building his own archery equipment for about 10 years.