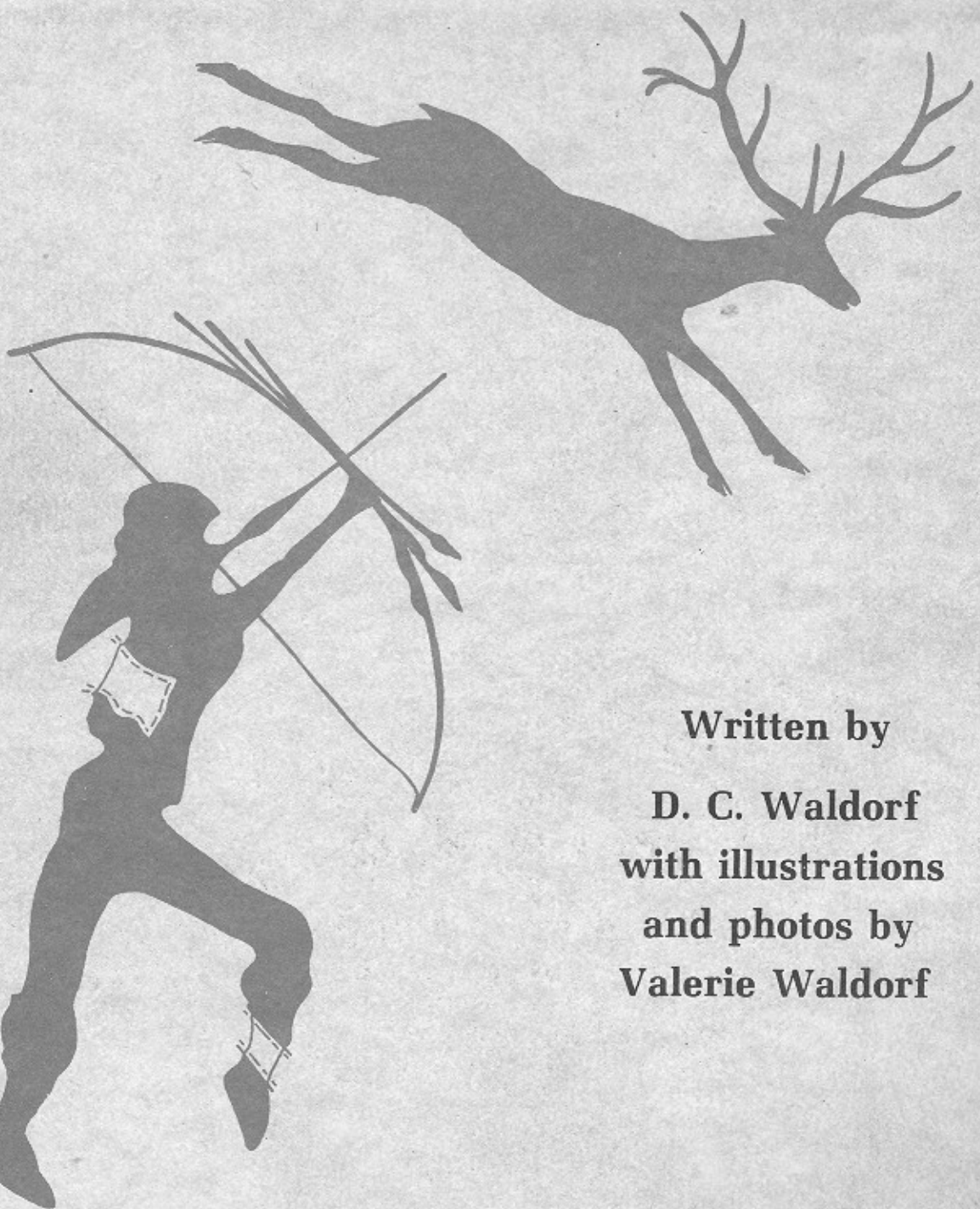
THE ART OF MAKING PRIMITIVE BOWS AND ARROWS



Written by

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TABLE OF CONTENTS

INTRODUCTION

Some time ago my Father gave me a shoe box full of papers and pictures, these things he had found while cleaning house. The papers were mostly report cards and those old childhood photos were even less inspiring, save one. It was a little boy wearing a cowboy hat, with a toy sword at his side and a bow and arrow in his hands. This was the author at 7 or 8 years old and the recent photo of me with a short, powerful Plains bow further documents a life-long interest in the history of weapons and archery. The boy never grew up, he just got bigger. At the age of 10 I made my first bow consisting of strips of split bamboo lashed together with kite string, a sort of crude lamination. Its cast was about 90 yards when the wind was blowing in the right direction. I made my first Osage bow when I was about 16 and the aquisition of a .22 rifle soon put it in the closet, but only temporarily. As my interest in flint knapping grew I began to make arrows tipped with flint points. These I sold at archeological society meetings and black powder shoots, and it wasn't long before I was making bows and quivers to go along with them. In the last 10 years we have probably made over 50 outfits, some of them quite elaborate and costly. My wife is good at sewing and beading and she did most of the work on the quivers while I made the bows and the arrows. Much of what we have learned from our past experiences has gone into this book, which is filled with practical knowledge gained mostly by trial and error.

Because this book is about making serviceable archery tackle, it contains little about history or ethnology. If you are interested in what kind of bow or arrow was used by a particular group of people, you will have to look at some of the other books written about this subject, some of which are listed in the bibliography. However, most of them will not provide accurate step-by-step instructions on how to make your own equipment. Some of the designs for bows, arrows, and quivers are not authentic (American Indian) while others are, the ones shown in this book are the best and most practical. The tools and techniques for making these can be applied to other designs that the reader may wish to replicate. Also in this book youwill find short cuts and modern substitutes for certain raw materials, it is up to you whether you wish to use them or not. The ancients would have used power tools and waxed nylon if they had had them. However, there is such a thing as going too far.

The advent of the compound bow has dealt a cruel blow to traditional archery and to some, using a "bow with training wheels" is a sacrilegious act. To me, shooting a beautiful Plains bow that has had its back covered with sinew and rattlesnake skin or mastering the power of a yew longbow stirs ancient memories in a primitive soul. I am not an Indian, but archery is as much a part of early Europe as well as the Americas. One only has to look at the 5000 year old Levantine rock paintings, one of which has been reproduced on the cover, to realize how much a part of our heritage archery is. If this book serves to return only a few to the way of the traditional archer, then it will have been worth the writing.

The author at an early age.

The author as he is today. He never grew up, he just got bigger.

I. TOOLS AND WOOD FOR BOW MAKING

No matter what kind of bow you plan to make, you must acquire the proper tools. If you are a purist then the tools you will need will be those that were used by prehistoric Man. A primitive tool kit for bow making would include an axe with a head made of pecked and polished granite or a chipped flint one with a ground and polished bit. A square-section, Danish flint axe would be my choice for an axe. To this I would add an adze of Danish type, several flake knives made from heavy blades struck from a core, wood or antler wedges, a heavy wooden maul and some rough, flat stones such as sandstone or pumice. The axe which is used to cut down the tree can also be used to rough out the stave after it has been split from the log with the wedges and maul. The adze is used for finer work and the flake knives and sandstones are used for the final finish.

In order to make and then use the stone tools I have just described, one must be a flint knapper of considerable experience. Even though these tools are the most efficient of their type, they are not handled in the same manner as those of steel or bronze. For instance, the Danish axe will cut wood almost as fast as a modern steel axe and hold its edge much longer. However, it can be quickly damaged if it is not used with the proper stroke and cutting angle.

If you're not into flint knapping you might consider the tools used by the Iron Age White Man and the Plains Indians. These same tools can still be found at your local hardware store or in the Sears Tool Catalog. An axe or hatchet, a sledge hammer and wedges, a good, sharp sheath knife or large pocket knife, a small saw, a wood rasp and some sandpaper are all that's needed to make a bow or two.

I have a fully equipped shop and my bow making tools include a chain saw, a draw knife and spoke shave as well as a band saw, belt sander, and a vise mounted on my work bench which holds the stave while I'm working on it. With these modern tools I have cut down the time it takes to make a self bow from a week or more to a mere five hours. If you are interested in making more than a couple of bows, I suggest that you get a draw knife and a spoke shave, or at least a draw knife. Frankly, I love these tools and I would be lost without them, they make the work that much easier. Anyway, once your bow is sanded and finished and all the original tool marks are gone, who is going to know how long it took you or what tools you used to do the job? What you are after is a bow that looks good, shoots good, and above all, is safe.

Osage orange, hickory, common locust, Pacific yew, ash, Eastern red cedar, Rocky Mountain juniper, white oak as well as some others, were the woods used by the North American Indians for making bows. Below, these trees are listed along with their botanical names and in order of desirability. The ones at the top are the best, being hard yet flexible and having a high resistance to string follow. The ones toward the bottom are softer or more brittle or have more of a tendency to follow the string. (A bow follows the string when it stays slightly bent after being unstrung.) The lesser grade woods should be sinew backed and all bows under 50 inches should be backed or lined for safety sake. For further help in identifying these trees you may wish to consult one of the many tree identification guides available at the library or at a bookstore.

OSAGE ORANGE — *Maclura pomifera*
COMMON LOCUST — *Robinia pseudoacacia*
PACIFIC YEW — *Taxus brevifolia*
PIGNUT HICKORY — *Carya (Hicoria) glabra*
WHITE ASH — *Fraxinus americana*
WHITE OAK — *Quercus alba*
EASTERN RED CEDAR — *Juniperus virginiana*
ROCKY MT. JUNIPER — *Juniperus scopularium*

Of all the bow woods I have worked, outside of the more exotic tropical types, Osage orange is my favorite and the Indians preferred it as well. Legend has it that this tree was named after the Osage Indians who used it for their bows, and for the yellow-orange color of its wood. Fortunately for me, I live in Southwestern Missouri in what was Osage territory and also the original center of this tree's distribution. Here in the Ozark Hills it is known as "bow dark", which is a corruption of "bois d' arc", French for "wood for the bows". Other popular names are hedge or hedge apple. Because Osage made such a good natural fence its distribution was greatly expanded by farmers and ranchers before barbed wire came into general use. It is now found over much of the Eastern U.S. as well as the Central and Southern Plains. Even after wire fencing was invented this tree was still handy for posts because its wood was so rot resistant. Hedge apple not only refers to the tree but has something to say about its fruit, which is green in color, has wrinkled skin, and is about the size of a softball. The easiest way to locate an Osage tree is to wait until fall when the fruit has ripened. In fact, these green balls will remain on the tree for some time after the leaves have fallen and this makes it easy to spot in early winter.

Osage trees can be found growing in open country or near the bank of a small stream as well as in hedge rows. The river bottom trees are the ones I prefer because they are straighter, the growth rings are larger and easier to follow with the draw knife and they have fewer knots because the small, dead branches on the trunk may be pruned by flooding. Those that grow on bald knobs or open prairies often have twisted grain in their trunks, this is caused by constant or uneven wind pressure on the tree's branches which forces it to grow in a spiral. Because they grow in a drier environment, trees on high ground will have more growth rings per inch, this might make a stiffer bow if you can overcome the twist in the longitudinal grain.

If you can't find an Osage tree that someone will let you cut, you might look for some old fence posts or some new ones. Sometimes a farm supply store will have Osage, or more often, locust posts for sale. Also, locust trees are more common than Osage. On a recent trip through Illinois, Indiana, and Ohio, I saw hundreds of them growing in brushy, second growth woods in between the fields. One must be aware that there are two kinds of locust, one that grows larger and has small thorns on the branches at the base of each leaf, and one that is armed with huge three inch thorns all over the trunk and branches. The common locust (Robinia pseudoacacia) has small thorns and this is the one you want because its wood is hard, dense and flexible like that of Osage. In fact it may be to your advantage to use locust because it is straighter of grain with fewer knots and will produce larger staves for longbows.

Ash and hickory are not as good as Osage and locust, I would consider them as a second choice. For those who live on the West Coast, Pacific yew may be a possibility, although difficult to obtain. This rare, slow growing conifer may now be protected in some areas. The yew staves I have were cut 25 years ago and I was very lucky to get them. Though soft like pine, this wood is not as easy to work as one might think. The growth rings average 40 to the inch, so one has to consider that he may be cutting a tree that took 200 to 300 years to grow, just for an old stick bow that, with care, may last 10 years.

If all else fails or you don't want to mess around cutting your own wood, which is followed by a period of a year or so while you wait for it to season, then you might want to buy a stave or two. Hickory and locust staves are available as well as the more exotic woods like purpleheart and goncalo alves. In the back of this book you will find listed a company that specializes in rare woods. Here you will also find sources for other things mentioned in this volume.

If you are lucky enough to find a dead standing tree or an old post that is well seasoned and has not been damaged by insects or rot, a bow can be made from these immediately. However, a freshly cut log will have to be air dried for a minimum of six months before a bow can be made from it. I have made bows from wood that was seasoned for as little as a year to as long as 25 years. Osage that is 10 or 12 years old is the very best, yew that has seasoned 3 to 7 years is good (Pope 1923:56). Some woods, like hickory, ash and cedar may become brittle with too much drying. Also, do not use kiln dried wood, it is no good for bows. Care in selecting and seasoning your wood will result in a safe but lively bow with superior cast (speed and range) and less of a tendency to follow the string.

The straightest trees and posts that are at least 6 inches in diameter should be selected, those that are under 5 feet will make Plains bows, those 5 to 6 feet will make Eastern Woodland bows and longbows. Theoretically, a 6 inch diameter log should yield four staves when quartered. As soon as they are cut, coat the ends of the log with paraffin to keep them from drying out too fast. This prevents unwanted splitting and checking of the end grain.

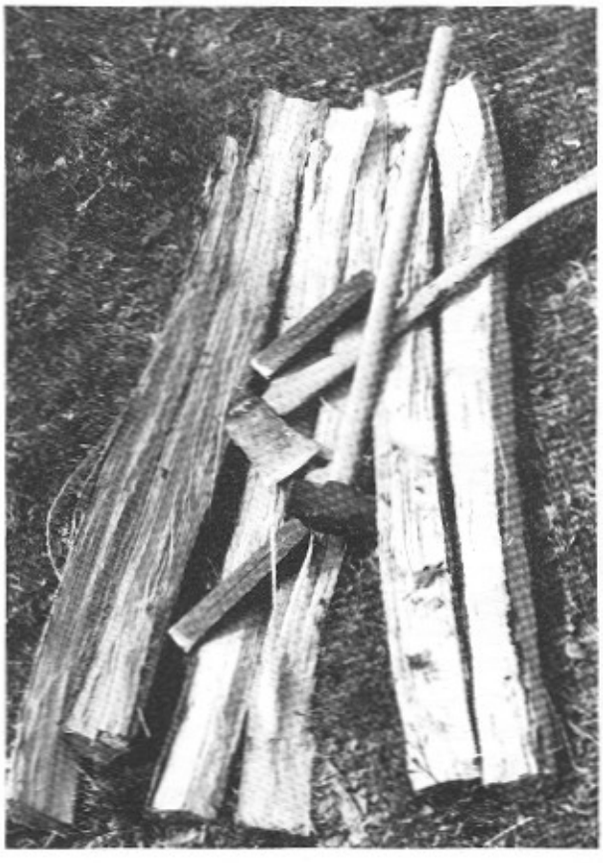
At this stage, there are two ways you can go. The Plains Indian split his log into staves immediately after cutting. The tree was usually felled in the winter when the sap was down, (this is always a good time, no matter which way you choose). Next, the staves were worked down into half finished bows and greased well with bear fat or tallow and hung up in the top of the lodge near the smoke hole. (In a hot attic or hanging from the ceiling above your wood stove or furnace would be a good substitute). Here it was cured in the rising heat and smoke for six months, after which it was finished, de-greased and the back lined with sinew. Because they were most often backed with sinew, these fast cured bows usually worked well and followed the string very little. In fact, many of them became reflexed (reversed when unstrung) because the sinew shrank as it dried. This of course, added considerably to the speed and power of the bow.

For all my bows, especially the larger woodland and English types, I prefer a longer curing time in which the log is dried for at least six months in a cool, dry place. Then it can be split into staves and dried another six months to a year in a hotter environment. Even though the ends of your log are covered with paraffin, one or two cracks will open up. These will follow the lateral grain of the wood and it is these cracks you should exploit to the fullest because the log is telling you where it wants to be split. If you use the largest and deepest of these, your log will almost always split perfectly.

The author with an Osage log and sledge hammer.

Splitting log following a natural crack.

It usually takes two wedges to split a log.



This log split into six staves, four of which made bows.

II. MAKING THE SIMPLE SELF BOW

A self bow or stick bow is made from a single piece of wood and next to the atl-atl is one of Man's oldest projectile weapons. A self bow has no laminations or sinew backing, however, it may be made of two pieces of wood joined at the handle by a splice when good, clear staves of suitable length cannot be found. In this chapter I will show you how to make a self bow from an Osage orange stave. Here we are going to concentrate on the basics while the next chapter will cover various bow designs with details pertaining to them.

The photographs that accompany this section show the making of two bows of the same design. They are both Plains Indian bows of rectangular cross-section with a recessed grip and recurved tips. The first stave presented a problem and had to be shortened by six inches, the second stave went without a hitch and made a beautiful 52 inch bow. Because the first was cut to 46 inches and also had a longitudinal crack in the tip below one nock, it was decided to leave this bow unfinished and use it to illustrate the section on sinew backing. I could have re-shot this sequence using another piece of wood, but the reader would not have had the benefit of seeing a problem and its solution. With Osage, such troubles are the rule, not the exception.

Most of my Osage staves run between 4 and 5½ feet in length, are triangular in cross-section with the bark still clinging to one side. This bark side will become the back of the bow and is 1½ to 3 inches wide. (The back of the bow is the side that faces away from the shooter, the belly is the side the shooter sees when he draws the bow.) The length and width of your stave and the placement of knots and flaws in it will be the determining factors when it comes time to decide what kind of bow you want to make, but first the bark must be removed.

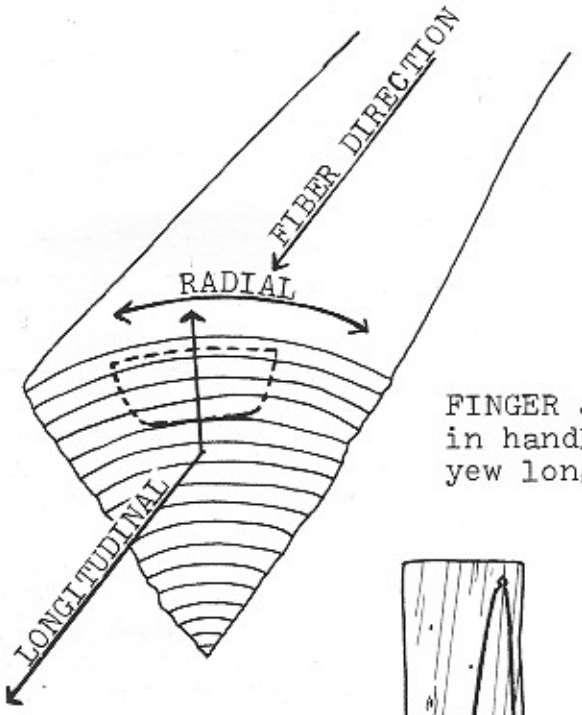
Place the stave in your vise and strip off the bark with the draw knife or rest one end on the ground and carefully hue off the bark with your axe or hatchet. If the tree was cut when the sap was down and has been drying for a year the bark should come off quite easily. If your stave is too wide to fit in the vise or it has sharp edges then it may be necessary to trim and flatten the side a bit so the vise will hold it more firmly. I have a problem with my old vise in that I have to really tighten up in order to keep the stave level. To prevent this teeter-tottering I have a rope fastened to the leg of another bench not far from the vise. This rope I loop over the opposite end of the stave, thus stabilizing it. This way I don't have to squeeze the wood so hard that it is damaged. Really, a woodworking vise should be used instead of a common metal vise.

Now that the bark is gone you can study the "longitudinal grain" (fiber direction) and look for flaws. The longitudinal grain will be represented by fine striations or pin stripes running parallel to one another along the length of the stave. These striations will flow around large knots, bumps, and undulations in the wood. The plan for your bow must be laid out running along this grain and missing most of the major knots and other flaws. Another thing, and perhaps the most important, is the back of the bow when finished must not have "cross-grain" in it. You cut across the grain when you cut through growth rings. When in between growth rings, following the "radial grain", your tool will cut smoothly, when cutting through a ring the tool will scrape and chatter a bit and a darker colored, rough area will be readily visible. This is the boundary between two layers of growth and you have to chase these boundaries off your stave in order to bring the back into one single ring.

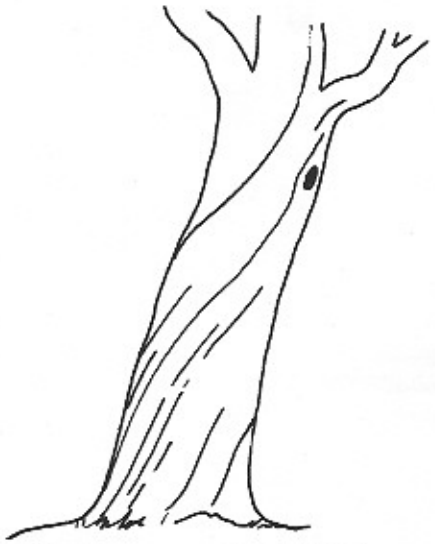
If the longitudinal grain runs straight and there are no major knots then you can continue to whittle away the white sap wood until you get down to the harder, darker heart wood. I usually work through only one or two growth rings after removing the sap wood, however, if a problem arises, such as splits in the grain due to drying, worm holes or other blemishes, then I may have to go deeper. Sometimes the stave is so badly flawed that there is nothing I can do with it. About 25% of the staves split out end up on the woodpile. An amateur just starting out should figure half of his staves will make bows and half of these will be good ones.

With all the heavy work done on the back of your bow it is now time to lay out the plan. First a line is struck down the center of your stave following the longitudinal grain. If your stave has a large knot or two your plan may have to be laid out off center in order to miss them or if the tree was twisted it may have to be laid out diagonally. After the center line is drawn, a halfway point is found on it and another line is drawn across it at a right angle, this marks the exact center of your bow. Now, two more horizontal lines are drawn, one 2 inches below the center and one 2 inches above, these delineate the handle or grip area. (If you have big hands you might want to expand this a bit by adding a half inch or so.) Using these lines as a beginning, you can lay out any one of the designs shown in this book that will fit on your stave.

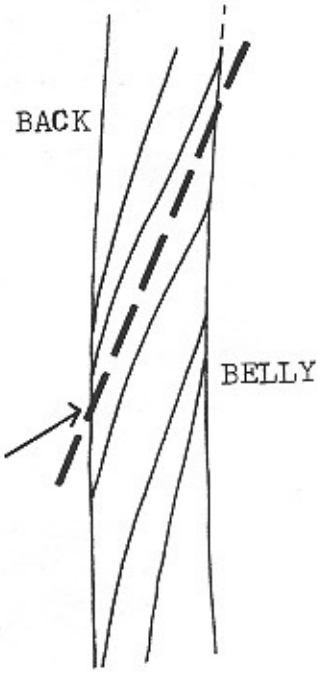
The next step is the removal of all the excess wood off the sides right up to within 1/8 of an inch or so of the outline of your chosen design. In order to easily reach the sides you will have to turn the



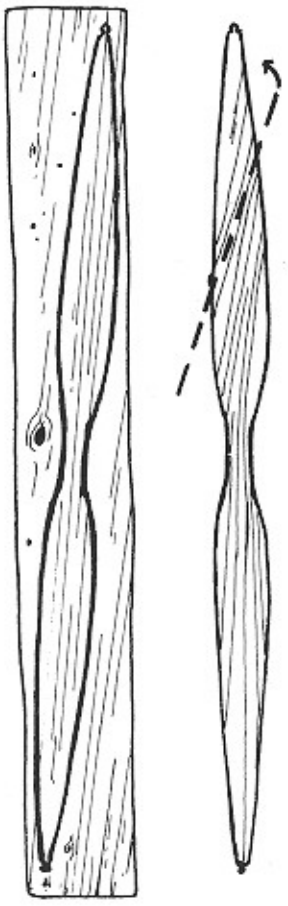
FINGER JOINT in handle of yew longbow.



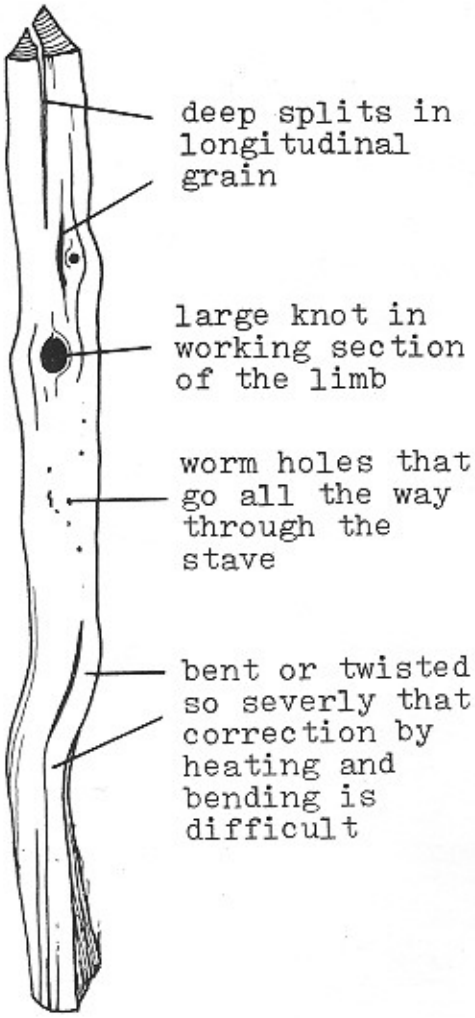
A high ground Osage. Note the spiral growth of longitudinal grain.



A cross-grained bow or arrow shaft will break along the dotted line.



A bow not made parallel to the longitudinal grain, even though true to the radial grain, may break by twisting.



CAUSES FOR REJECTION

stave on its side in the vise so the jaws come together on the back and belly. If the belly side comes to a sharp edge it will have to be flattened to allow for a better hold. You can safely remove all of the excess wood down to within a quarter of an inch of the finished thickness of the handle. If you have a band saw you can cut the belly down so the stave lays level and saw out the bow blank, still leaving 1/8 inch on the sides for finishing.

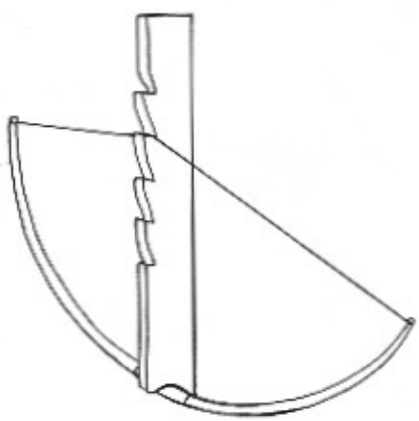
From now on careful and accurate work with the draw knife will be required. This tool will remove a lot of wood fast; you can actually cut the limb off a bow if the knife is pulled into the wood at the wrong angle. If you have never used this tool before, you should practice on a scrap piece, taking careful note of how it follows the grain or cuts through it as you vary the angle of the blade and the power and length of the stroke.

The spoke shave is a safer tool to use, because like its cousin the plane, it will only remove wood in the form of thin shavings. It will take many strokes with this tool to equal what can be done in one stroke of the draw knife. Usually I use the spoke shave for work in areas where the grain may be rough or curly. These areas are to be found around small knots and at the tips of the limbs where the grain feathers out. I also use it for some finishing just before sanding, it helps to smooth out the tool marks left by the draw knife.

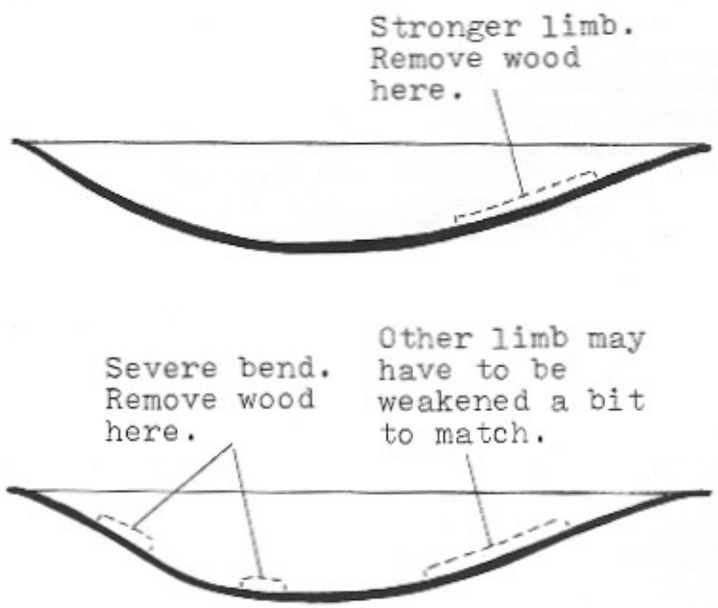
Now comes the hard part, finishing the belly. In this stage the limbs are tapered and tillered and the handle or riser is formed. First a line is drawn down both sides, this delineates the handle and the thickness of the limbs with 1/4 inch to spare for finishing. Where this line is drawn will be determined by the design you have chosen, the weight (pull) you desire, and by any flaws or undulations in the grain. After the lines have been drawn the blank is placed back in the vise, belly up, and the excess wood is carefully removed down to these lines with the draw knife and spoke shave.

Before a bow can be tillered, notches for the bow string must be cut into the sides of the bow near the ends of the limbs. In doing this I first cut slots about 3/16 inch deep and ½ inch down from the tips using a hacksaw. This is followed by widening and shaping with a jack-knife and small, rat-tail file. For tillering and testing I string the bow with a special string I call a "tillering string", one size fits all. For more on making strings and stringing your bow properly, see the chapter on strings.

"Tillering" is the act of bringing a bow into balance, that is, making the bow bend in an even arc with both limbs being equal in strength. The word tiller is derived from the devise that is used to hold the bow at different draw lengths so it can be examined. This tool looks like the tiller on a sailboat rudder, perhaps this is where the name actually originated. In *Hunting with the Bow and Arrow*, Pope has given us a perfect description of the tiller and how it is used. "The tiller is a piece of board three feet long, two inches wide and one inch thick, having a V-shaped notch at the lower end to fit on the handle and small notches on its side two inches apart for a distance of twenty-eight inches. These are to hold the string.



TILLERING DEVISE
IN USE



Lay the braced bow on the floor, place the end of the tiller on the handle while you steady the tiller upright. Then put your foot on the bow next to the tiller and draw the string up until it slips in the first notch, say twelve inches from the handle. If the curve of the bow is fairly symetrical, draw the string a few inches more. If again it describes a perfect arc, raise the string still farther. A perfect arc for a bow should be a trifle flat at the center. If on the other hand, one limb or a part of it does not bend as it should, this must be reduced carefully by shaving it for a space of several inches over the spot and the bow tested again.

Proceeding very cautiously, at the same time not keeping the bow drawn more than a second or two at a time, you ultimately get the two limbs so that they bend nearly the same and the general distribution of the curve is equal throughout.

As a matter of fact, a great deal of experience is needed here. By marking a correct form on the floor with chalk, a novice may fit his bow to his outline." (Pope 1923: 61,62).

As Dr. Pope said, tillering requires some experience and should be done cautiously. Here are a few things that I have learned that I wish to pass along. These tips, if followed, might save you some grief. When the bow is first strung and a severe bend appears, it should be unstrung immediately. A severe bend is found at the weakest spot on the limb, this place will bend more than the rest of the bow and it usually occurs just below the half way point between the handle and the tip. To correct this, more wood should be scraped off the limb above the bend and towards the tip. This will make more of the limb bend, thus taking the presure off of that spot. (In some cases it may be necessary to remove some wood off the section below the bend and towards the handle as well.) If this condition is not corrected and the bow is drawn, even slightly, the wood cells on the belly will collapse. If the bow does not break, there will always be a weak spot at this point. If one limb bends nicely and the other stays straight, it is the straight limb that is the stronger and it is the one that should be tillered to match the other. When tillering, try to remove as little wood as possible, in some cases it only takes a few passes with the spoke shave or file. Over tillering will weaken your bow. On the other hand, if the bow is fully tillered but too strong, shoot it for a while, if you can, and break it in. If it's still too strong, then more wood should be removed evenly along the limbs and the bow re-tillered if necessary.

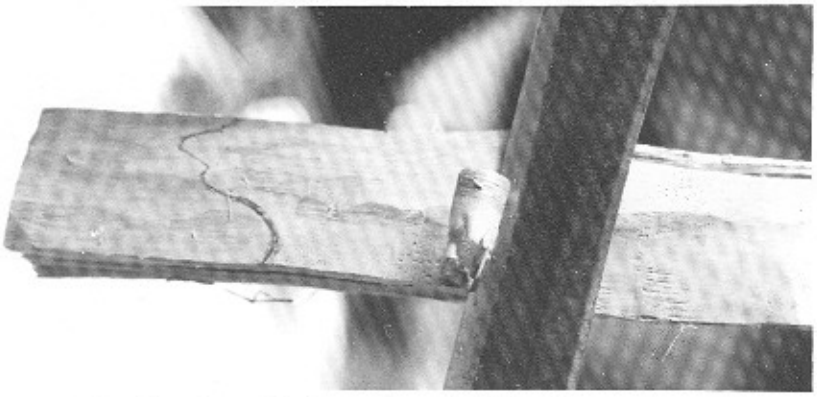
The handle section makes up about 20 to 25% of the bow's total length and it should be stiff enough that it does not bend. The working or bending portion of the bow takes up to 50 to 70% of the bow's length, depending upon the design, this percentage being divided almost equally between the upper and lower limbs. On a recurve bow the recurved tips are stiff and they bend very little. Because they take up almost 30%, the working curves are shortened, therefore the bow will be stronger and the tips will act like levers, adding additional speed to the bow's cast. A longer bow without recurved tips will have more working curve and will be slower. Bows that have short working curves should be made of the best wood with no knots or flaws in their working parts. A small knot in the handle or close to the tips can be tolerated if it goes straight through from back to belly and does not displace too much of the longitudinal grain. These percentages of working as opposed to static portions of your bow should always be kept in mind while tillering and while heating and bending recurves and reflexes.

If the limbs are to be bent by heating, depending upon the circumstances, this may be done before, during, or after tillering. If the bow is a short Plains bow I will bend the tips before tillering because I know that the stresses in the limbs will be changed and the bow may have to be re-tillered. A longer bow can be recurved any time after tillering because I bend only the last three or four inches; this does not effect the limbs enough that they have to be readjusted. Occasionally I get a blank which has a limb bent to the side or one that has one limb leaning toward the shooter and the other away. These conditions I can correct by bending them into proper alignment before tillering. Also, a reflex can be set into the bow using this method.

For me, heating and bending is a simple operation. All I have to do is wet down the area I am going to bend so the flame from my gas stove won't scorch the wood, then I heat it by waving it slowly back and forth above the fire. When the bow is just hot enough that I can't hold onto it I put it in my bending jig, (see photo), tie it up and leave it until it's cool. If you don't have a jig or don't want to build one, you can step on your bow or put it in the fork of a tree until it cools. Remember, don't scorch or burn the wood and don't try to make such a tight bend that the wood is cracked or crystallized.

After tillering and bending the only thing that's left is to scrape off all the major tool marks with a knife, sand to a smooth finish with sandpaper and steel wool, and then apply a couple of coats of varnish or linseed oil. If you decide to sinew back your bow, finishing will have to wait until the sinew and glue has dried completely. Also, a leather covering can be glued and sewn on to the grip area. This not only adds a nice touch but makes for a more comfortable handle.

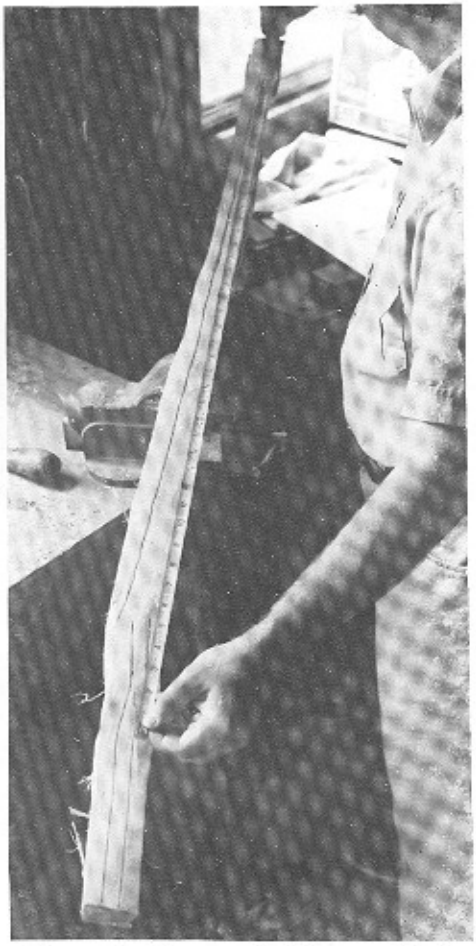
Removing the bark with a draw knife.



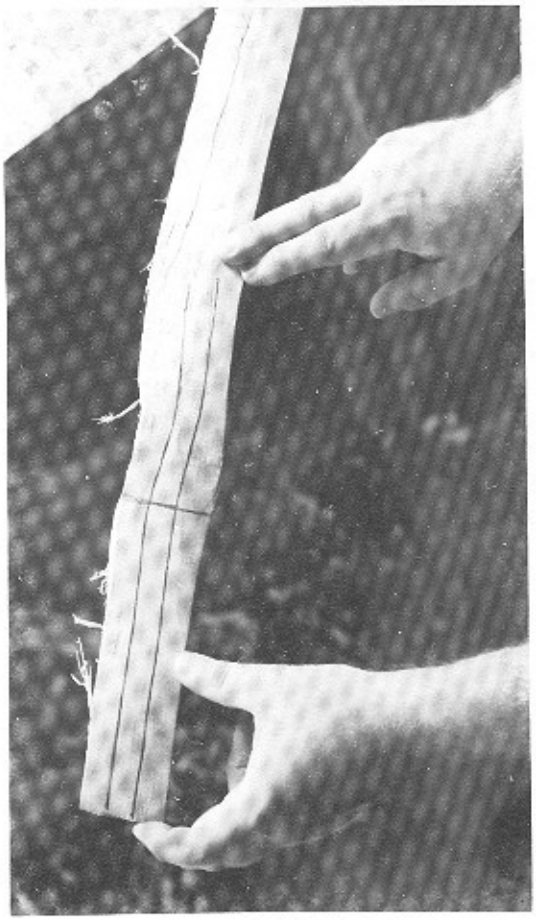
Working into the heart wood. Note the rough area and the line I drew to clarify the division between growth rings.

After the back was brought into a single growth ring, the sides of the stave were further trimmed for a better fit in the vise.

Drawing a center line following the longitudinal grain.

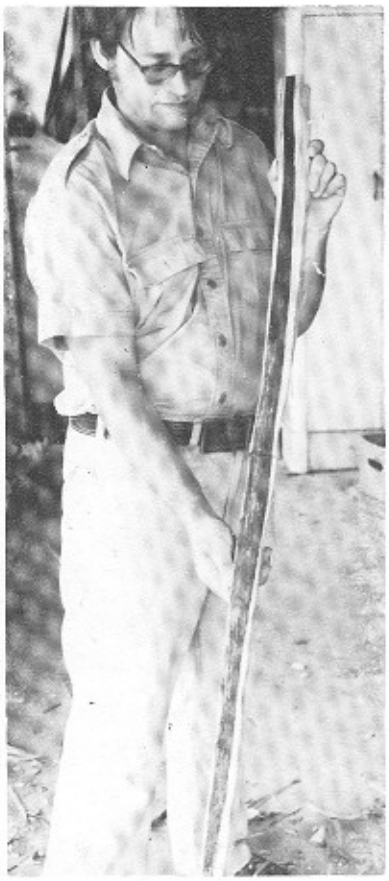


The 52 inch stave had a very bad bend at one end.

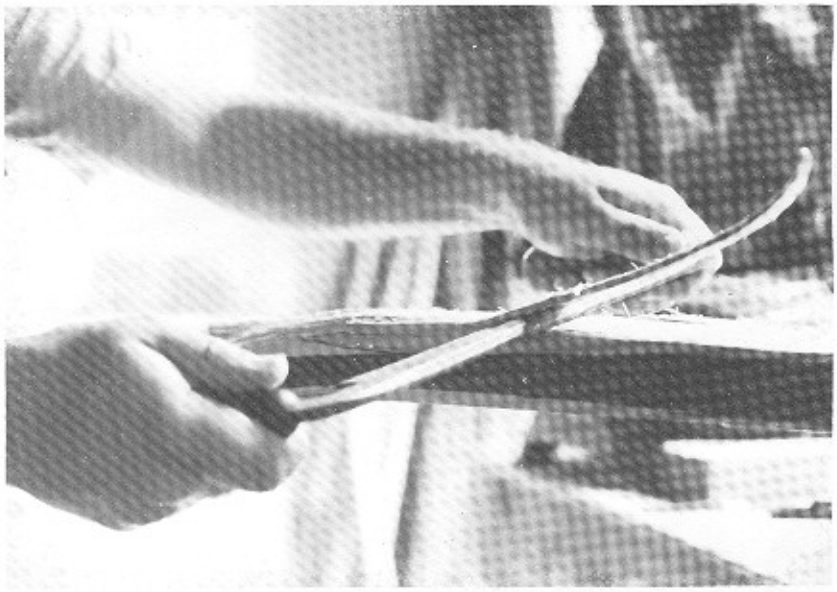


To compensate. I sawed off 6 inches.

Sawing off the end of the stave with the hacksaw.



The design laid out on the back of the shortened stave, colored in black for clarity. Note the curve in the tip of the upper limb, this will have to be straightened by heating and bending.

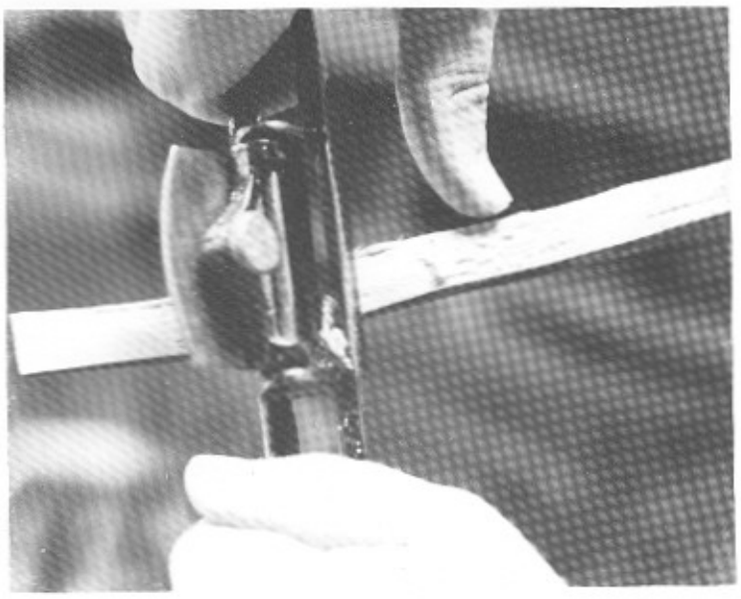


Removing excess wood off the sides with the draw knife.

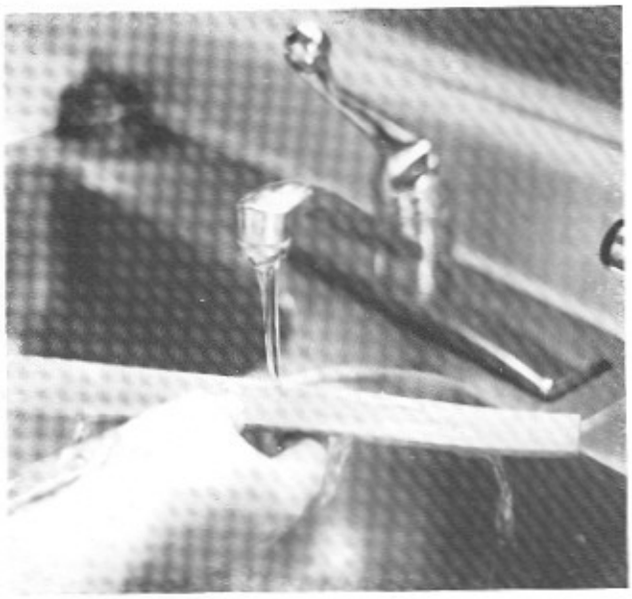
Marking the stave for removal of excess wood off the belly.

You can remove the excess wood off the belly with an axe or a draw knife.

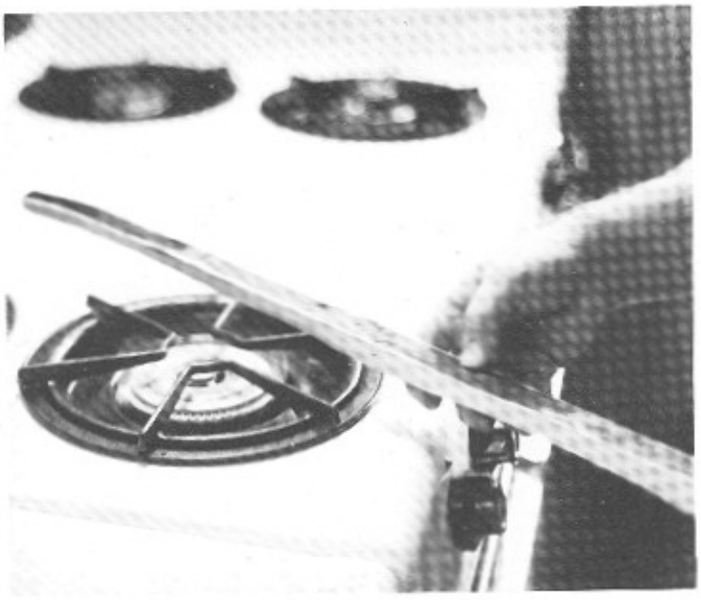
In this case I removed it with the band saw. If you follow your lines carefully, all major cuts can be made this way.



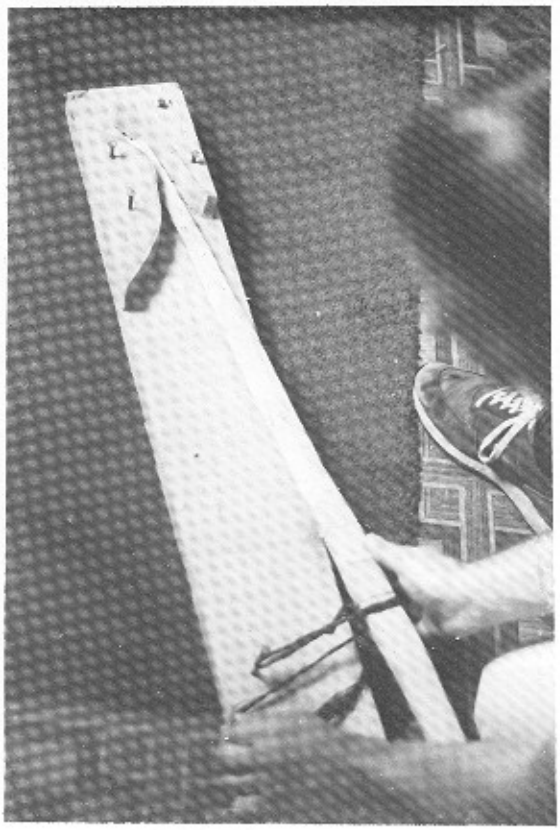
Working with the spoke shave to smooth the sides of the limbs. Note the rough spot just ahead of the tool, this is where the grain went around a small knot. The spoke shave and file are the best tools for smoothing these rough spots.



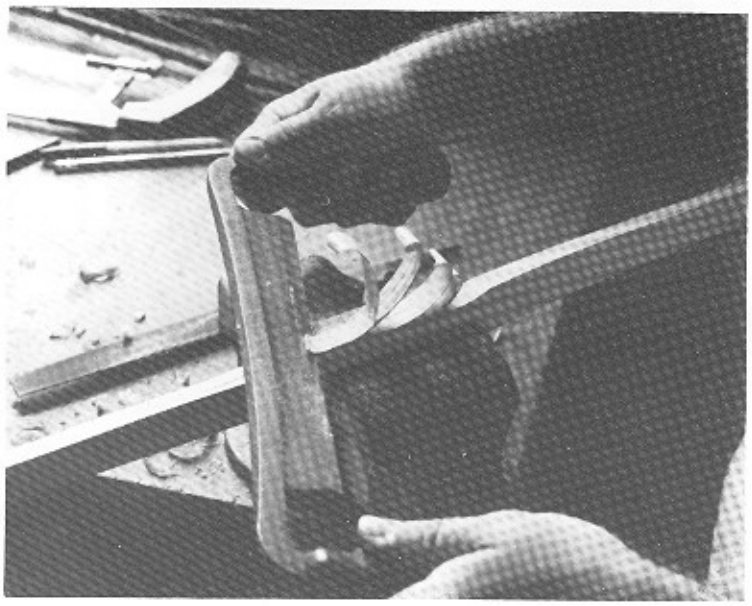
Before tillering, the crooked end of the blank had to be straightened by heating and bending. Here it is wet down so that it will not be scorched when heated.



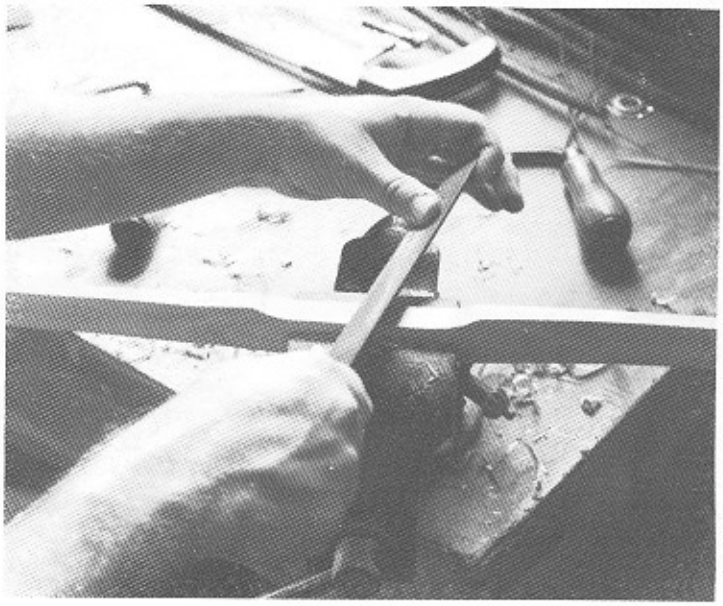
Heating the bow over the burner on my gas stove. Only that portion of the limb where the bend is to occur should be heated, and this should be moved back and forth, in and out of the heat so as to further prevent scorching.



Using the bending jig; when cool, the tip stayed straight. While I had the jig set up I went on to bend the recurves in the tips.

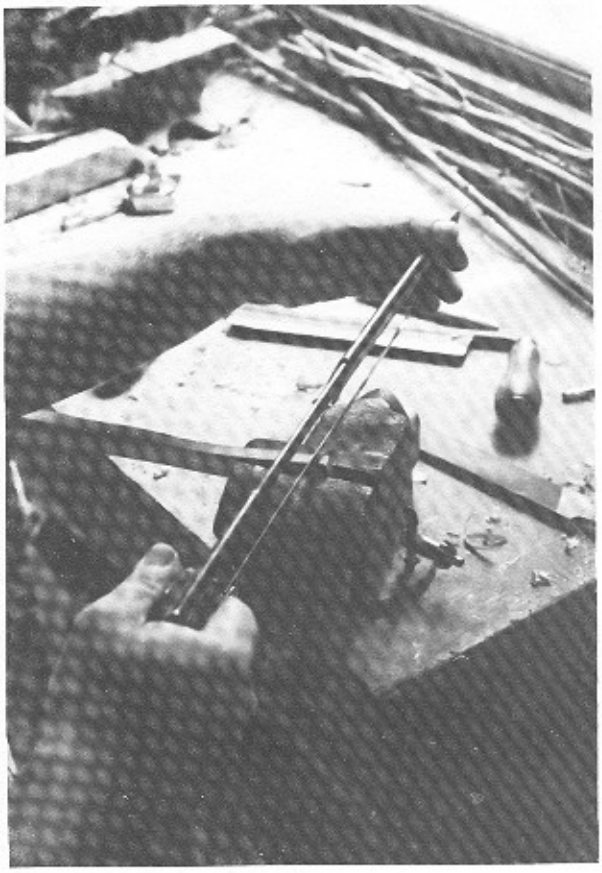


Cutting in the recess for the grip.

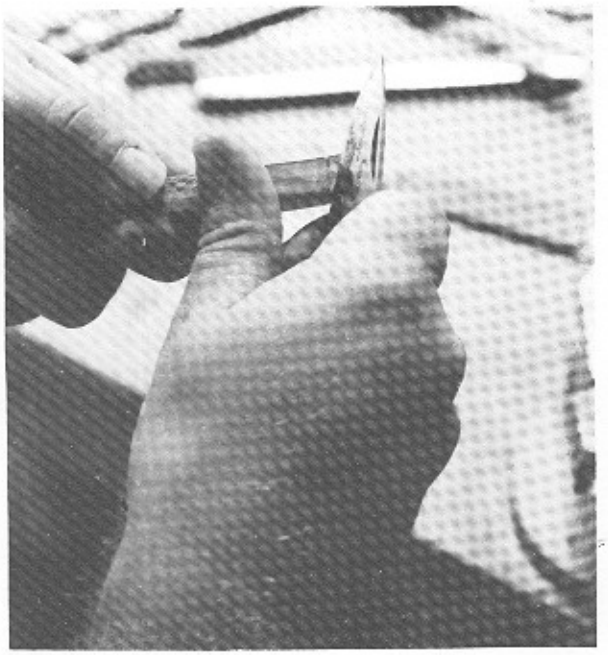


Rough finishing with the file.

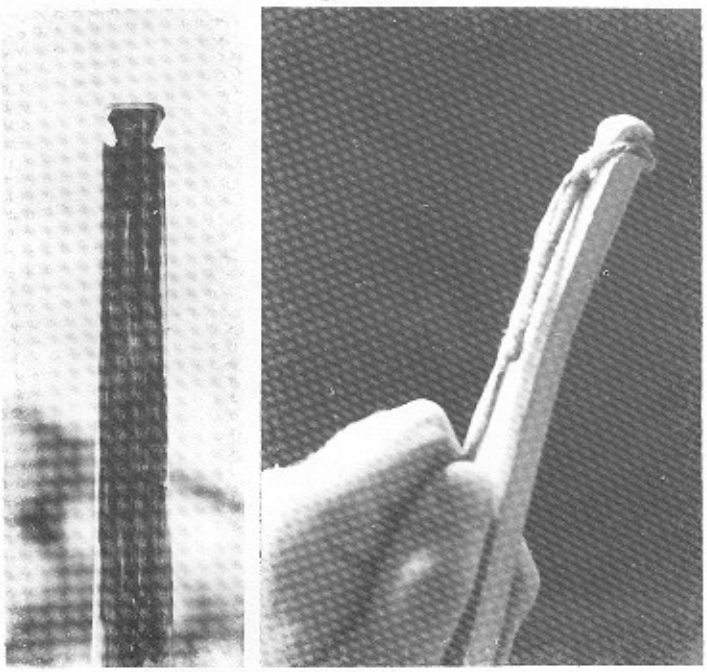
On short bows, before cutting in the nocks, I will test the tiller by bending it while it is in the vise.



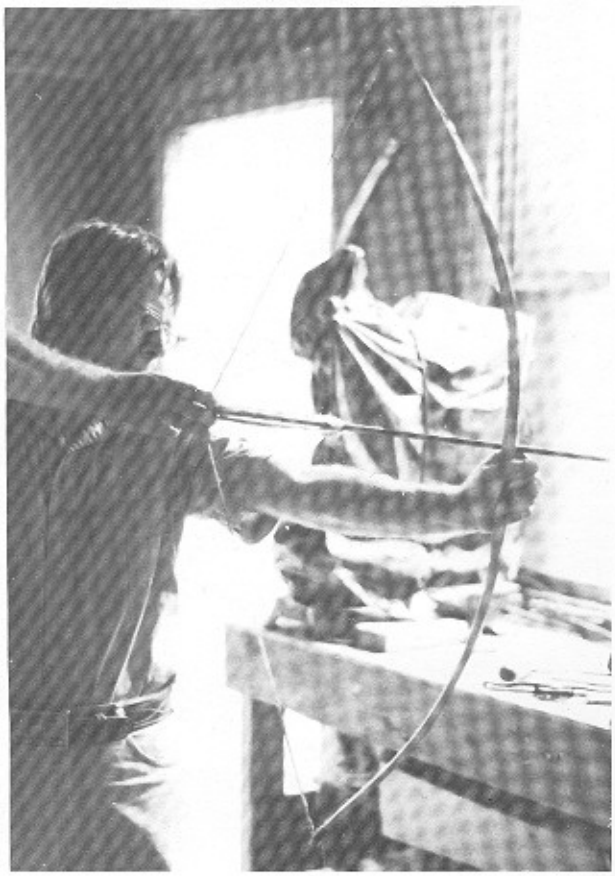
Cutting in the nocks with the hacksaw.



Cleaning them out with the knife.

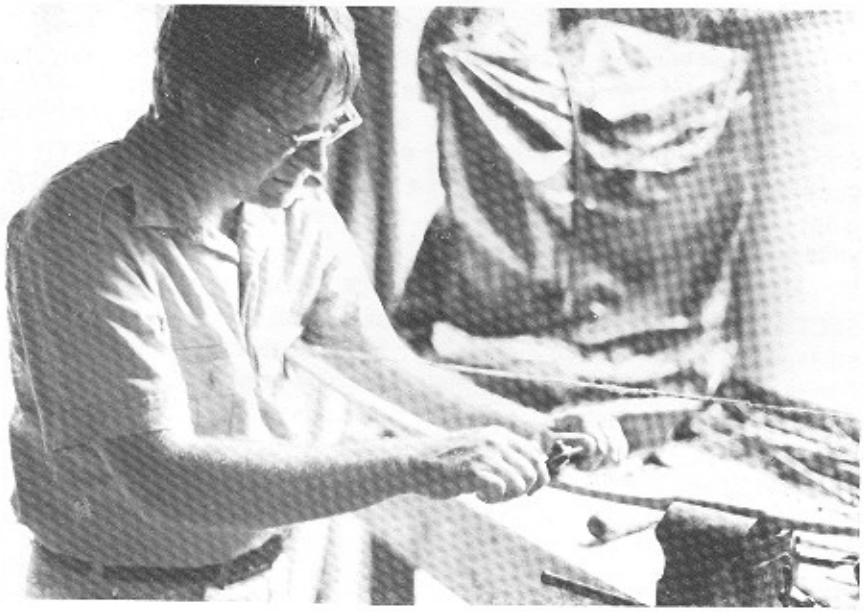


The finished nocks, and fitting the tillering string.

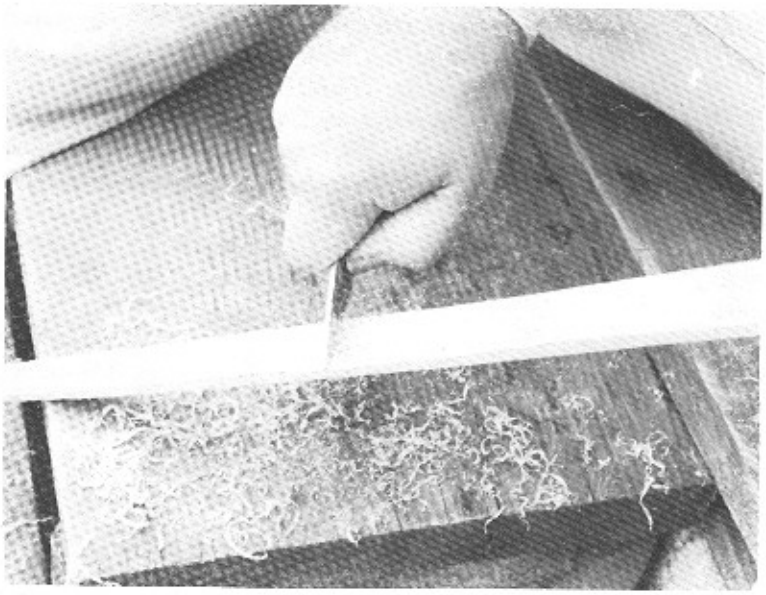


This bow was perfectly tillered when strung. Because it was so short and it had a small crack just below the nock on the upper limb, I left it unfinished and used it to illustrate the section on sinew backing.

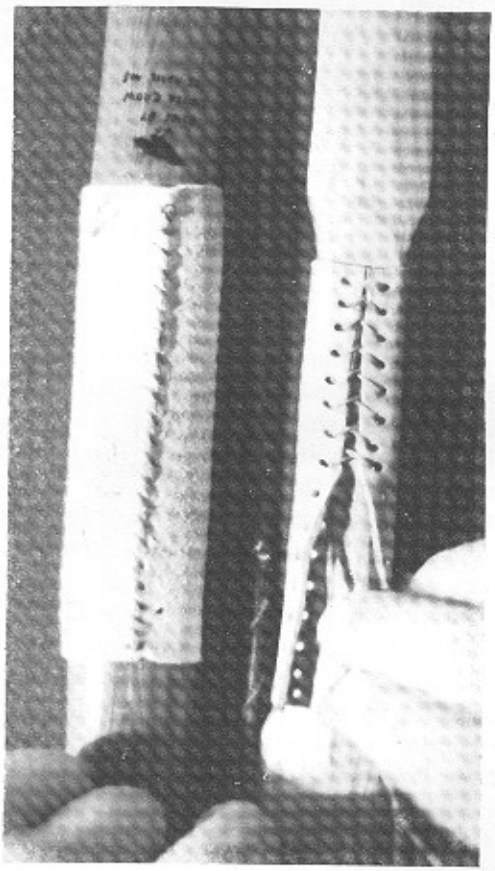
Another bow stave was selected and worked down the same way as the first. The longitudinal grain in this stave was much straighter, allowing me to lay out the plan closer to center.



When nearly finished, this bow needed tillering. Here I am removing a small amount of wood with the spoke shave to make both limbs bend equally.



Finishing was accomplished by scraping with the jack-knife and then sanding with sandpaper, after which two coats of linseed oil were rubbed into the wood.



A leather covering can be sewn on using either a spiral stitch or a baseball stitch.

III. BOW DESIGN

Now that you understand the basics of bow making, it is time for you to consider what type of bow you wish to make and choose one or two of the designs shown in this chapter. Your choice will depend upon the size of your stave, the kind of wood, what you intend to do with your bow, and of course, your level of skill and patience.

NO. 1, BOW WITH RECTANGULAR CROSS-SECTION. For the first timer, this is the easiest of all types to make, I have made many bows of this design from 40 inches on up to 60 inches. The bow illustrated is a straight, flat, rectangular piece of Osage orange 41 inches long that has been recurved at the tips. It is thickened only slightly at the handle where it is about 1-1/8 inches wide and 5/16 inches thick. Its sides taper to 5/8 inches wide and 5/16 thick at a point just below the nocks. The measurement at mid-limb is 7/8 X 5/16. This is the measurement of the wood only, this bow has a sinew backing 1/8 inch thick, which adds to the bow's spring and power. It has a draw weight of 40 lbs. at 18 inches and the limbs follow two growth rings exactly with only a portion of a third showing at the handle.

The 60 inch bow that I have at present measures 1-1/8 X 9/16 at the handle, 7/8 X 3/8 at mid-limb, 5/8 X 5/16 at the tips just below the nocks, and it follows two growth rings at the tips, goes into a third mid-limb and a portion of a fourth at the handle. (The growth rings on Osage orange average 3/16 thick and are seen on the sides and belly only. If they appear on the back, the bow may break at this point.) At first, this bow had no recurves at the tips, by adding these its cast was increased while its weight stayed at 35 lbs. at 26 inches.

Recurving the tips adds to the speed of a bow while adding little if any to its weight. Also, shortening, as well as sinew backing, will add speed and weight as clearly shown by these two examples. The shorter bow shot the same size arrow 10 to 15 yards farther than the longer bow. The only other way to increase a bow's strength is to make the limbs thicker and/or wider.

NO. 2, RECTANGULAR BOW WITH RECESSED HANDLE. This bow is similar to No. 1 except it is narrower and thicker and has a recessed grip. The reason for the narrowing of the handle is not only for comfort but to make the arrow shoot closer to center. It is 46 inches long, 1-1/8 X ½ at the widest point just above and below the handle, ¾ X 11/16 at the center of the handle, 13/16 X 3/8 at mid-limb and 5/8 X 3/8 at the tips. It is made of Osage, has 1/8 inch of sinew on its back and is 40 lbs. at 21 inches.

At the time of this writing the sinew job was only two weeks old and I think this bow will get a little stronger as the liquid hide glue I used has a chance to come to full cure. This may take as long as 6 months. This is a good argument for the use of powdered hide glue which cures in less than 2 weeks, more about this in the chapter on sinewing.

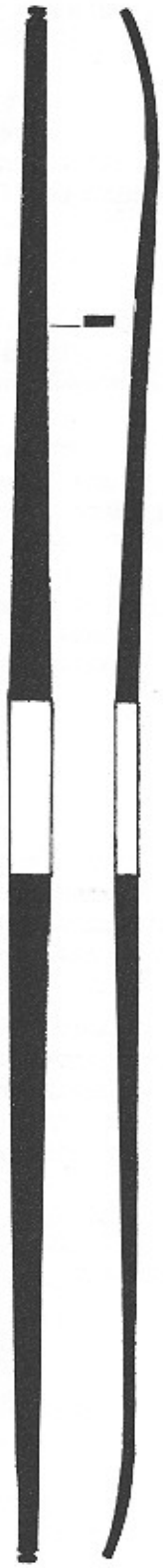
NO. 3, CALIFORNIA FLAT BOW. This is a type of bow used by the Indians of Northern and Central California and it is one of the best of the primitive types. This drawing is a composite made up of several I have seen.

Most of the old bows were made of Pacific yew, were from 40 to 56 inches long, with limbs from 2 to 4 inches wide and from 5/16 to ½ inch thick. The handle was usually oval in cross-section and the limbs were flat on the belly and convex on the back like a very flat D. The Indian boyers removed the sap wood and seemed to ignore the radial grain somewhat, perhaps relying on the sinew backing which was always well executed; the finest sinew work I ever saw was on one of these bows. Even though the backing was only about 1/8 inch thick, that added up to a lot with the bow limbs 3 to 4 inches wide. Because of the sinew and the recurves bent into the tips, these bows had a deep reflex which certainly added to their cast.

NO. 4, SUDBURY BOW. Perhaps the oldest known and documented American Indian bow, it was taken from an Indian who was shot while in the process of ransacking a house in Sudbury, Massachusetts. The event took place in 1660 and the bow has been in the collection of the Peabody Museum at Harvard since 1826. The drawings and measurements of the bow are copied from *Native American Bows*, by T. M. Hamilton, the photos are on page 31 and a description is found on page 32. Hamilton states that Dr. Pope made an exact replica of this bow and it was found to have a draw weight of 46 lbs. at 28 inches and a cast of 173 yards. (Hamilton 1982: 31, 32) If you want an authentic Eastern Woodland bow, this is it.

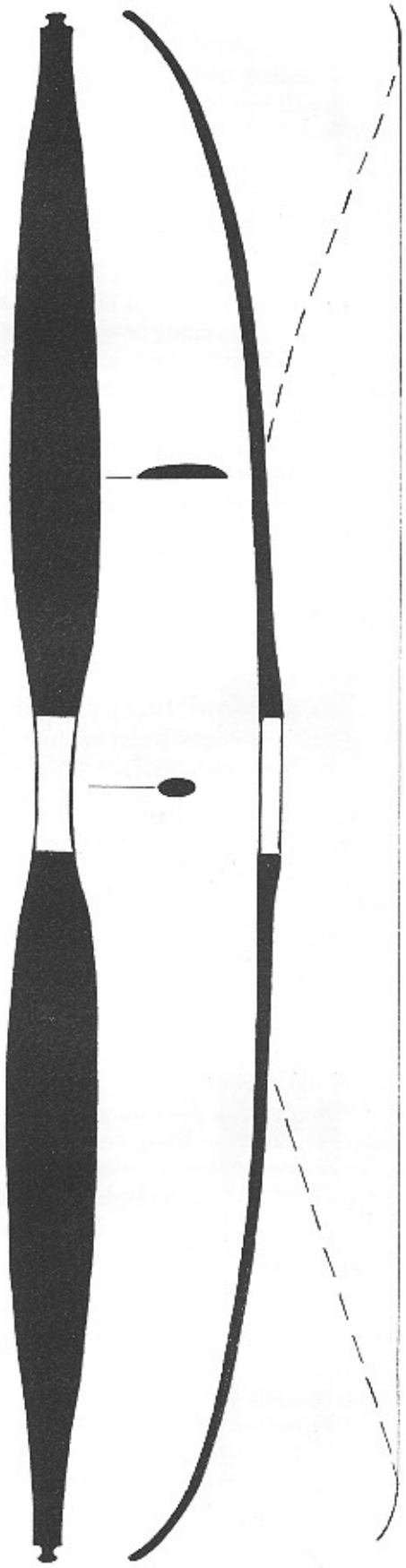
Length, nock to nock .....65 inches
Length over-all .....67-1/8 inches
Grip .....1-3/16" X 15/16" wide
Midway from grip to nock
  Upper limb.....9/16" X 1-7/8" wide
  Lower limb.....9/16" X 1-3/4" wide
Below nocks
  Upper limb .....3/8" X 3/4" wide
  Lower limb .....5/16" X 3/4" wide

Note: The back view of the bow as I drew it shows it stretched out, the side view shows it curved as it followed the string from being left strung for so many years.



NO. 1

NO. 2



NO. 3

NO. 5, EASTERN WOODLAND FLAT BOW WITH RECURVED LIMBS. Perhaps the best all around design, this bow is a modified version of the Sudbury. It has been shortened and recurved making it look more like a modern bow as well as being made of Osage instead of hickory. Also, the handle is very narrow so the arrow will pass closer to the center of the bow. If the handle of this design could be further modified as shown in 5-A it would shoot center and have the added benefit of an arrow rest. I haven't done this yet but I'm giving it some thought.

I have made many bows like this, some as short as 48 inches to as long as 63 inches, the one illustrated is probably my best effort to date. It is 63 inches long, 13/16 X 1-3/8 at the center of the handle, 1-3/8 X ¾ at the widest point above and below the handle, 1-1/8 X 3/8 at mid-limb, and 5/8 X 3/8 at the tips just below the nocks. It was hewn from a 20 year old Osage stave given to me by a friend. When he saw the finished product he had to have it back and I couldn't blame him. He is an avid deer hunter and all he has to do is wait until a deer with his name on it comes close enough and I am sure that this 53 lb. poison slinger will do its work well.

NO. 6, TRADITIONAL FLAT BOW. In the days before fiberglas and wood laminated recurves, this was the bow everybody had. Since they have not been in general use for over 30 years they are now called traditional. My Father and Grandfather shot bows just like this one and it is with some feeling of nostalgia that I make and shoot them today. The specimen illustrated was cut from an old lemonwood bow blank that probably came from the Stemler Archery Company, now long out of business. It is 68 inches long, 7/8 X 1-3/8 at the center of the handle, 1½ X ¾ at the widest point above and below the handle, 1-5/16 X 9/16 at mid-limb, and 3/8 X 3/8 just below the nock.

I don't think you can get lemonwood anymore, however, others have come to take its place, purpleheart, goncalo alves, satinwood, and the hardest of all, ipe from Brazil. Also, there is nothing to stop you from making a flat bow from any of the North American woods listed in this book, providing a stave long enough can be found. Because exotic woods grow steadily in a tropical environment they have very little, if any, radial grain and the longitudinal grain is so straight the staves come as sawed boards about 2 inches wide, ¾ inch thick, and about 6 feet long. Usually the stave itself is not thick enough, so a short piece of the same wood is included and it is glued on the belly to form the handle riser.

I recently purchased a purpleheart stave from Woods Unusual, and it really is a beautiful purple color, especially when finished with a coat of Watco Danish Oil Finish. Along with it came a little instruction pamphlet which included a table that gave the dimensions for bows of different weights. Now I don't know whether these figures leave room for tillering and finishing or not. The tables were worked out using Pacific yew and are very helpful for getting the proper dimensions, though the weights may be approximate and will definitely be different for other woods. I chose 40 lbs. for the lemonwood stave and got 45. I made the purpleheart blank the same size, and it was so strong I had to reduce the thickness of the limbs considerably in order to get it to where I could manage it. If I had left it at the dimensions given for 40 lbs. it would have weighed at least 70.

Keeping the purpleheart in mind, I wish to add a note of caution. First of all, these staves are not cheap, if you mess one up you will be out some bucks. Purpleheart is not the hardest of tropical woods but it's harder than Osage, therefore it has almost no tolerance for severe bending. The limbs must be tapered well so that they bend evenly for most of their length. This must be done before stringing and tillering so as to greatly reduce the chance of a severe bend. Because of this, I would not try to make a bow from this wood much shorter than 68 inches. If something goes wrong, the stave cannot be salvaged by making a Plains bow out of it, and, I think recurving by heating and bending would not be a very good idea either. Needless to say, the same company that sells these tropical woods also sells 6 ft. hickory and ash staves and I recommend the novice boyer start with one of these.

NO. 7, OLD ENGLISH LONGBOW. The legendary English longbow conjures up visions of long ago battles where armored knights fell clutching at the heavy shafts that transfixed their bodies, their chain mail and steel plates were no protection against the archers' deadly probes. Today we marvel at the always accurate shooting of Robin Hood, who lived and hunted in Sherwood Forest, or the exploits of the Thompson brothers in post-Civil War Florida, and those of Dr. Saxton Pope and Howard Hill in the 20's and 30's. For me, the most vivid and real vision of all was the raising of the *Mary Rose* in 1982. She was King Henry VIII's flag ship at the battle or Portsmouth Harbor on that fateful day of July 19, 1545.

The *Mary Rose* had been fitted out with additional artillery and extra crew, many of them archers. This proved to be her undoing, for in a sudden shore breeze she capsized and sank, never having had the chance to join the battle. At this time the English were experimenting with heavy guns on ships that were not properly designed to carry them, and while artillery was evolving rapidly, slow loading single shot muzzle loaders would be the only small firearms in general use until the middle of the 19th

NO. 4

NO. 5

NO. 6

NO. 7

Century. At this time the longbow was still being used and it would remain a superior weapon until the invention of the Colt revolver and the Henry rifle. However, due to the changes in demographics and politics, the use of the longbow was already declining in the time of Henry VIII.

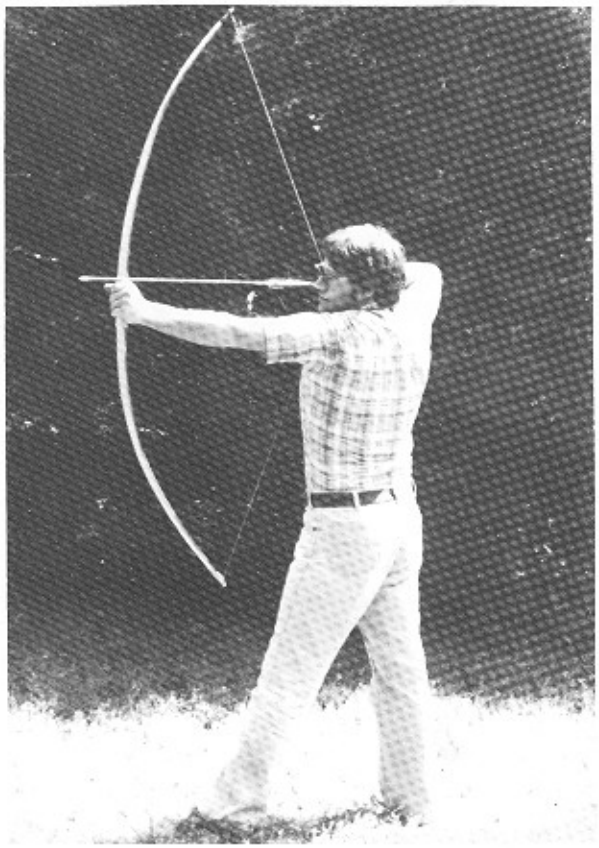
To become a military archer, you had to be able to loose 12 rounds a minute, all striking a 3 foot diameter target 250 yards away. The bow you would use would be made of a six foot stave of Spanish or Italian yew and would have a draw weight of 80 to 100 lbs. at 28 inches. In order to master such a weapon you would have to have started shooting almost as soon as you could walk. In fact, the law at that time required every man to have a bow and practice with it so many hours a week.

If you find what I just said hard to believe, then have a look at what was discovered on the *Mary Rose*, 139 longbows, some in such a state of preservation that they could be strung and shot once again. Along with these bows were found 2500 arrows and the skeleton of one of the archers who used them. "Careful analysis of (this man's) skeleton confirmed that he was a professional archer. Two of his middle vertebrae had been pulled forward and twisted to the left, suggesting chronic pressure on his spine from that side. Also, his lower left arm bone was noticeably enlarged and flattened, the result of prolonged strain. Obviously he had been right handed and had spent long hours at the butts, as archery ranges are called." (Rule 1983: 665). Dead men do tell tales!

After reading about the bows found on the *Mary Rose* I suddenly became interested in the old yew stave I'd been saving. This was Pacific yew, which is on a par with that from Spain and Italy, (English yew is not as good). It was over 6 feet long and because it is hard to find an Oregon yew tree that doesn't have any big knots in it for such a length, it had a finger joint splice in its center. I knew the glue was old and I worried about it just long enough to get the bow half finished. It broke during tillering and I had to re-splice it, thus cutting it down to 5½ feet and removing the thicker portion of its center. After re-tillering it weighed in at a disappointing 40 lbs. Just recently I got some more yew and I'm going to try it again. There is so much yet to be learned and each new piece of wood is a lesson in itself. Yew is very scarce and difficult to work and the longbows design doesn't help.

If you are going to make a longbow I suggest you make your first one out of hickory or ash. Even though these are not the best woods for shorter bows (neither is yew, for that matter) they are more than adequate for longbows and six foot staves are easily obtained.

The 72 inch specimen illustrated is a fairly powerful weapon and the dimensions are based on those given by Pope for a yew bow. 1¼ X 1-1/8 at the center, 1-1/8 X 1 at mid-limb, 1 X ¾ at three fourths, and 5/8 X ½ at just below the nocks. True English longbows have a D-shaped cross-section with the slightly concave back forming the straight part of the D and the belly the rounded part. (This D-shaped cross-section is just the opposite of that found on a California flat bow.) If yew is used the yellow sap wood is left on because this tree has 40 or so growth rings to the inch and it is almost impossible to follow the radial grain. The sap wood forms a kind of backing. Also, the heavy longbows found on the *Mary Rose* once had nocks made of cow horn; yew is soft and the horn tips kept the string from cutting and splitting the wood. No matter what wood you use, the D-shaped cross-section must taper and narrow evenly towards the tips and the round belly must be tillered with great care so too much wood is not removed in any one place. Longbows seem to be more sensitive to tillering than flat bows, this is why a good one is hard to make and I wouldn't recommend starting one for a first project.



Shooting the yew longbow. In this photo the light colored sap wood on the back is clearly visible. Also, the arrow I'm shooting is too long, for me is should be 26 inches.

If you are bent on making a certain type of bow because it was used by natives in your area or you just happen to like that style, then I suggest you try and make it no matter what, because you won't be happy until you have that particular bow in your hands. Now if you are open to suggestions, read on.

If you have had little experience in woodworking or you have a minimum of equipment, make a bow like No. 1 or No. 2, and plan on spending a week on the project. If you are trying to do something that you have never done before, then it is always wise to do it slowly. Using an axe and a pocket knife the work will naturally proceed at a slower pace and this has its advantages because you have more time to study the grain and make decisions.

If you make a bow under 50 inches then consider sinew backing it or at least backing it with rawhide. Then if it breaks it will not shatter sending a limb into your face. If you are worried about the longer bows breaking then it is a good idea to back them with rawhide also. These procedures will be discussed in detail in the following chapter.

Over drawing your bow is dangerous. Make and use arrows of the proper length and spine weight for your bow. Your arrows should be no longer than half the length of your bow. A 48 inch sinew backed Plains bow will take an arrow 24 inches long, however, to be on the safe side, a self bow should take an arrow an inch or two less than half its length. If you shoot a 28 inch arrow you should make your longbow or woodland bow at least 58 inches because a bow that is drawn to half its length is dangerously close to being over drawn.

Fred Bear in his *Archer's Bible* gives us a very good description of spine. "In order to perform properly, arrows must be matched in spine to the draw weight of your bow. 'Spine' refers to the stiffness of the shaft. When an arrow is released, it bends around the bow handle before straightening out in full flight. If the arrow shaft is not of the correct stiffness, or spine, it will bend either too little or too much and thus be thrown off course. Arrows that are too stiff for the bow's draw weight may not bend enough and will therefore fly off to the left. Arrows that are too limber are even more erratic and may fly off either to the right or left...Two bows may have exactly the same draw weights, yet one may have much more cast or shoot an arrow faster than the other. The faster bow will require a stiffer arrow than the more sluggish one. The old English longbow design, with a handle section an inch or more wide at the arrow pass, called for an arrow spine very close to optimum, as the shaft had the full width of bow to bend around before it could resume straight flight. Modern bows are much closer to being 'center shot' and are thus more tolerant of spine variation" (Bear 1968: 14,15)

What does all this modern stuff about arrows have to do with primitive bow design? Well, it has a lot to do with it. First of all, if you are making a 100% authentic Plains bow that shoots arrows made of dogwood or cane, don't expect pinpoint accuracy at long ranges. These bows were intended to be used on horseback, they delivered their short arrows with great speed at almost point blank range. This was ideal for buffalo hunting and warfare on the move when most shots were made at a distance of 50 feet or less.

I have found that most of my Plains bows will shoot to the left slightly, especially those without recessed handles. The arrows also wobble before straightening out, this led me to think my primitive arrows were really poor until I shot them out of my wife's modern target bow. Boy, what a difference! It was the bow, not the arrows, that was at fault. Because these Plains arrows were so short even shafts that were spine tested at as little as 25 lbs. would not bend around the handle so they wobbled and flew off on a tangent.

There are several solutions to this problem. One is to learn to shoot the bow, as is, compensating for its idiosyncrasies. If you can hit small moving targets at 20 or 30 feet with regularity then you are ready to go rabbit hunting. You will never become a championship archer with this outfit but at least you can put meat on the table, and to the Indians, that was all that mattered. The other way is to alter the design of your bow. If you wish to retain authenticity, the limbs of the bow can be carved out so they are offset slightly to the left, thus the string will come closer to being in line with the left side of the bow. This is difficult to do to a wide bow, however, it works pretty well for narrow bows and those with recessed handles. The last and perhaps best solution is to break with tradition and make a center shot bow with a handle like that illustrated in 5-A or make one of the longer bows and use arrows that are the proper spine.

As for a serious hunting bow or target bow, I would consider only the last three with a preference toward No. 5 and 6. No matter which you choose, your hunting bow should be as heavy as you can make it and still shoot accurately. Your target bow, on the other hand, should be lighter because you are going to shoot it a lot more. If it's too heavy it will make your muscles sore and you will get tired, thus accuracy will suffer.

If you have made a good bow and you have worked up to it, and it begins to feel light, it can be made heavier by cutting an inch or so off each limb. However, it should never be shortened so much that it is over drawn, and this should be done only to bows that are so long they have room to spare.

IV. SINEW BACKING

Sinew backing a bow is not a real difficult job, the hardest part is obtaining the raw materials, the sinew and the glue. At the time of this writing, I know for certain of only one place where you can get sinew and I am aware of only two brands of hide glue, and they are radically different from each other. The sinew comes from your local slaughterhouse (if you were not lucky enough to have killed a deer or a buffalo on your last hunt) and the hide glue comes in a liquid or a dry, powdered form.

The best sinew is found in two areas on the animal, the back and the legs. The back sinew is a flat, fiberous strip about 18 inches long, 3 inches wide, and 1/8 inch thick which lies parallel and next to the spine between the fat and the meat. (Look at a T-bone steak, the gristle right under the surrounding fat is sinew.) The leg sinews are cordlike and make up the tendons which move the hoof. One runs down from the knee to the front of the hoof, splitting at the hock. The other runs down the back of the leg and attaches to the back of the hoof. On a cow, the back tendons are severed and contract when the legs are cut off below the knee, so all you will get will be pieces about 4 inches long. The ones from the front of the leg are 6 to 8 inches long and about ¼ inch thick, these are the ones you want.

The leg tendons that come off a deer, elk, or buffalo are much longer, and because these animals have longer legs than a domestic cow, both back and front cords can be used. Also, their sinew will be tougher and harder to split because they lead such active lives. Even though cow sinew isn't the best in that it will not reflex your bow as much, it is readily available to anyone willing to do a little work to get it. One advantage it has is that it's free, if you can stomach a trip to the slaughterhouse and what follows.

We have two slaughterhouses in our area. The first we visited was a big outfit and I asked the boss if he had any sinew I could have. He gave me a funny look, went into the back where they were processing the meat, and came out with a half dozen neck tendons. Now neck tendons are a foot long, triangular in shape, about ½ inch thick, flabby and cream colored when fresh. When dry they are rock hard, cannot be pounded with any effect, and won't split into long fibers. These tendons are sometimes called "chew" or "chewing gum". As a kid I remember finding a piece of this in one of my Mother's cheap pot roasts, I chewed on it for an hour. This was not what I wanted. I tried to explain to him that what I preferred was the sinew off the back or leg. "Oh! What you want is silverskin." "Silverskin" or "silver tissue" is what they call back sinew now a days because it appears shiny, silver, or brilliant white when it is fresh and moist. Unfortunately he was unwilling to let me have any.

About a week later I found another slaughterhouse, this one was a much smaller, family run operation and they were much more cooperative. They told me that I could have all the cow legs I wanted, but the back sinew would have to wait until they had a hamburger cow, because removing the back strap would mess up the look of the steaks. Now when looking for buffalo sinew, this works to my advantage, because a lot of buffalo are turned into hamburger and sometimes the sinew finds its way onto the trade blankets at black powder shoots.

A day or two later they called us and told us to come in around one o'clock before the gut truck showed up. An hour and thirty miles later we were standing out back of the place staring down into a 55 gallon drum full of cow legs. This was going to be a lovely July afternoon! We spent four hours in the broiling sun cutting tendons out of those legs. Along about the time we were finishing a little, thin man appeared out in the holding pen. His beady little eyes sparkled from behind dark glasses which stuck out of a face completely covered with hair, (I do believe there are trolls in Missouri). He promptly chased a heifer into the shoot next to us, pulled out a gun and said, "Look at Daddy!" When the poor beast went down with a thud he was heard to say, "I got four more for ya, they're real fresh too!"

"That's okay," I replied, "I think we have enough."

To remove the sinew from a cow's leg, carefully split the hide down the shin from knee to hoof and peel it back. The sinew lies in a mass of fat and gristle along the bone. It is freed by slipping a sharp knife between it and the bone and cutting it loose from the knee to hoof. After this mess of fat and gristle has been removed from the leg, the tendons must be carefully pulled or cut out so all you have left are the gleeming white cords, each about the size of a pencil. Your sinew will dry faster, split easier, and won't stink if all the excess flesh is trimmed away. If you're lucky enough to have gotten hold of some back sinew, this should be cleaned as well. If it came dry and still has some unwanted flesh, don't worry about it. This will come off when you pound the sinew in preparation for splitting.

After a week or so of drying in a warm, sunny spot that was out of the way of any animals that might want to make a meal of them, your tendons or strips should be ready for processing. If they are

completely dry they should be very hard, stiff and translucent amber in color. The back strap will have some very fine lines in it which denote the fibers while the leg tendons may be clear. Both will turn white when they are pounded vigorously with a rock or mallet and the fibers will start to separate. Also, any unwanted tissues that are not sinew will peel off.

Pounding and twisting and separating should continue until the sinew has been split into hundreds of single fibers. Cow leg tendons will split into very fine, soft hairs without too much work. The back strips will split even easier, but are coarser (about like mono-filament fishing line). Deer leg tendons are the hardest to process, those I got from a taxidermist friend were dried but not cleaned and this added to the difficulty because the tough membrane required a lot of pounding and pulling to remove from the sinew. This is why I prefer back straps when I can get them, because both deer and buffalo handle just as easily as those from a cow.

To make things easier later on I leave about 1 inch on the end unpounded and start splitting from that spot downward, leaving all the strands attached at this end. This saves hours of sorting loose pieces. I often leave the Y unpounded (on leg sinew) and split from there downward. The strands are so intertwined at the Y that separating them is almost impossible. When I'm all finished splitting I will have several large bunches with hundreds of strands, all attached at one end. Now I sub-divide these big bunches into smaller bunches. These will be about ¼ inch in diameter at the end where they are fastened together and may contain 75 to 100 strands. After this operation you will no doubt have some loose strands, they can be gathered and sorted according to the length and knotted together on one end. These will always make several small bundles of various lengths and are good for filling gaps.

The amount of sinew it takes to cover the back of a bow depends on the bow's length and width (the area to be covered) and the thickness desired. The last bow I sinewed at the time of this writing was 48 inches long, 1½ inches wide just above and below the recessed grip with limbs tapering to 5/8 inches wide. To cover its back to a depth of 1/8 inch it took two large buffalo back straps. Four large deer leg tendons were used to cover the 46 X 1-1/8 inch bow featured in this chapter, so I would guess that it would take at least 8 cow legs for this same job. There is as much glue on the back of a bow as there is sinew, so it's hard to calculate just exactly how much you will need.

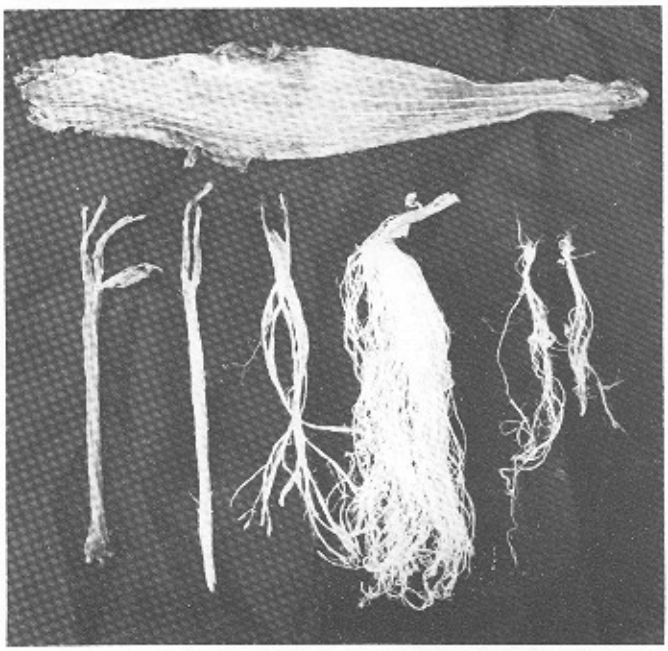
As far as glue is concerned, there is no substitute for hide glue, it is made of the same protein stuff as is the sinew. In fact, if you boil sinew long enough it will turn into glue. The Indians obtained their glue by boiling down hide scrapings, hoof shavings and sinew scraps. There are two kinds of hide glue, one comes in a liquid form and the other comes in a dry, powdered form, both will work but each has its advantages and disadvantages.

The first three bows I sinewed I used some liquid hide glue I got from a friend in Ohio, it was made by a chemical company in Columbus, Ohio, and at the beginning it seemed to work well. However, it took the stuff forever to get hard. Laubin said he was shooting his bows two weeks after sinewing, but mine were still a bit sticky and soft at the end of three weeks (Laubin 1980: 66). Finally after a month they were stiff enough that they could be shot. At this time I finished the bows, putting snake skins on two of them and then applying a thin coat of some kind of varnish my wife used on her paintings.

A month later I took my prizes to the big black powder shoot at Friendship, Indiana. This was one of the hottest and stickiest August shoots on record, and the bows went limp about the same time I did. Even with the varnish and the snake skin it seemed they were bent on taking back all the moisture they had given up and all I could do was take them back to the motel and sit them on a chair next to the air conditioner. It took the better part of that nine day event before they were dry enough to be displayed. At that same meeting I mentioned the sinew and glue fiasco in a conversation with George, my Sioux Indian friend, and he chuckled and said, "The White Man never learns." Then he went on to tell me he used the dry powdered stuff, the same thing Laubin used.

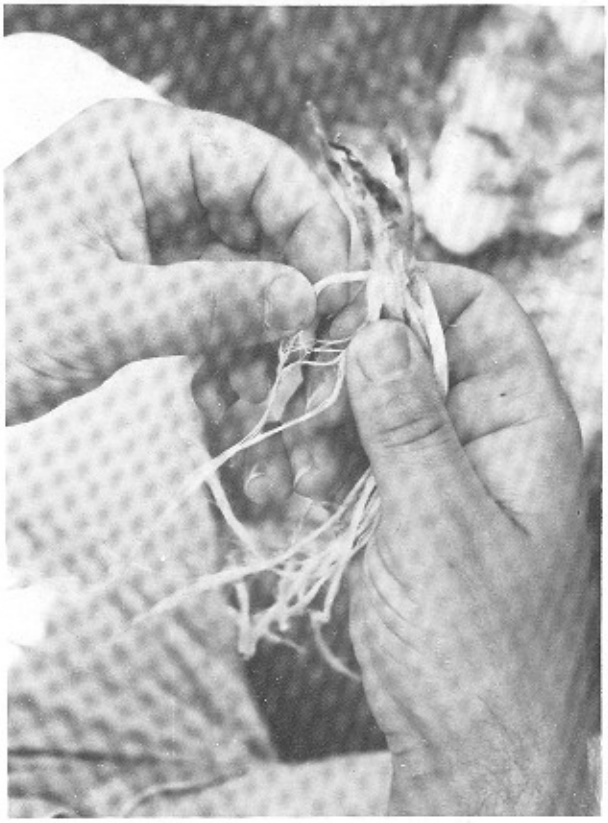
After fooling around with both kinds of glue I have learned a lot and this I wish to pass on because it will save you a lot of time and trouble. The label on a bottle of liquid hide glue says, "Long assembly time", and that's just what it means. This glue contains some agent that keeps it from jelling before it's used and this is what prevents it from hardening when used in mass. This agent can be counteracted by adding 1 tablespoon of vinegar to a half cup of glue. It's the acid in the vinegar that does the trick. This will make your liquid hide glue harden much faster, but still not as fast as the powdered type.

The powdered glue is closer to what the old timers used and it can be found in large, well stocked art supply stores. Mine came from the art supply center in the basement of the Toledo Art Museum and it is the same glue that was used by the artists who painted the beautiful old paintings we saw upstairs. They would mix it in hot water, thin it out and brush it onto their canvases to protect the cloth fibers from the deteriorating effects of their oil paints, that's why 300 year old paintings are still around.



Top: buffalo back strap sinew. Bottom, left to right: deer leg tendon with tough covering; the same tendon with the covering pounded off; split into sections; separated into many small strands; subdivided into small bunches.

Pounding the sinew with a rock.



Splitting sinew into small threads, leaving them all attached at one end.

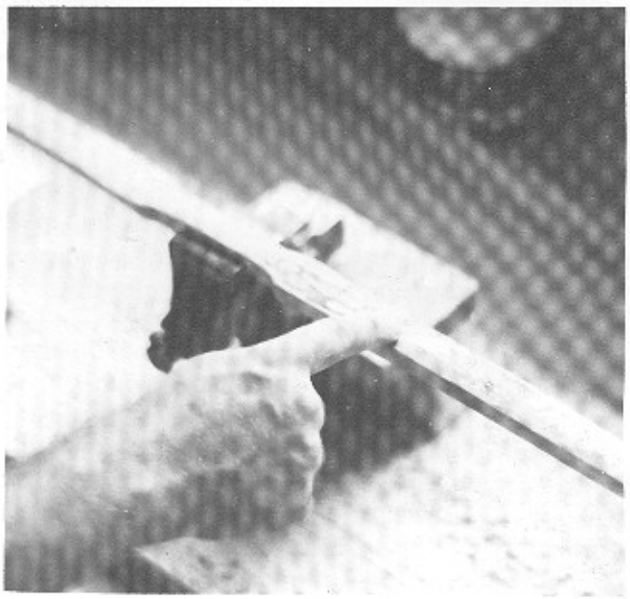
Two types of hide glue.

The instructions on the back of the can tell you to mix 1 ounce of glue to 12 ounces of water, this is for canvas sizing. Your glue should be a little thinner than corn syrup, start with half and half and add more water or powder as needed until the right consistency is reached. A water temperature of 160 degrees is recommended for mixing, don't let it boil. When thoroughly mixed and dissolved the glue can be kept at 120 degrees, this is a comfortable working temperature and the glue will not jell. A double boiler is a big help here, however, if you don't have one you will have to keep reheating. Before I got a double boiler I used to keep the glue pan inside a bigger pan of hot water, that way I wouldn't have to reheat it so often. Still, with each reheating I had to add more water because the glue was thickening due to evaporation.

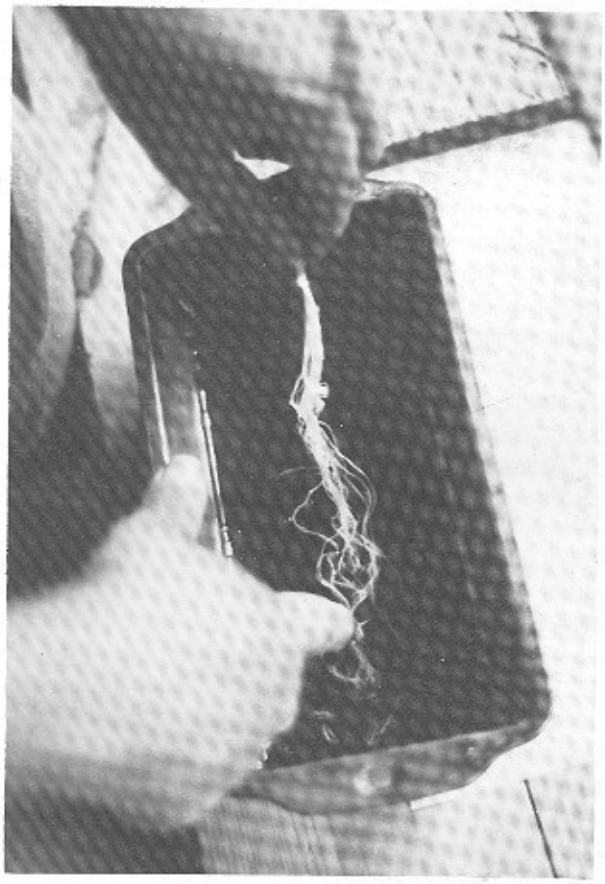
When this hot glue cools it jells and loses its stickiness and this happens very fast, so when applying your sinew you have to work quickly. You have less than ½ minute or so to place each bundle of sinew on the bow and smooth it out. When the job is done the glue begins to cool immediately. First it will be jelly-like after which it becomes more like rubber and it gets cold and clammy to the touch, then it will start to harden. After two weeks it will be rock hard and the bow will be ready for testing. Because the liquid glue dries slower, you might consider using it on your first bow, this will give you more time to gain experience in placing the sinew. However, don't expect your bow to draw up into a reflex, for some reason the liquid glue effects the sinew's ability to do this. On the other hand, the powdered glue will cause a reflex, if the backing is heavy enough.

Before sinewing can begin, the back of the bow must be prepared by roughing it up with a rasp or coarse sandpaper. To do this I put a brand new medium grit belt on my belt sander and sand the back of the bow lightly so that the wood is scratched and some fibers pulled up, but no stock is removed. This leaves a coarse and splintery surface which is perfect because the glue sticks to it so well. If you fast cured your bow, Indian style, the wood will no doubt be impregnated with grease. To get this grease out so the glue will fully adhere, the bow should be washed in hot water and a 10% solution of lye, after which it is rinsed thoroughly and dried. I usually work with dry, well seasoned wood with no sap or grease to cause a problem and after sanding I try to keep my oily hands off the back of the bow until sinewing begins.

The procedure for glueing the sinew onto the back of your bow is fairly simple. Once you have prepared your glue, put a thin coating of it on the roughened wood, then dip one of the longest bundles of sinew into the glue and swish it around. When it



Spreading the glue on the back of the bow.



Dipping sinew into the glue.

is well coated and soft, pull it through your fingers to remove the excess glue. This first bundle will be laid down the center of the back of the bow with its end wrapping around the tip of the limb and running down the belly for about 1½ inches. The next two bundles will run parallel and down each side of the longer first strand. From this beginning you will now work towards the grip area by laying down bundle after bundle, carefully smoothing them down as you go, staggering and overlapping slightly so that the joints won't fall in line with one another. When you reach the handle, start at the other tip and work towards the center again.

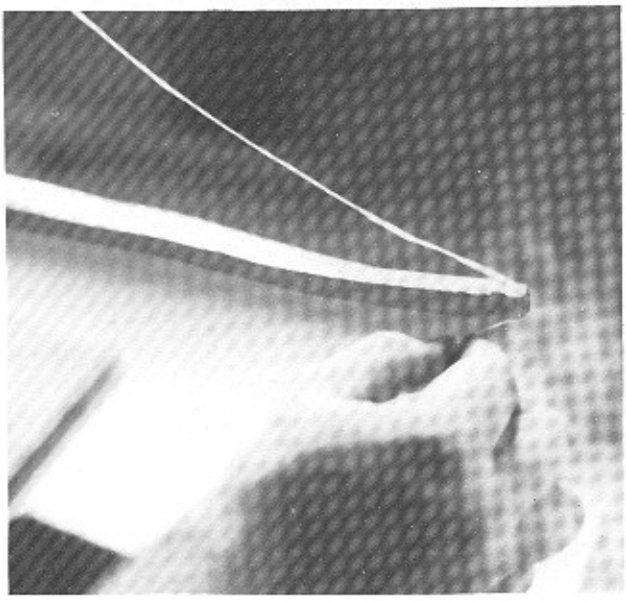
When working with the hot glue, you will have to be precise in your placement of the sinew, because the glue sets so fast the strands cannot be moved around easily once they are laid down. The little bundles are easier to work if the ends where the strands are fastened together are left on while dipping in the glue. These ends keep the strands together while providing handles for your fingers and as the sinew is laid down, these ends are snipped off with the scissors. During this operation your fingers and the scissors will get sticky so you will have to keep washing them off. This is why I do my sinewing near the kitchen sink.

The first layer of sinew will be about 1/16 inch thick when it dries, so another course will have to be added in a day or so to bring it up to 1/8 of an inch. Actually, you can let a bow stand for a month and still add more sinew to it for as long as no grease or paint has been put on the back. A powerful composit bow with reflexed limbs such as the Turkish bows will have half of their thickness made up of sinew and it may take several courses to reach this depth. After the last course has had time to dry you may wish to go back over it again, adding single strands to fill in any low spots, this evens everything up and makes for a smoother job.

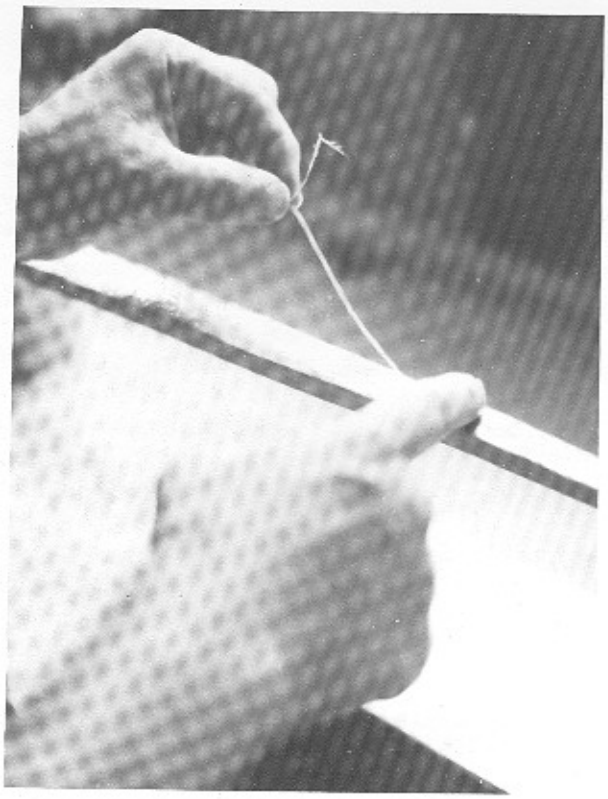
The sinewing complete, your bow must be cured and then finished. As mentioned before, if you used the liquid glue it will be three weeks to a month before you can test it and it should dry an additional month before varnishing. Bows sinewed with powdered glue will be ready for testing and finishing as soon as the glue gets rock hard, which can be in as little as a week to ten days. Heat and high humidity will slow the drying process, especially if liquid glue is used. If your house is air conditioned, this will help, or you may wish to sinew your bow in the winter time when the air is drier. Bows with very heavy backs may take as long as a year to cure to where you know for certain what they're going to do.

If the sinew has been applied evenly to a bow that was well tillered, then it should not have to be tillered again. Should this not be the case, then re-

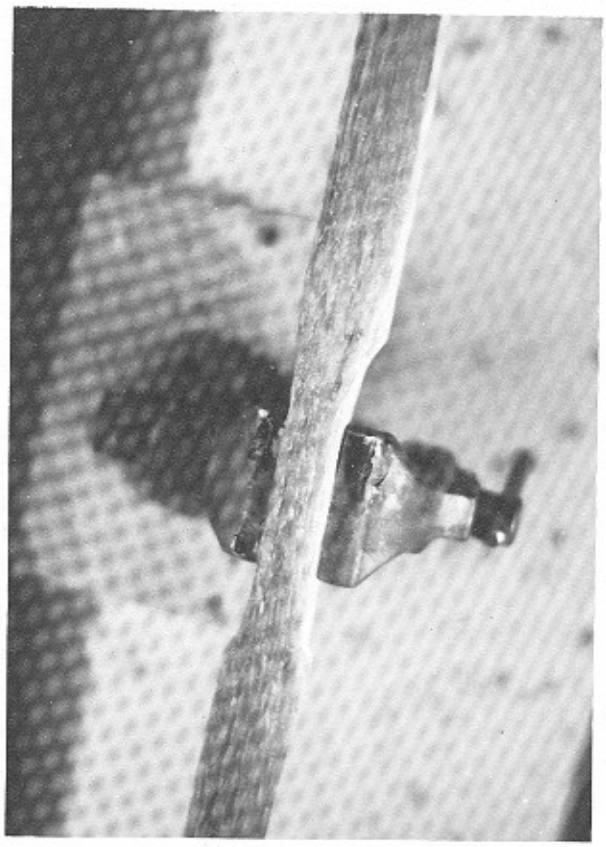
Removing excess glue with the fingers.



Laying down the first strand.



Smoothing it down with the forefinger.



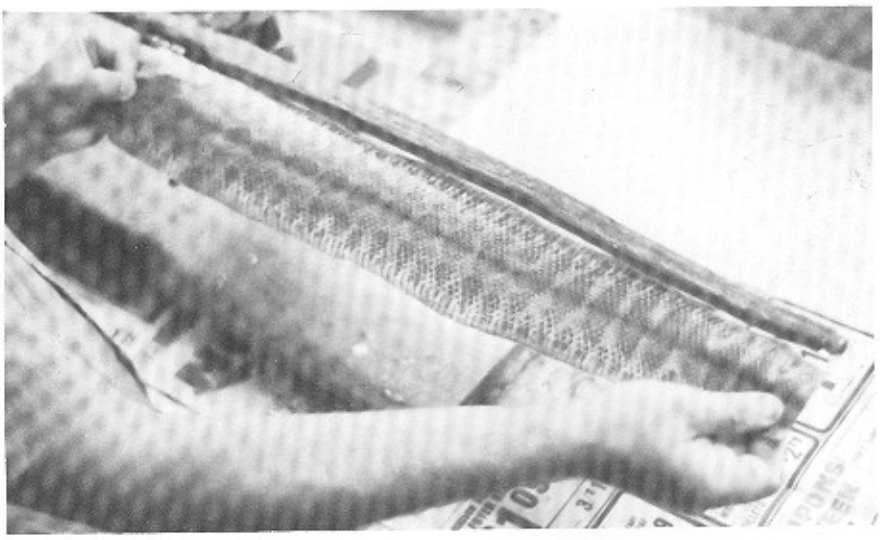
First layer of sinew complete. It will dry for a day or two and then another course will be laid on.

tillering or adding more sinew to the weaker limb may be the solution. However, don't alter the wood or the sinew until the bow has been shot a few times, it may settle in and be just fine.

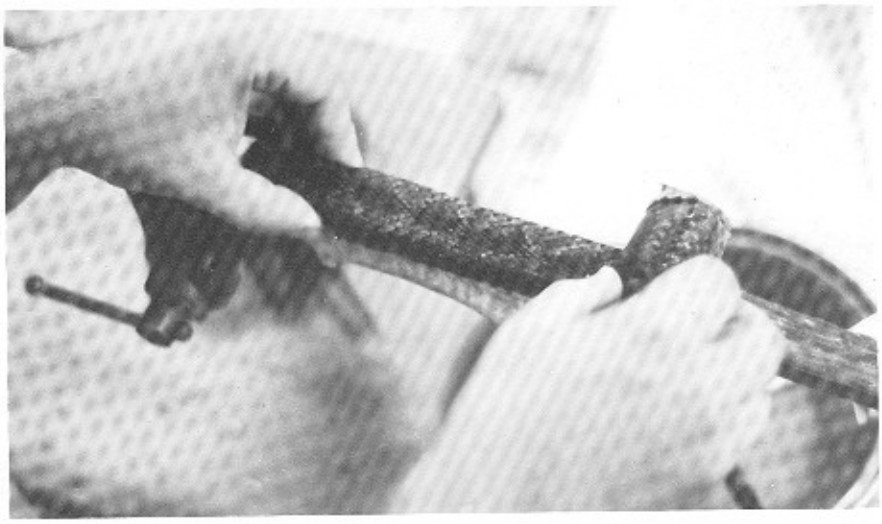
After the bow has been tested and you're satisfied with it, the belly and all other areas not covered by sinew should be sanded and steel-wooled to a smooth finish, after which the entire bow can be varnished if no other decoration is desired. The Indians used to grease their bows with bear fat or deer fat, this is okay and it's authentic, but if you live in the east where the humidity is high, I suggest you use two coats of Zar varnish. Better yet, cover that ugly sinew with a nice rattlesnake skin and then varnish it.

Since rattlesnakes are never around when I want them, I buy my skins already tanned and I get the dry ones, not those that are coated with Vaseline. While the skins are soaking in a pan of warm water the bow is given a coat of liquid hide glue. The glue should be applied only to where you want the skin to stick, this is the back and the sides of the bow. (Note: If you use the powdered glue you will have to brush it on just ahead of the skin as you roll it out and you had better make sure you have it lined up because you won't be able to move it once it's down.) Now a skin is removed from the pan and all the excess water is daubed off, then it is rolled up so that when unrolled on the bow, the scale side is out and the flesh side is in. I use two small 30 to 36 inch skins on a 48 inch bow, they are large enough to cover a limb 1½ inches wide. When placing them on, they are unrolled starting with the head end at the center of the handle and ending with the tail at the tip. After unrolling they can be stretched around a bit so the diamond pattern is in line with the center of the bow. Then some of the excess skin is trimmed off so that only a little bit overlaps onto the belly. With both skins glued down the whole bow is wrapped spirally in a gauze bandage and left to dry for a week. When completely dry the gauze is removed and the remaining excess skin is trimmed with a razor blade or exacto knife. Now the bow can be finished with two coats of Zar varnish and a leather covering wrapped around the handle. The reason I use Zar varnish is because it is flexible and will bend with the bow without cracking, it is also very hard and does a good job of protecting the snake skin.

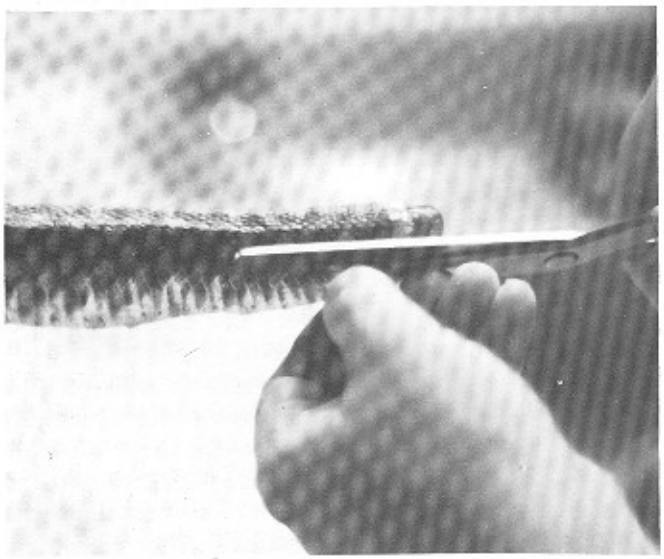
Now if snakes don't turn you on and you still want some decoration on your bow you can paint Indian style designs on it using casein tempera paint mixed with water and a little glue. These paints are very close to what the Indians used and they will stick to the sinew without peeling. Also, you might consider covering the sinew with raw hide, this handles the same way as the snake skins and it makes a much nicer surface to paint on.



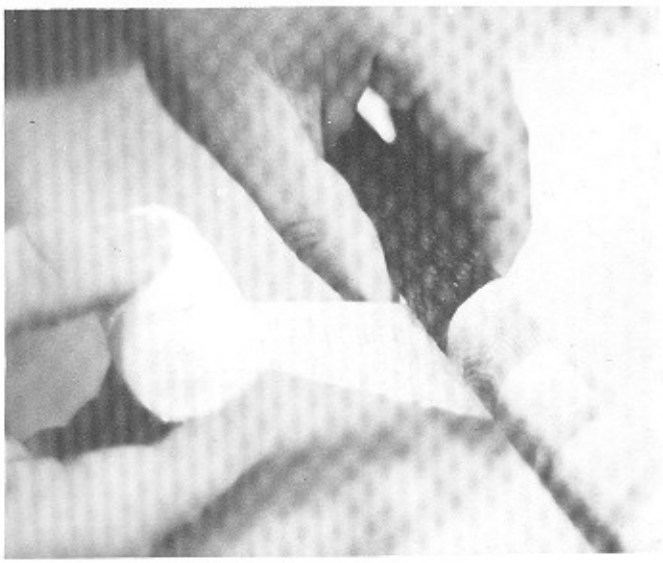
The snakeskin has been cut to length and is ready for wetting.



Rolling on the damp skin, after the glue has been applied.



Trimming off some of the excess skin with the scissors.



After being wrapped with gauze, the bow is left to dry for a week.

V. MAKING A BOW STRING

Sinew was the best material the Indians had for bow strings and the making of them is an art in itself. To make a string they twisted strands of sinew together by rolling them on the thigh with the palm of the hand. As the string grew in length more threads were spliced in. The sinew was worked while it was damp and a coat of hide glue was added when the string was finished. Frankly, I have to admit, I have never made a sinew bow string. However, I have talked at length with people who did, and they said it was a lot of work for something that didn't last very long when used. Sinew bow strings wear out quickly and they're not worth a hoot in the rain. In fact, hunts and battles were called off when clouds gathered.

Years ago when I was still shooting store bought bows, I had trouble with the serving string coming unwound, so I ran some waxed nylon tieing cord over it in a series of half hitches, this solved the problem. When the rest of the string went to pieces I made a whole new string out of the same cord and this one didn't wear out. Now all of the bows I make have strings just like that first one and no one has come back to me yet asking for a replacement. One fellow did order a spare to go along with one of my bows, but it has been 5 years and I don't think he has used it yet.

The hardest part of making the string is getting the cord. Originally it was used by electricians for tying bundles of wires together and may yet be available through an outfit that sells electrical supplies. Because it looks so much like sinew, many trading posts and black powder gun shops have started to sell it. A roll has about 500 yards on it and at the time of this writing they were selling for around $8. That seems like a lot of twine and a lot of money, but you can also use it in place of sinew on your arrows and you can sew your quiver together with it. However, this stuff will not take the place of real sinew when it comes to backing a bow, and hide glue will not stick to it very well.

To make a bow string out of waxed nylon, I use a 2 X 4 with two nails driven in it for wrapping posts. This is my "string jig". If I'm going to make a one loop string I set the nails so it will be 3 or 4 inches longer than the bow. The looped end is the removable end while the other end is simply tied, this makes an adjustable string. The two loop string is made shorter than the bow. To determine the proper length, string the bow with the tillering string and measure from nock to nock. For a longbow, correctly strung, the distance between the string and the belly of the bow at the handle should be the width of your closed fist plus the outstretched thumb or about 6 inches. This is called a "fistmell". For a short Plains bow it will be less, about 4 or 5 inches.

Tie one end of your roll of string to one of the nails with a single half hitch leaving a tail about 3 feet long hanging free. Now go back and forth between the posts until you have a number of strands spanning the distance. A bow of 30 lbs. will take 6, one of 50 takes 8, 60 and above, 10 or more. When you have reached the desired number of strands, untie the tail end and bring it around the post and connect it with the roll end. They should be tied together at about 2½ inches below the post and the roll of string cut free leaving another tail about a foot long. After this knot is tied the tails should be pulled so the waxed string will pull through the knot and tighten any loose strands.

The next step is to tie a series of half hitches with the tails above and below the joining knot. Maybe 10 or 12 hitches will be needed to secure the short tail, after which 3 loose hitches are made and the tail's end passed through them next to the string. When these hitches are tightened the rest of the tail can be pulled under and its end snipped off.

Now take the long tail and continue tieing hitches, side by side, until the loop gets narrower. The loop should be left large enough so that it slips down the limb easily, however, it should not be so large tnat it comes out of the nocks when the bow is strung.

When you have determined the size of your loop, it is made by following half the number of strands as they divide and go around the nail. Once the loop is finished about three or four hitches are tied just below where all the strands come together. If the tail is a foot or so long it can be used as a "string keeper" by tieing it to the nock, thus keeping your string in place if it will not stay by itself when the bow is unstrung. Or, this tail can be finished off and removed as you did the other.

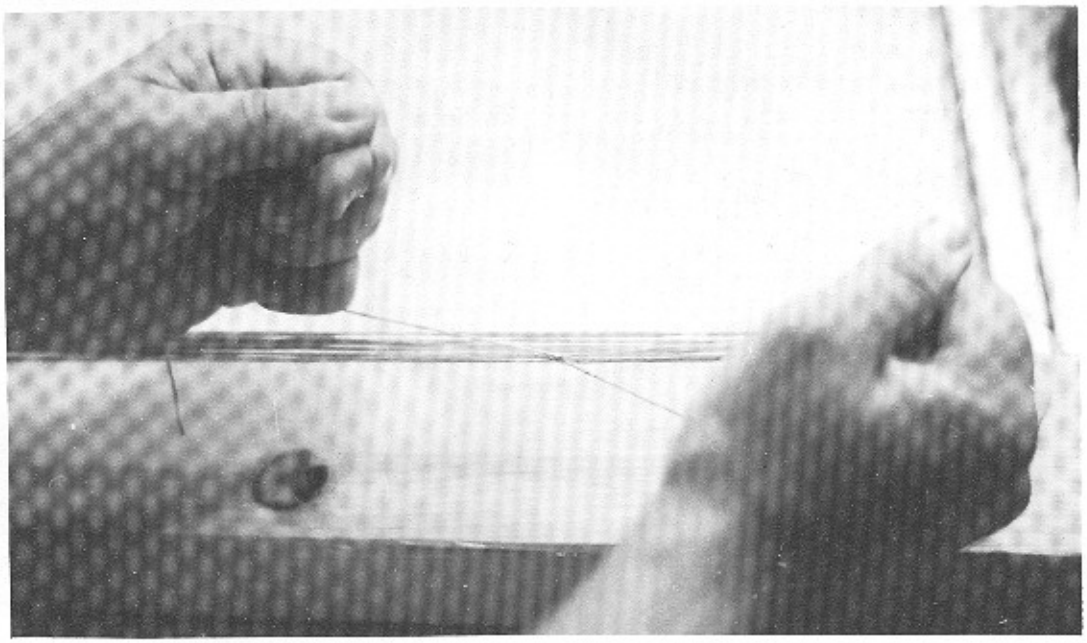
If you are making a two loop string the other end should be whipped in the same fashion, then the string can be removed from the jig and placed on the bow. A single loop string will be removed from the jig by first taking off the unwhipped end, (the string should be kept taught when this is done), twisting it up a bit so all the strands stay together and then tieing a knot in the very end.

No matter which type of permanent string you make you will have to reinforce it in the area where the arrow is placed. This "serving string" is made by marking 2 inches above and below where the arrow rests when nocked and then whipping with half hitches between these points. This will take about 3 feet of twine. After the first knot is tied the short tail is left along the string to be covered by suc-

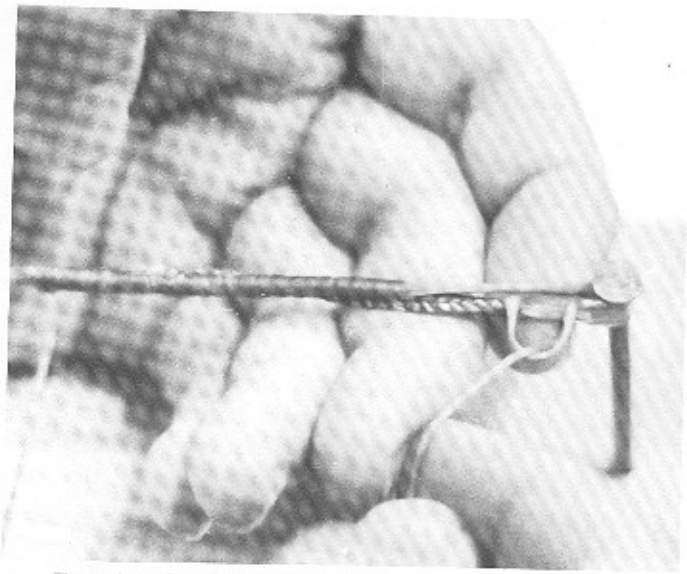
ceeding knots and when finishing the last three should be left loose and the ending tail passed through them and pulled down just like you did for the loops. This makes a nice, neat job and the tails won't come undone. Since the tillering string is used for tillering bows, it doesn't need a serving string. However, this extra long single loop string should have its end whipped for a foot or so, this allows it to be tied and untied easily without fraying. I have two of these strings, one for my longbows and one for shorter bows under 56 inches.

When working with waxed nylon, one should remember that single knots will slip and come un done when tension is placed on the string. This is wh I always tie a series of hitches with the tails abov and below a splice. Also, a string will stretch a bi at first. A single loop string can be adjusted by retie ing its un-looped end, a two loop string is adjuste by knotting it once or twice just below the loops.

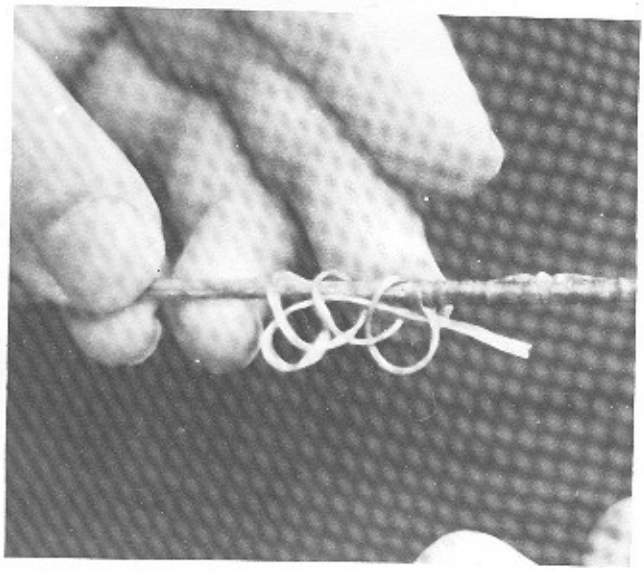
Going back and forth between the nails with the roll of waxed nylon. Note the 3 foot long tail.



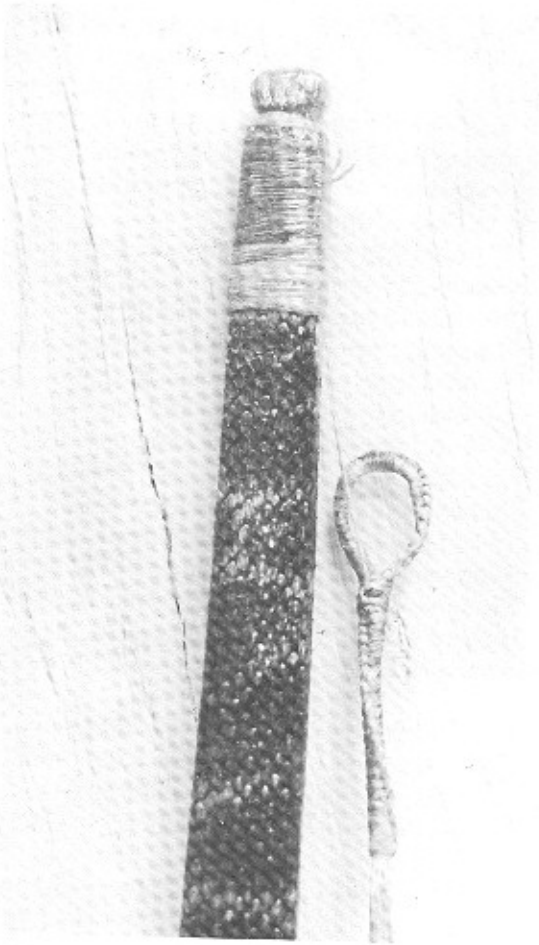
Tieing the two ends together after the desired number of strands has been reached.



Forming the loop by tieing a series of half hitches that will go around the nail.



Tieing off the tail so that it won't come undone.



Bow string with string keeper and finished sinew backed bow with snakeskin cover. Note the sinew lashing. This not only closed the crack just below the nock, but it also served to protect the snakeskin from any abrasion caused by the string.

The correct way to string a bow.

VI. MAKING ARROWS

What good is a bow without arrows? The bow, no matter how beautifully wrought, will not realize its fullest potential until the same love, time, and care are spent in making its arrows. My authentic arrows have shafts made from dogwood shoots, fletching lashed on with sinew, glued with hide glue, and heads of flint or sheet iron. The best arrows (performance wise) I ever made for my bows were those with Port Orford cedar shafts, feathers lashed on with waxed nylon cord, glued with plastic model cement and pointed with modern field or target tips. In this chapter I will show you how to make both types of arrows and I have also added detailed illustrations of some of the other types of arrows that you may find interesting.

The first step in making your primitive arrows is the collecting of shoots for the shafts. For my arrows, I use red dogwood, also called osier (Cornus stolonifera) or stiff dogwood (Cornus stricta). I have also used other straight, but unidentified hardwood shoots as well as cane. Dogwood shoots (actually tiny saplings) can be found growing in the rich soil of creek bottoms. If you are lucky enough to find a tree that has been cut or pruned, there will be many of these shoots sent out as the tree attempts to grow back. This happened once when my neighbor trimmed his stiff dogwood hedge, guess who got all the cuttings. In the southern regions of the country, cane was used a great deal by the Indians and I have made some cane arrows with hardwood foreshafts like the one illustrated. The hardest part of making these shafts is sanding down the joints and getting the foreshaft to fit properly.

After you have cut your shoots in February or March, they should be stripped of their bark, straightened a bit by bending while they are still moist, and then tied in a bundle and left in a warm, dry place to season. Dead standing cane that has not had time to rot can be cut at this time, or green cane can be cut in the summertime. However, these must be dried until stiff and golden yellow in color. Cane will not shrink much while green shoots may lose 20%. Shoots that are just under ½ inch in diameter will make shafts near 5/16 when peeled and dried. By June they are dry enough that they can be taken from the bundle and made into arrows.

Dogwood shoots can be used to make either Plains or woodland arrows. The standard Plains arrow shaft is about 23 inches long while the woodland shaft can be 26 to 30 inches in length. Cane arrows will be longer because the foreshaft will extend their length another 4 to 6 inches. These arrows are not drawn beyond the joint between the two shafts. Dogwood shafts are finished by cutting to length, whittling off any prominent knots, straightening by heating and bending, then they are sanded down and the nocks sawed out and filed smooth. Keeping the shafts round and straight while sanding was a problem. This was solved by sanding them between a pair of grooved sandstone blocks. I use wooden blocks covered with sandpaper, (see photo). As mentioned before, the joints on cane have to be sanded, however, I leave one joint unsanded above which I cut the nock, this prevents splitting. The Indian always put the nock in the large end of the shoot so he could narrow the shaft just below it. Bulbus or expanding nocks were a trade mark of Plains arrows and were a big help when the Indian drew them by pinching the nock between his thumb and forefinger. This is called the primary release. The secondary release, where the middle and third finger assisted was also used. Today we use the Mediterranean release, (tip of the forefinger wrapped around the string above the nock and second and third below), so it is no longer necessary to go to all the trouble of whittling the shafts down to form expanded nocks unless you want super authentic arrows or you are going to shoot Indian style.

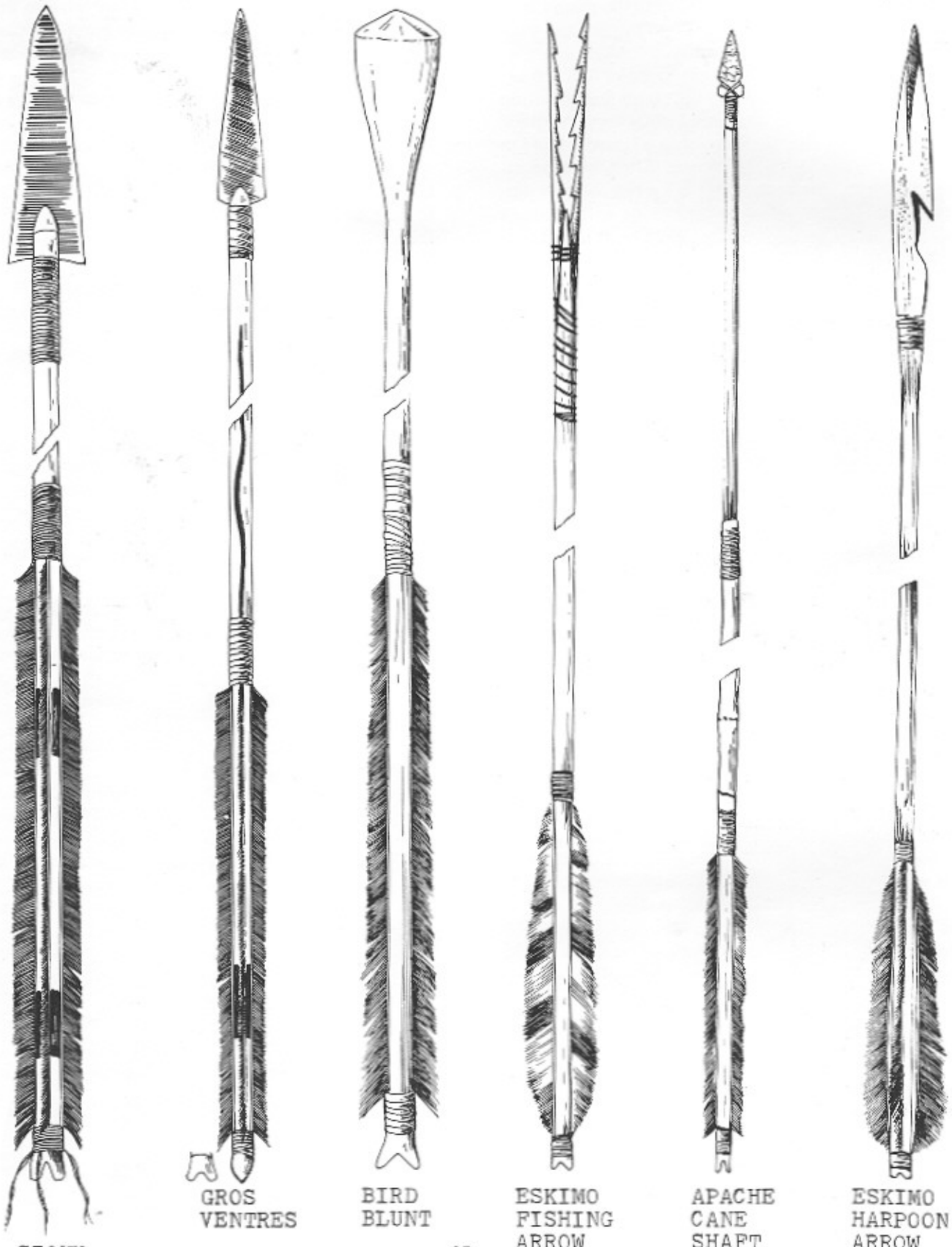
If you aren't up to spending hours in a stream bed looking for straight saplings, then you can use 5/16 birch dowel rods, .36 caliber hickory ramrods, or better yet, Port Orford cedar arrow shafts. The dowel rods come from the lumber yard, the ramrods from a black powder gun shop and they must be examined carefully, checking for straightness and those with cross-grain should be rejected. The cedar shafts are spined and you should buy those that fit your bow. Most large archery shops will still have them, however, you will get them cheaper if you order them by the hundred from Acme Wood Products. When I use these milled shafts I always cut the nock in across the radial grain so as to lessen the chance of splitting.

For fletching I use turkey tail feathers. That's right, tail feathers! Most people use wings, but I use tail feathers because they are easier to cut and trim, and in the case of long, low, Indian style fletching they stretch out and lay down better. The only drawback is that turkey tail feathers are not as durable as turkey wing feathers, but neither were the now illegal feathers from predatory birds that the ancients used. Unless you are a successful turkey hunter then wild turkey feathers may be hard to come by, however, there is always the rendezvous or the Indian arts and craft store. Most archery stores sell precut feathers but they are too small for

VARIOUS NORTH AMERICAN ARROWS

not to scale

(After Mason)



SIOUX

GROS VENTRES

BIRD BLUNT

ESKIMO FISHING ARROW

APACHE CANE SHAFT

ESKIMO HARPOON ARROW

what you want. I get my bronze turkey tail feathers from Schwartz & Son, Inc. and I buy them by the pound. That's about 400 feathers to the pound so if you have friends you can save by getting your feathers and shafts in quantity.

It takes about 18 feathers to make a dozen arrows, if you don't mess one up, so plan on splitting about 20. To split my feathers I use a very sharp exacto knife and I lay them down on a board while I'm cutting the quills up the center. After splitting all the feathers I take one and make a template by cutting it to about 8 inches and trimming with scissors so that an inch and a half of bare quill is left forward of the vein and 1 inch is left behind, then I trim the vein down to about ¼ inch. If you want veins longer than 5½ inches or taller than ¼ inch that's okay but I have found these to be the optimum. Most of the arrows I used to make for the tourists had bigger feathers but they flew slower than the ones I made for my own use. Using the template feather as a guide, I now cut the others, after which the excess pith is carefully trimmed off with the knife. When all the feathers are cut and trimmed I sort them out according to left or right hand spiral, then gather them into groups of three and tape them together.

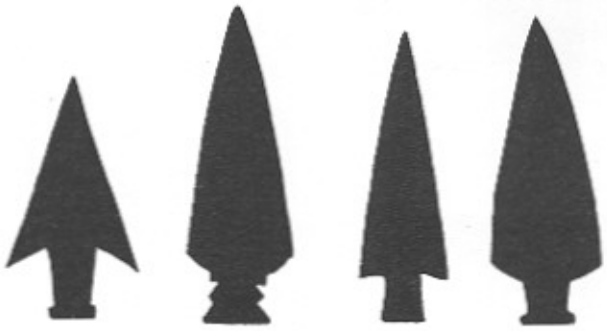
There are two ways I lash my feathers on the shaft, the easiest way is to tie them on backwards 1 inch below the nock and then fold them over and lash down their forward ends. This was done a lot in Central and South America and there was no need to glue the feathers down. The other way is to lay the three feathers along the shaft at equal intervals and lash them at the nock end first, as always, and then at the forward end with the feathers being pulled down with a pair of needle-nosed pliers just before the lashing is finished. This last method was used in North America and the feathers and the lashings both were glued. This type of fletching, though more time consuming, is better because the feathers stay close to the shaft and will not loosen with shooting or when the temperature or humidity changes.

If sinew is used for lashing it should be soaked in warm water to soften it and threads of about 16 to 18 inches should be used. Back strap sinew would be your best bet. For most of my arrows I use waxed nylon that has been split into finer strands and when it is glued with plastic model cement it looks just like sinew and it's waterproof. Since this cord is slippery and knots on the lashings are ugly, I lay down a loop that goes under the lashing and catches the tail at the other end. When finished I just pull the loop under and cut off both tails, (see photo). This doesn't work for real sinew and I use a half hitch around the shaft to hold the tail down and then I glue the lashings and the feathers with hide glue.

For authentic arrows I use flint or steel heads that I make myself, for arrows I shoot all the time I use modern field or target tips. Decent flint arrowheads of modern make are getting hard to find because most commercial knappers (myself included) don't want to fool with them. If you do find some for sale, don't be surprised if they are $5 a piece or more for good ones. Actually, small arrow points of obsidian, bottle glass, or chert flakes are not that hard to make once you get the hang of it. *The Art of Flint Knapping* and *Story in Stone*, the other two books in this series, will be very helpful if you decide to do a little chipping. The metal heads can be cut from scraps of sheet steel with a hacksaw and a file, they can also be purchased. The modern points can be found at an archery shop or ordered by mail. Stone and steel broadheads are set in grooves cut with the hacksaw, then they are glued and lashed down. (I ignore the myth that these heads were set perpendicular for animals and horizontal for humans and just set them in line with the nocks). The modern socketed joints are pushed on and a set punch or nail used to dimple them so they won't slide off easily.

For decoration I usually paint red, yellow, and black bands on the area of the fletching before the feathers are put on. Also, lightning grooves can be cut into the shaft before or after fletching. The Indians believed that these grooves, usually 3 in number, would cause their arrows to fly straighter and strike with the power and speed of lightning. I don't know if they were put on woodland arrows but they were a big thing with the Plains Indians. Again, they are a lot of extra work, even when I use a nice V-gouge (see photo), so I mostly put them on my authentic display arrows.

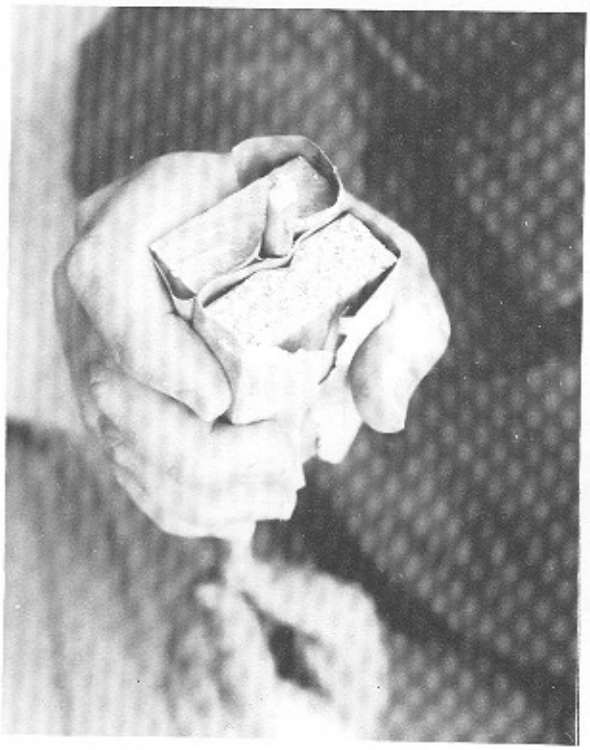
Before closing, let me tell you a secret. No matter what you are using for shafts or how carefully you make your arrows, there will always be those that will fly better than others. To find them, shoot each of your arrows separately a dozen or so times at the same draw and at the same target. Those that shoot straighter can be isolated and marked. The next time you shoot to impress your friends, use these arrows, then you have only yourself to blame if you miss.



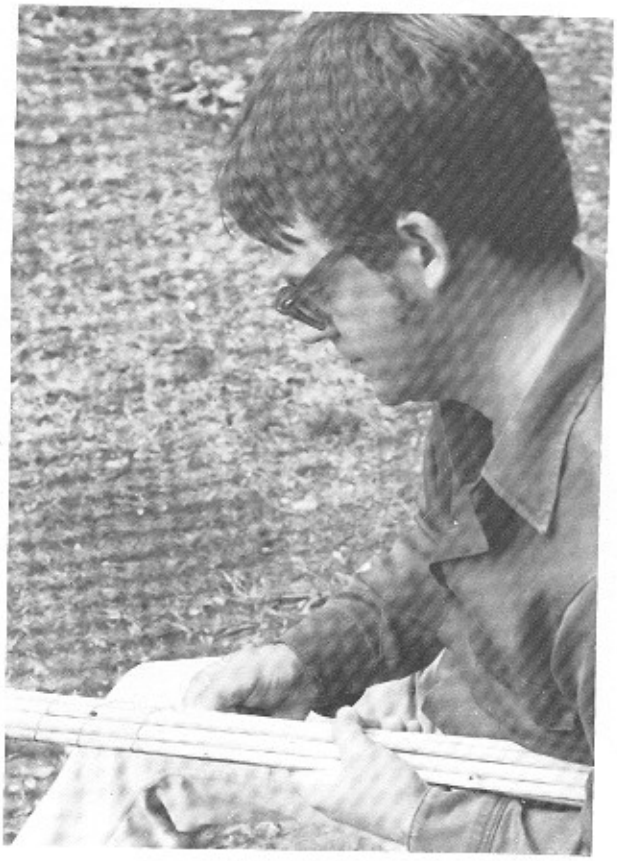
Old style steel arrowheads

Cutting a dogwood sapling.

Peeling the sapling with a knife.

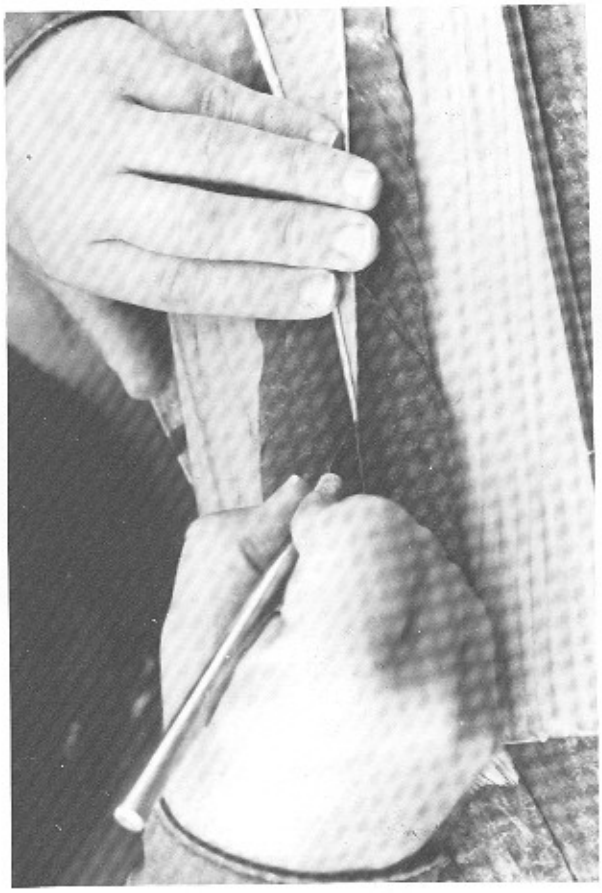


Special sanding blocks for smoothing the shaft.



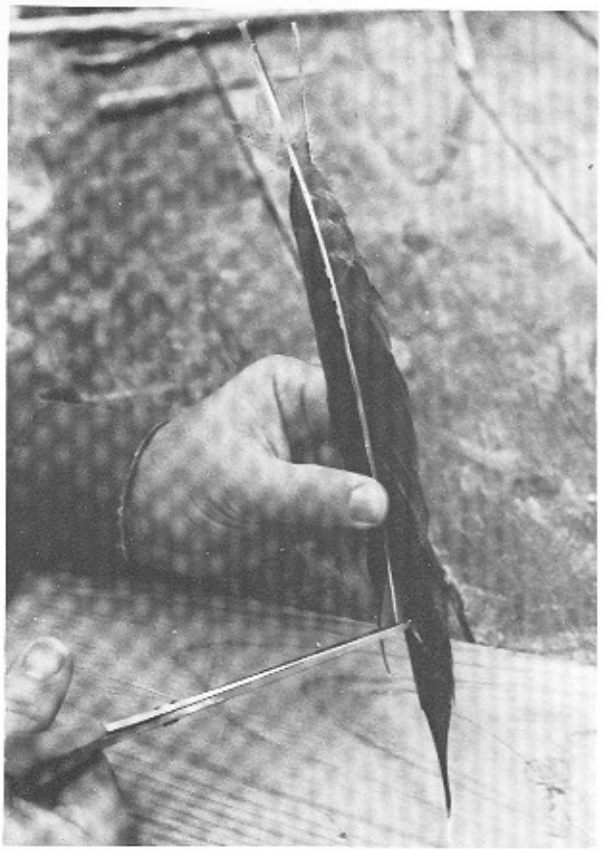
Tieing the shoots into a bundle in preparation for drying.

After being cut to length, a rough nock is made with the hacksaw.

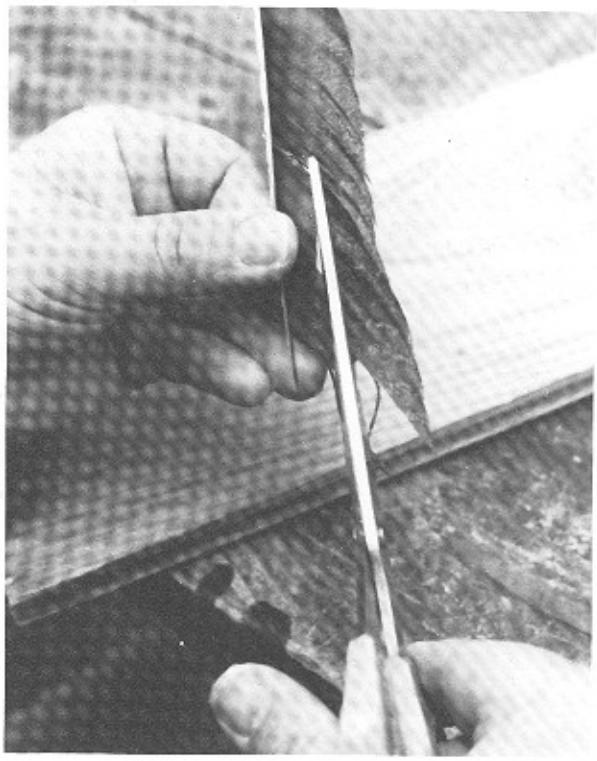


Splitting a feather with the exacto knife.

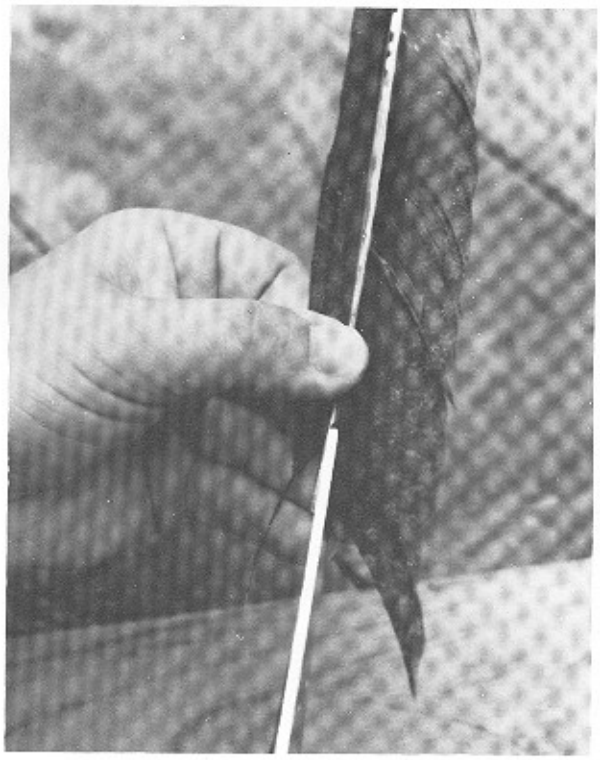
Finishing with the exacto knife and rat tail file.



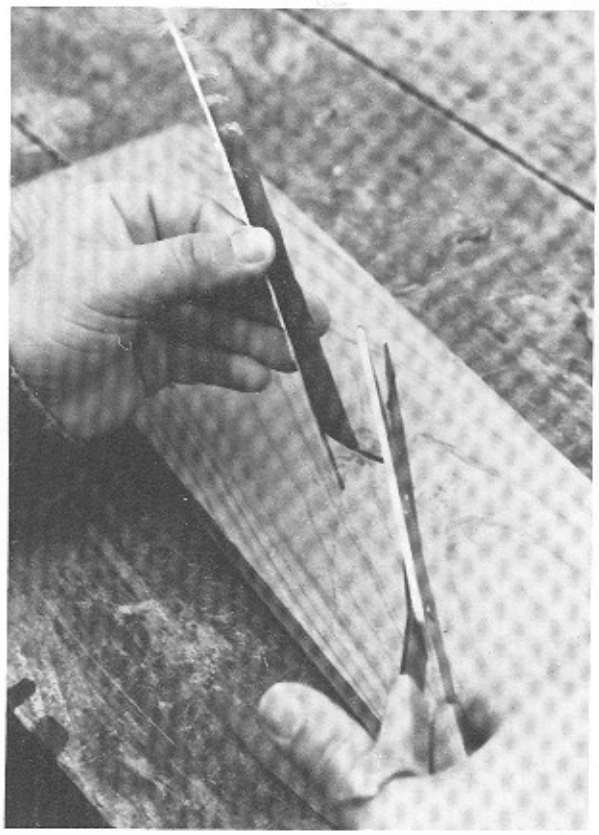
Using the template feather as a guide, the other feathers are cut to length.



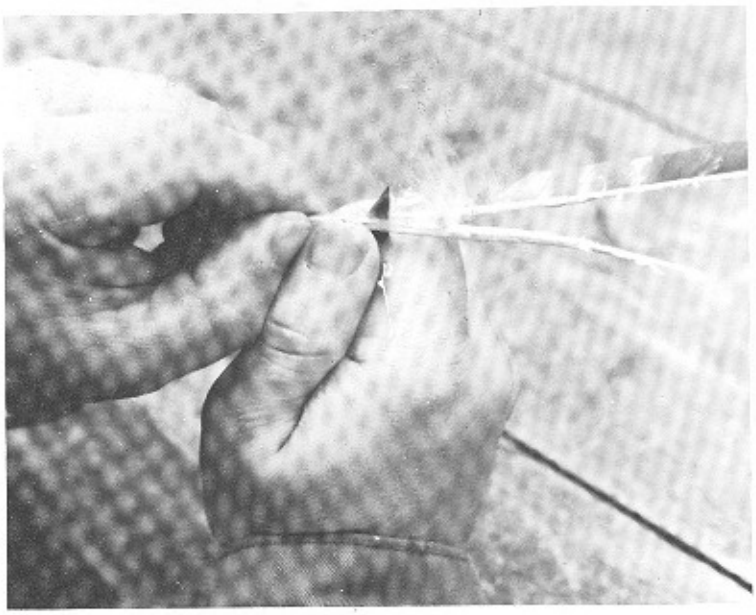
Trimming the vein.



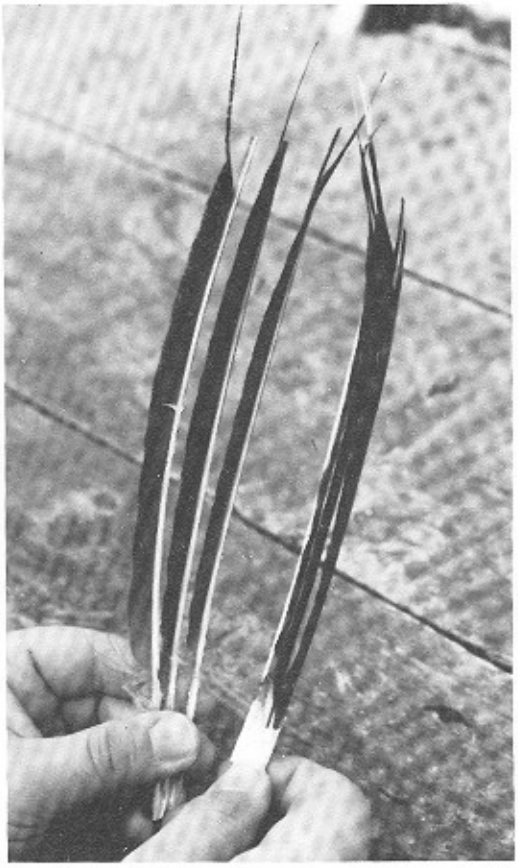
Trimming the nock end using the template feather as a guide.



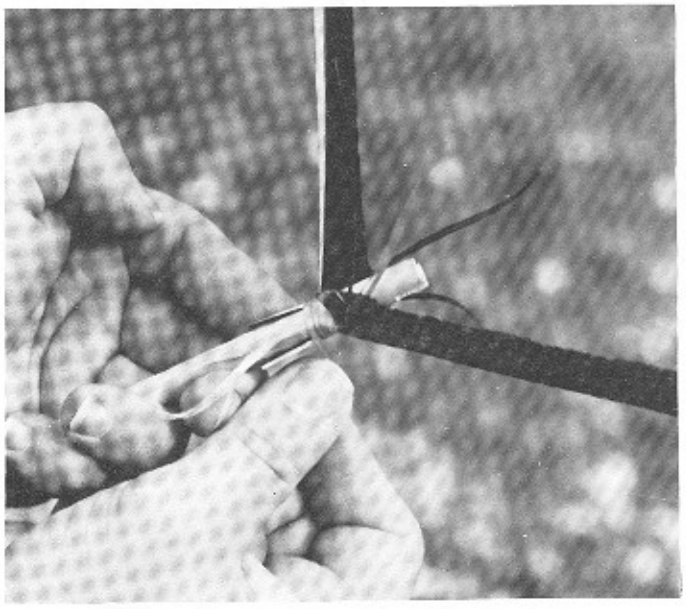
On some of my arrows I leave a little decorative tail, which is being trimmed to the proper length.



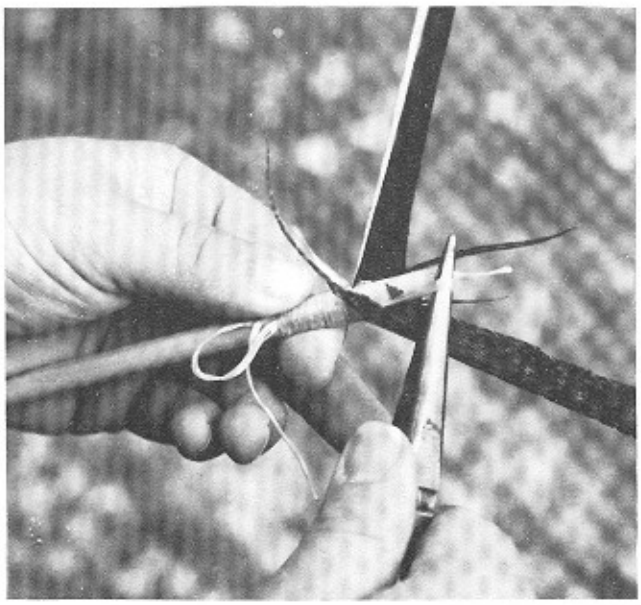
Cutting off the excess pith with a very sharp exacto knife.



After sorting into left and right hand piles, the feathers are divided into bundles of three. Note the tape used to hold them together.

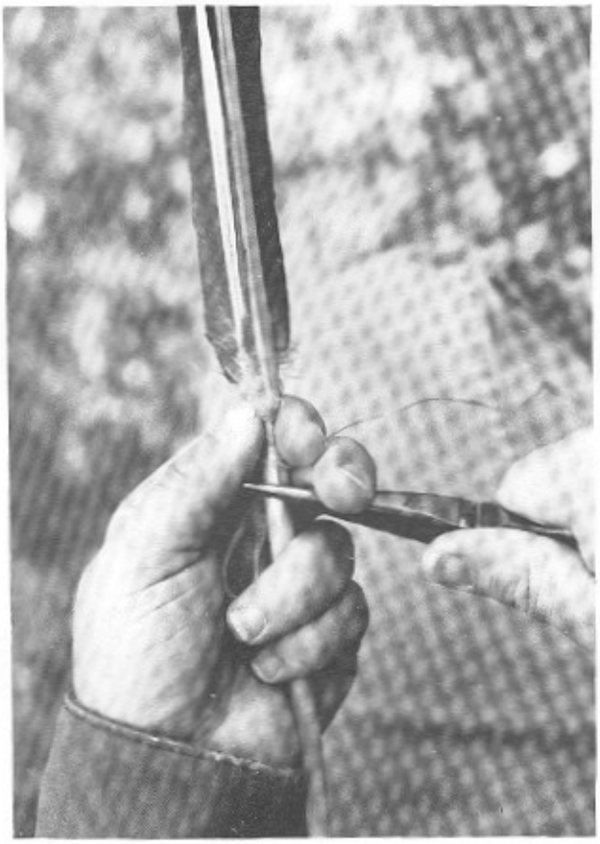


Lashing the feathers on backwards, South American style. Note the loop left to catch the tail.

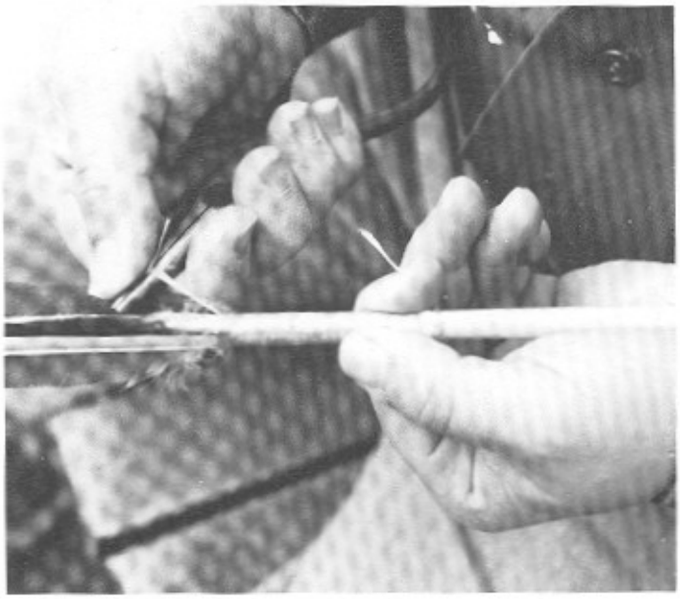


Using the needle-nosed pliers to pull the loop under the lashing, after which the tails are cut off.

Folding the feathers over.

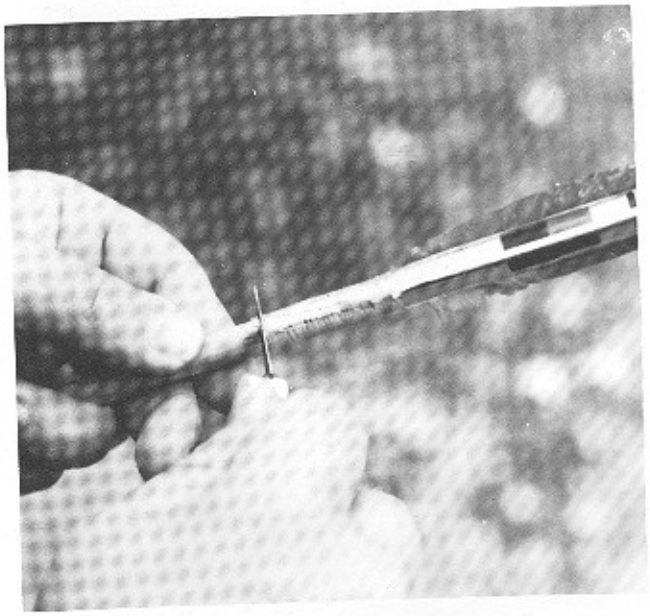


When lashing is half complete, the feathers are tightened by pulling on them with the pliers.

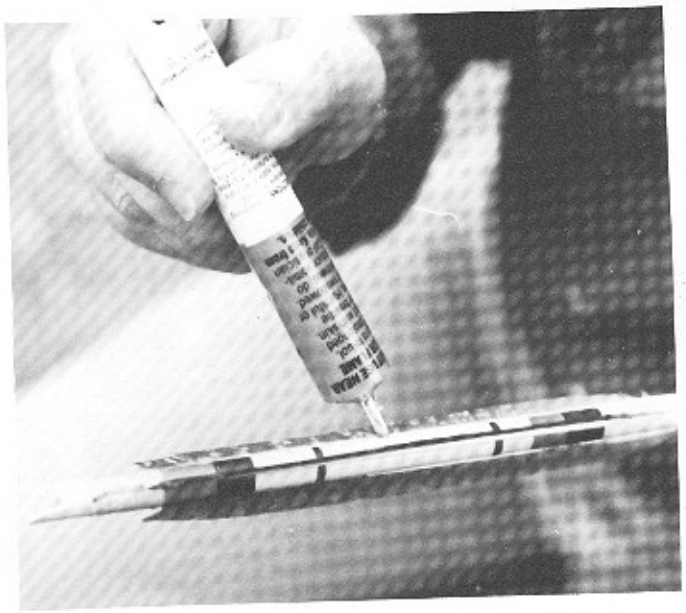


The fletching complete, the tail is pulled under and trimmed off, the same as was done for the upper lashing.

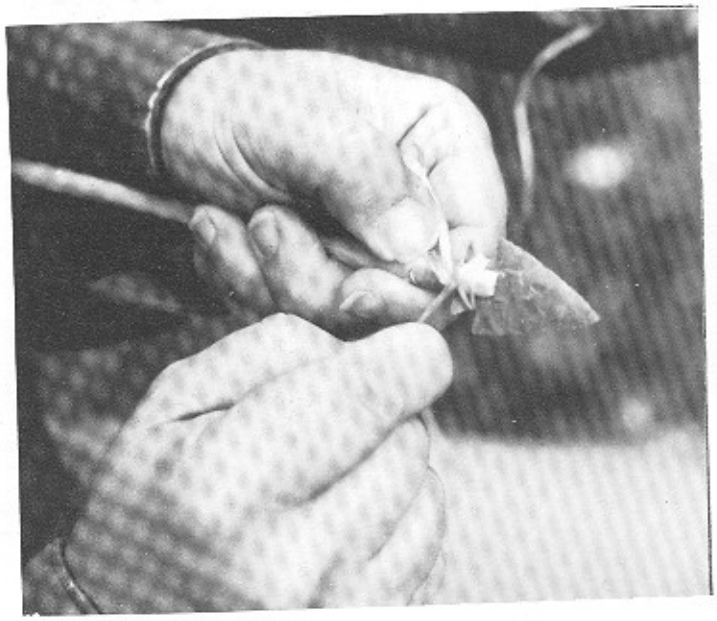
Lashing feathers on North American style. Either style of lashing can be done with real sinew or waxed nylon. The waxed nylon is better because you can use it continuously without splicing and it's waterproof.



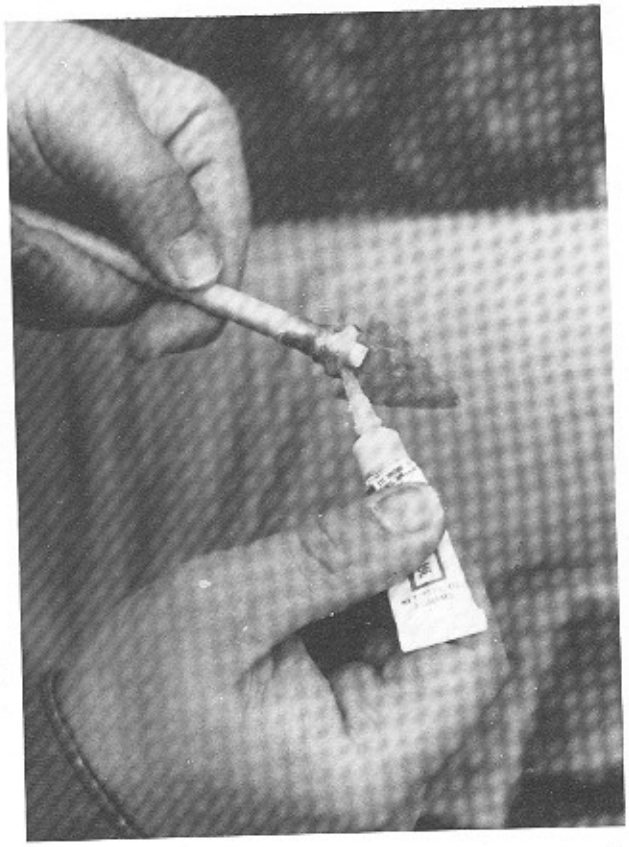
With lashings complete, a little bit of the feather may protrude, cut these off with the exacto knife.



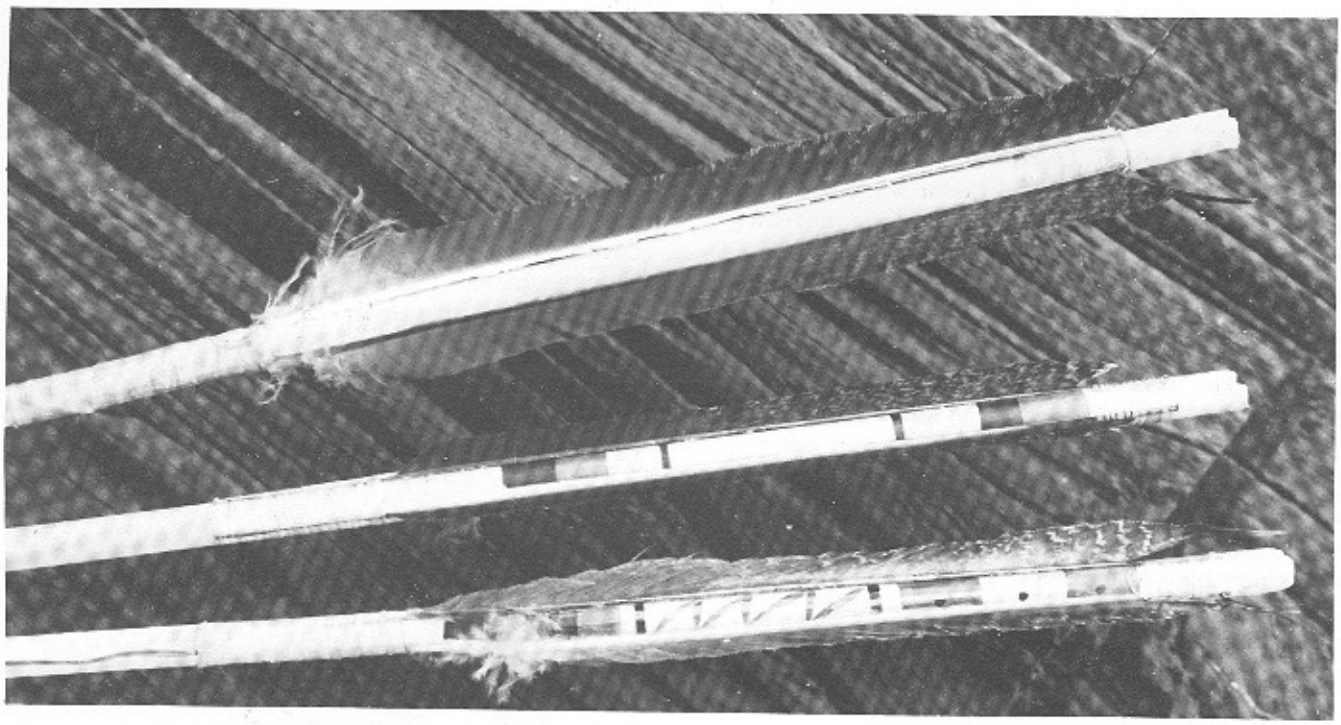
Gluing the feathers and the lashings. Plastic model cement is used for waxed nylon and hide glue is used for sinew.



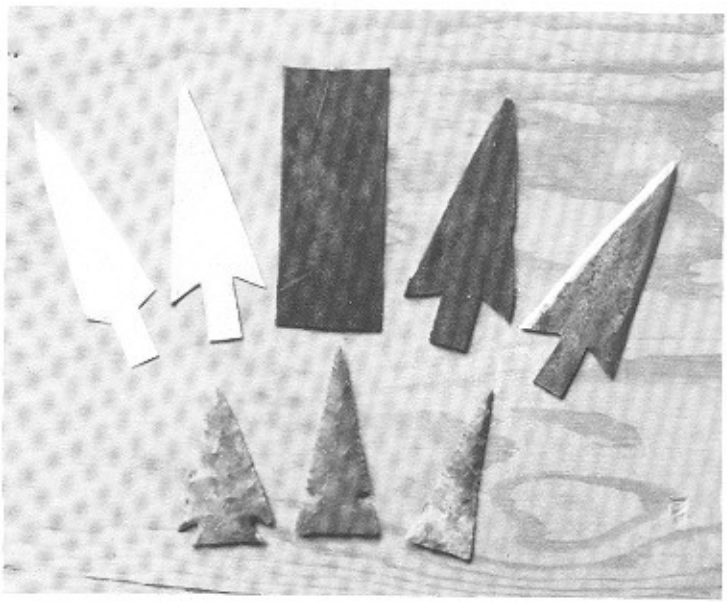
Lashing on a flint arrowhead.



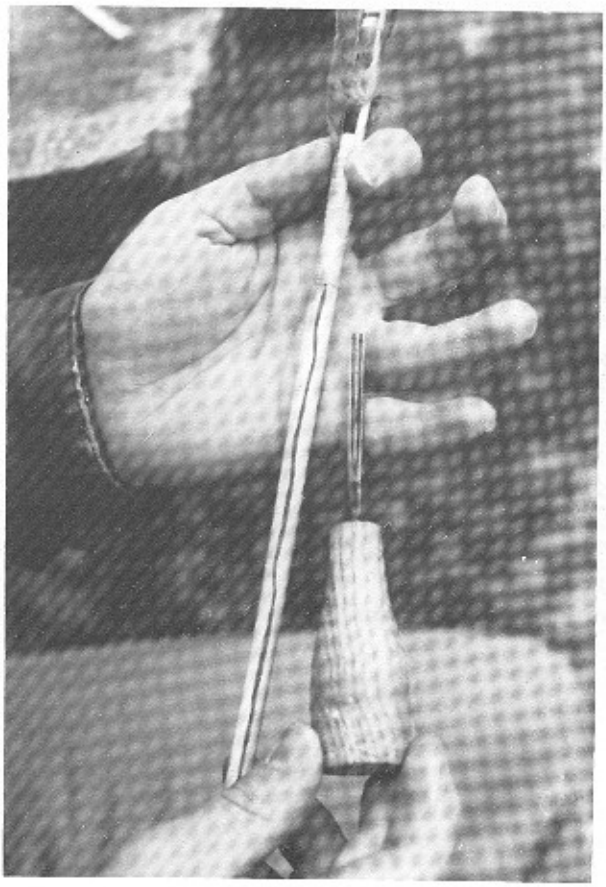
If waxed nylon is used, then the head is glued with superglue for insurance. If sinew was used, then glue it with hide glue.



Three arrows made by the author. Top: South American style fletching, lashed with nylon. Center: Plains style target arrow, lashed with nylon split into fine threads. Bottom: authentic Plains arrow with dogwood shaft, lightening grooves and fletching held in place with sinew and hide glue.



Paper patterns for steel arrowheads, steps for making steel arrowheads, and three flint arrowheads.



Lightening grooves can be cut in with a small V-gouge, after which they are painted with red paint.

VII. QUIVERS

The two basic types of quivers that will be covered in this chapter are the woodland and the Plains. These are the two we most often see in museums, the latter being more common. The woodland quivers of the East Coast were made of woven fibers so they looked like very long, narrow, baskets, however, animal skins were also used. The two woodland quivers illustrated are both made of leather and are more durable. The Plains outfit has a shorter quiver and includes a case for carrying the unstrung bow when not in use. They were made of buckskin, cow hide (often with the hair left on), buffalo hide, beaver, otter, mountain lion and others. The sets shown here were either made by the author and his wife or were drawn from old specimens. These will give you some ideas, you can copy them, design your own or use some of the techniques and materials mentioned to help you make copies of other specimens you have seen.

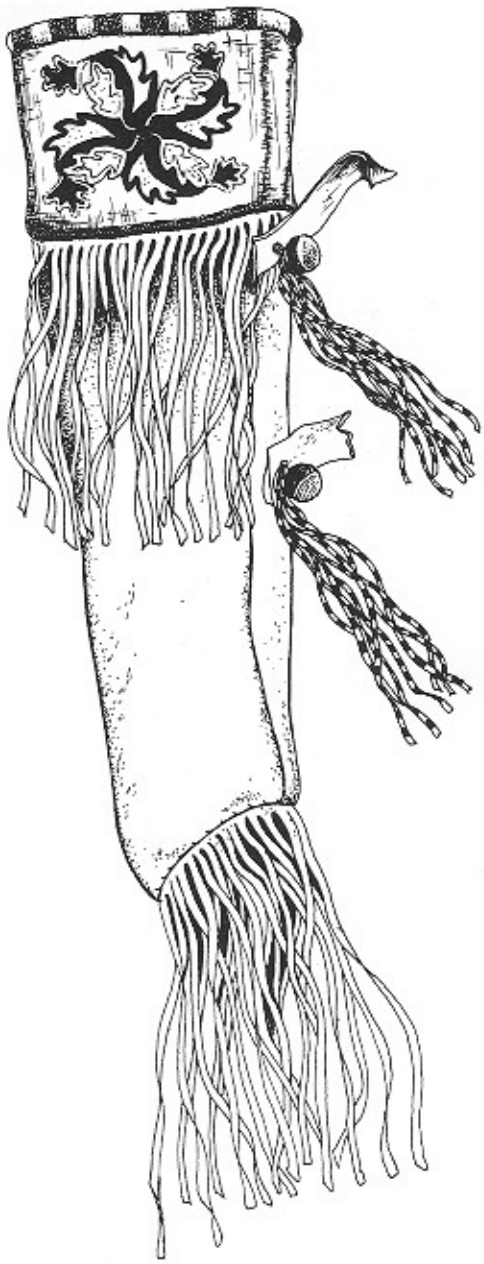
OLD OJIBWA QUIVER. The only old woodland quiver that I have ever seen is one shown in a photo on page 68 of *Beads: Their Use By Upper Great Lakes Indians*. This beautiful quiver is about 38 inches long and 8 inches wide at the mouth, the bag or part that held the arrows was about 27 inches deep and a round disk of hard leather was carefully sewn into it to form the bottom. Its cuff was covered with red wool cloth and beaded in a floral pattern. It was thought to have been made by an Ojibwa around 1875 from a piece of brain tanned moose hide. To me, this is the ultimate woodland quiver and I'm hoping Valerie will make a replica for me someday, at least she has gone so far as to illustrate it for this book so that we may share its beauty with you.

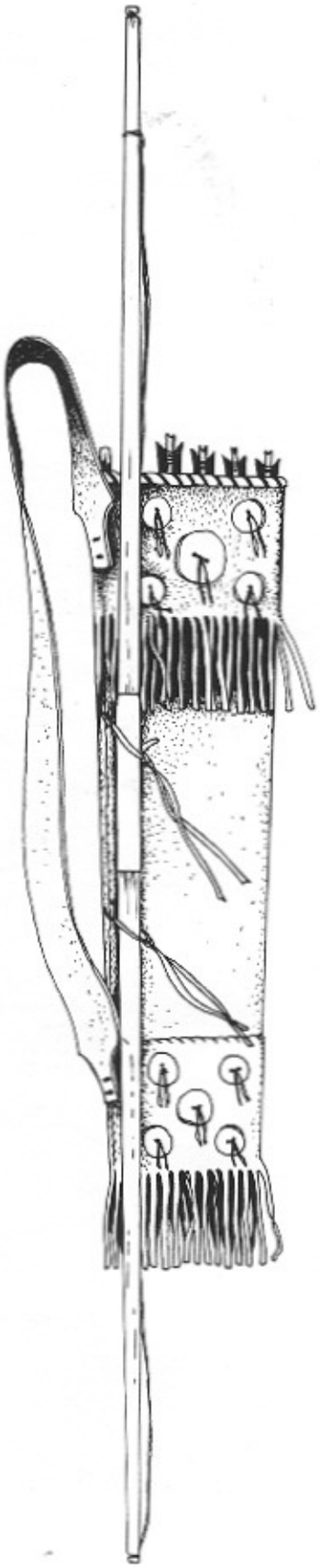
MODERN WOODLAND QUIVER. The details of the woodland type quiver I am now using have also been illustrated. Note that it is equipped with a "stiffener" to keep it from bending and pushing the arrows up and out as it lies across the back. Because the Indians used soft and not hard leather, every one of these quivers had a stick tied to either the outside or the inside. The straps were fastened to this stick and in the case of this quiver, the two loops that hold the bow when this outfit is hung up or carried are also fastened to it.

The 60 inch bow that this quiver goes with has a peculiar but useful antler tine arrow rest and this hangs up on the first loop, thus preventing the bow from sliding out. If your bow does not have an arrow rest like this, then it may have to be tied down to the quiver. I don't know if loops were used in the old days but I find them convenient and both quiver and bow look nice hanging together. The leather I used was double suede elk hide and the lower and upper cuffs are decorated with abalone shell disks.

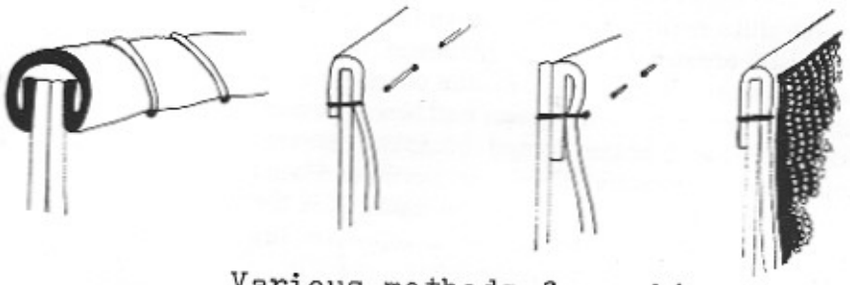
This type of quiver can be used with any of the longer bows shown in this book or it will serve a modern bow just as well. The only thing to remember is that the Indians used sinew for lashing on the fletching, and they made their quivers deep enough to cover all but the last inch and a half of their arrows. This protected them from moisture. This is not necessary for modern arrows or for arrows having nylon lashing, however, I like to make my quivers in the old style.

OLD OJIBWA QUIVER

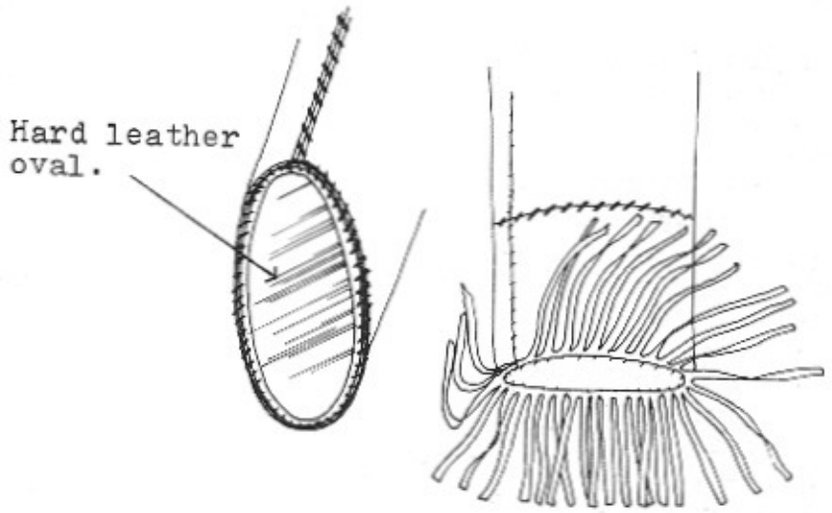




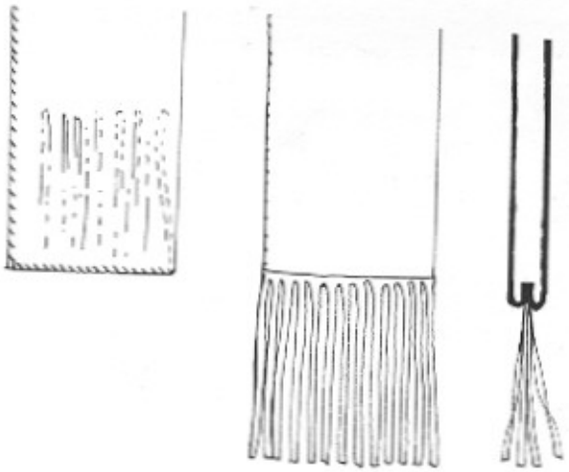
MODERN WOODLAND QUIVER



Various methods for making a rim for the quiver.



Quiver with round bottom is sewn together inside out and a hard leather oval is glued in. Then it is turned.

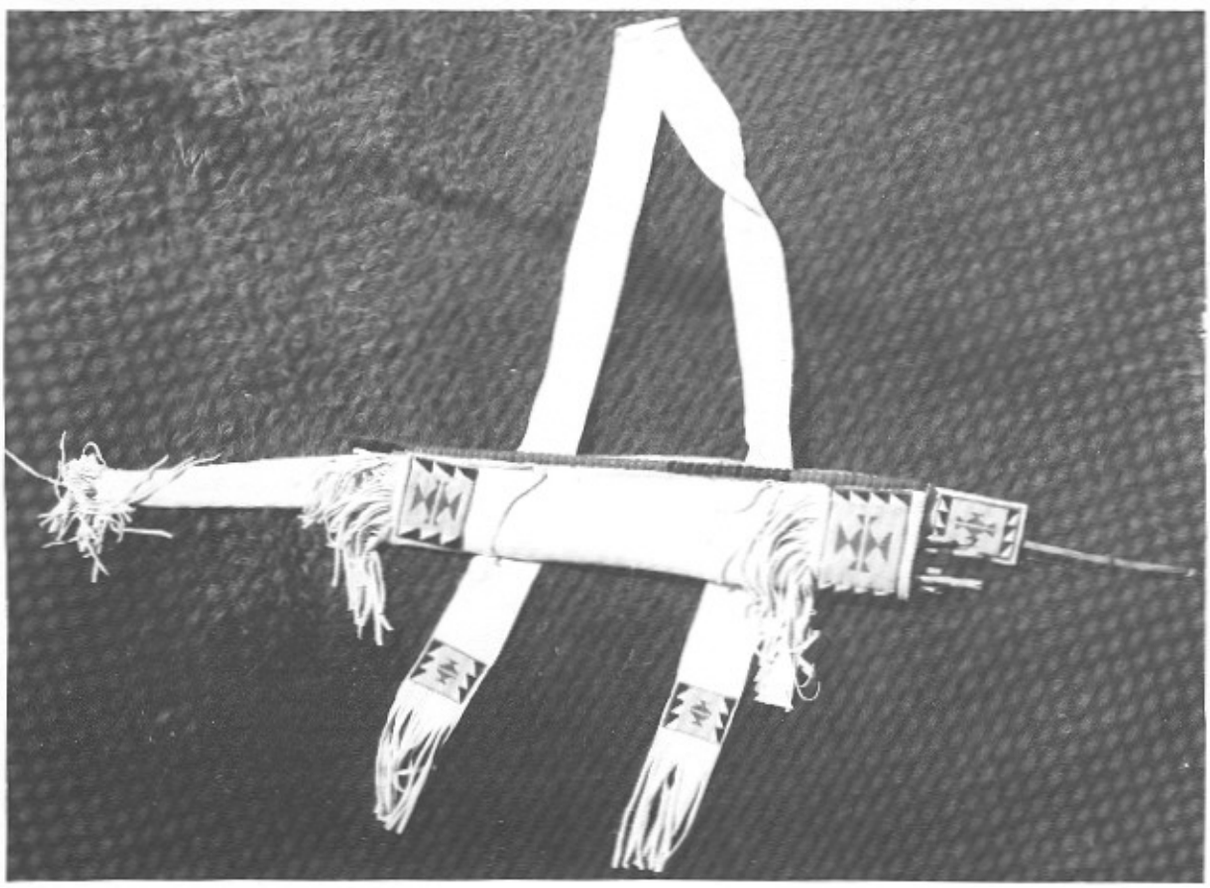


Simple straight bottomed quiver includes the fringe when it is sewn together.

NORTHERN PLAINS QUIVER AND BOW CASE. Though still a rarity, there are quite a few old Plains outfits still around that can be examined, therefore we know more about them. Over the years we have built some beautiful Plains quiver and bow case combinations out of brain tanned buckskin, beaver, mountain lion and otter skins. My Northern Plains quiver is made of brain tanned buckskin, it is the simplest of these and also serves to represent the standard.

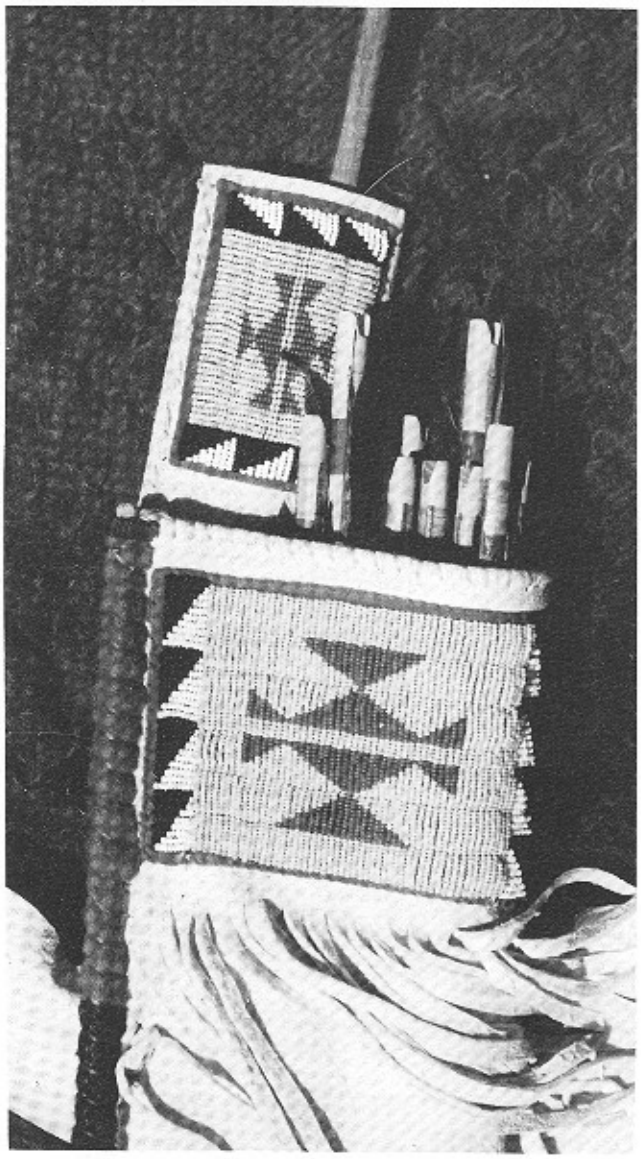
It has patches of red cloth covered with red, yellow, black and white beads sewn on using the lazy stitch method. (Any good book on Indian beadwork will help you with the details of sewing and correct patterns.) If you don't like to do beadwork the cuffs can be painted or left plain. The stiffener was tied to the outside along the seam and then covered with a long strip of wool trade cloth which was sewn on spirally with waxed nylon. The nylon is used in place of sinew for all the sewing we do, it is much more convenient to use and will not rot. The beads were sewn on with special beading thread which is also better than sinew and far easier to use. The bottom of this quiver does not have a round, hard leather piece, it was just sewn together (inside out) incorporating the fringe and then turned. Directions for making both types of bottoms are clearly illustrated. The advantage of the round bottom is that it increases the quiver's capacity while lessening the chance for an arrow to poke through.

Two 16 inch buckskin thongs looped over and passing through a pair of holes punched into the bow case, strap and quiver, hold the set together. Waxed nylon can also be used, especially on fur sets, although with buckskin thongs the knots and trailing tails add to the decoration. When assembling the Plains quiver and bow case, keep the following in mind. Originally, Plains outfits were worn over the left shoulder instead of the right. When hunting or fighting they were brought around under the left arm so that the arrows stuck out in front at waist level, this made them easy to get at. We always made ours so they hung over the right shoulder since they were made for White Men, who seemed to like this way better. Old quivers seen in museums may be done either way, they are so old that many of them have fallen apart and some repair work was done on them years after they were collected.

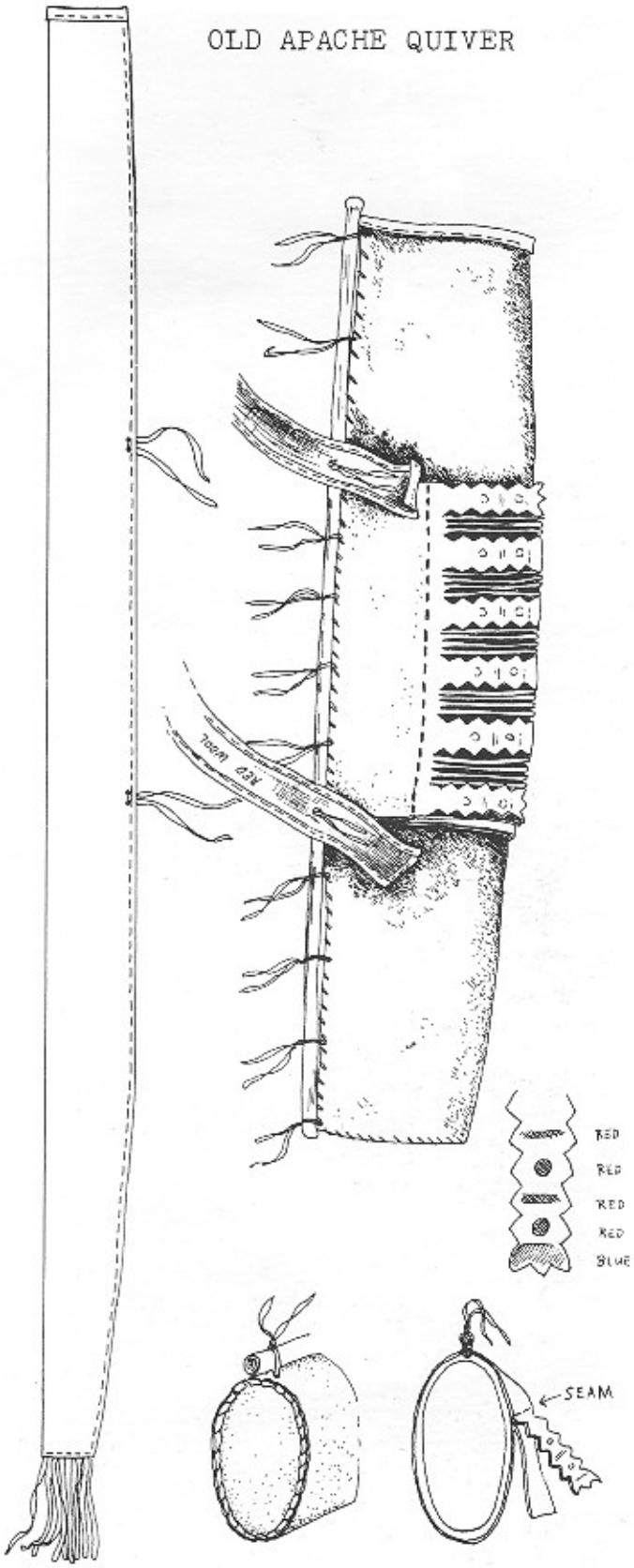


The author's Northern Plains quiver, made of brain tanned buckskin and beaded in the lazy stitch style.

OLD APACHE QUIVER. This old Apache quiver we found in the Firelands Museum in Norwalk, Ohio. It is made of the hide from an unborn horse (the hair still on) and has narrow and broad serrated fringe on a wide belt that goes around the middle. The broad fringes were painted with red and blue stripes and spots. The stiffener was tied on with thongs spaced about every two inches, and the strap was also fastened on by thongs. This quiver once had a simple, undecorated, detachable bow case that would have been tied to the strap thongs. It is probable that the Apaches removed the case when the bow was in use, and because it was not permanently attached to the quiver, this may explain why this and some other Apache quivers I have seen had no bow cases.

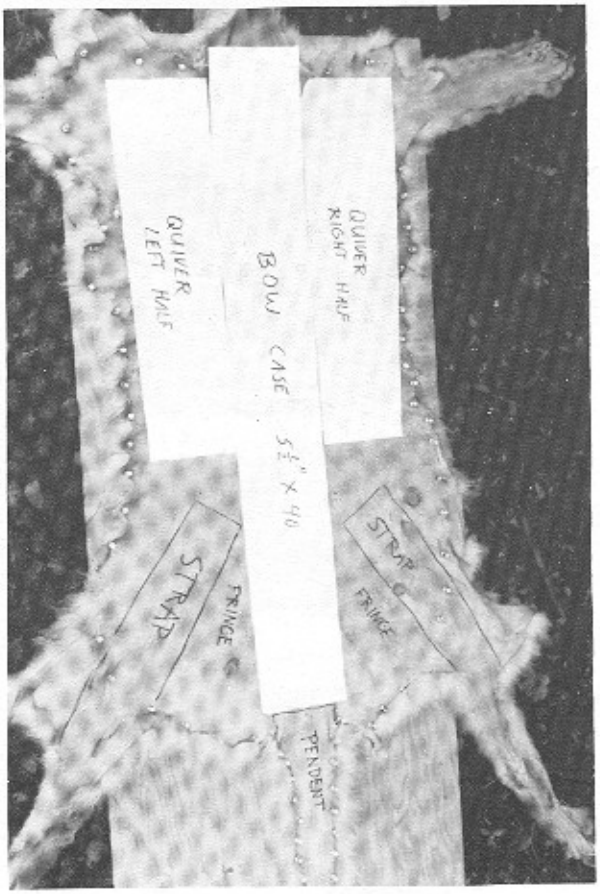


Details of the brain tanned buckskin set showing beadwork and cloth sewn to the stiffener.



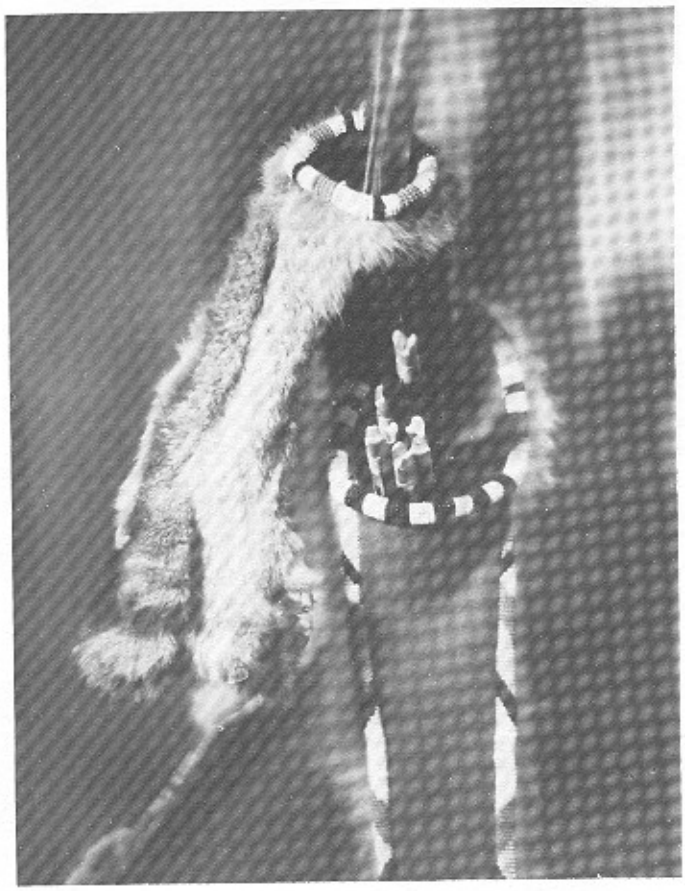
Detail of bottom and cross-section of quiver.

Valerie with 6½ foot mountain lion skin.



The skin all stretched out and pegged down, with templates lieing in place.

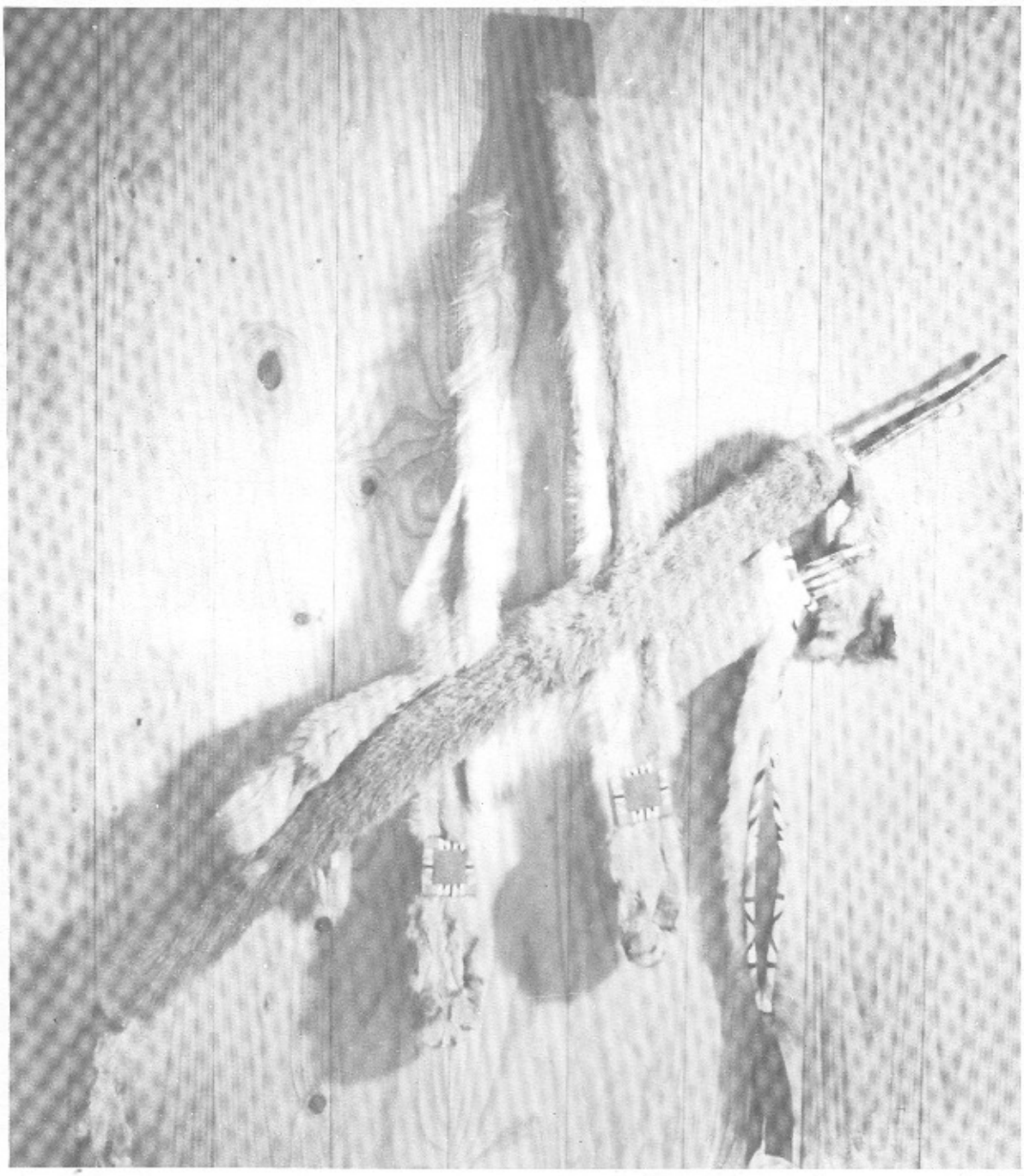
KIOWA MOUNTAIN LION QUIVER AND BOW CASE. This is an improved replica of the magnificent Kiowa outfit shown on pages 434, 435, and 506 of *The Mystic Warriors of the Plains* (Mails 1972). It was made from a single 6½ foot mountain lion skin using the body for the quiver and bow case, the legs for part of the straps and appendages on the case, and part of the tail for the pendent hanging from the mouth of the quiver. The head was later used for the flap on the strike-o-light bag which goes with this set. We enlarged the hide by dampening it, stretching and tacking it down. When the hide dried we had gained 4 inches on the sides and we used almost every scrap on the construction of this set. The improvements we made were in backing the hide with red wool cloth and sewing it together with waxed nylon. By glueing red cloth to every piece before it is sewn together, it insures strength and long life. The hides of cats and other thin-skinned fur bearing animals simply will not last unless they are backed. The first mountain lion set we built over 7 years ago fell apart



Details of the mouths of the bow case and quiver. The beadwork was done over a round edge made by a 1" strip of cloth that was sewn onto the fur side, then rolled over and held down with a spiral stitch.

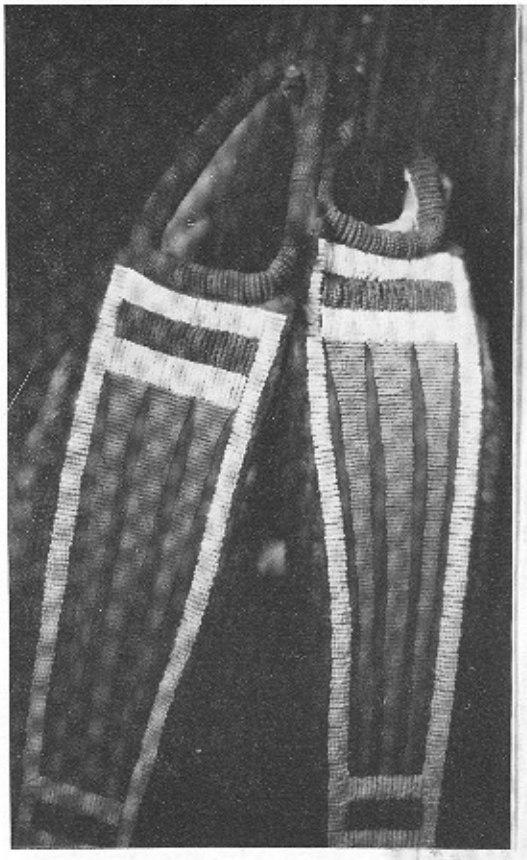
because this was not done. The hide was an oily, home-tanned affair, not commercially tanned, and the set was stored in a hot closet by its owner, which only helped speed its deterioration. For glueing the cloth to the hide I use "Aleen's Tacky All Purpose Glue", it's the best because it doesn't get stiff and it won't bleed through the cloth. It can be found in craft supply stores or art stores. Because the hide was worth so much, we made a paper pattern and carefully studied the possibilities before cutting. It really takes a lot of nerve to go after a $300 mountain lion with a pair of scissors!

For those who are interested, building and decorating of the quiver and bow case required 62 hours and another 50 or 60 hours went into the snake skin covered, sinew backed bow, (the same bow shown in the chapter on sinewing), and the 6 authentic arrows with dogwood shafts and sinew lashings. The next time you see a bow and arrow set like this one for sale, don't gape at the price, just enjoy its beauty. If sold, the maker will have earned every penny.

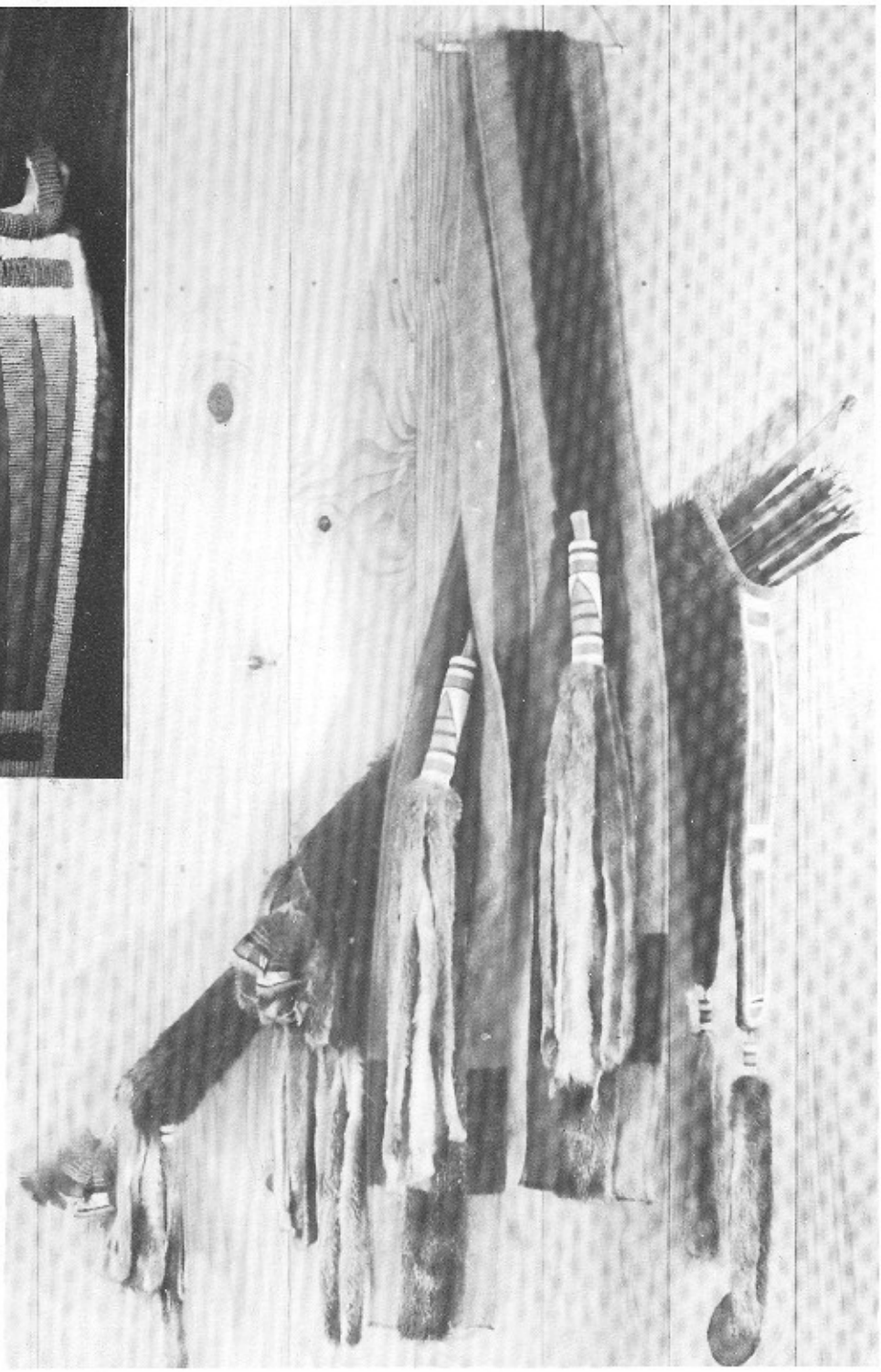


This magnificent mountain lion bow and arrow set required over 120 man hours to complete

NEZ PERCE OTTER QUIVER AND BOW CASE. Three big otters and a months work went into the Nez Perce set which was patterned after PLATE LXXXVIII and PLATE XC of *North American Bows, Arrows, and Quivers* (Mason 1891-92). It has two pendents made from the otters' tails, one for the quiver and one for the bow case. Both are covered with red cloth and a combination of lazy stitch and appliqued beadwork. It has an 8 foot wool strap decorated with a strip of otter fur and a pair of beaded awl cases. The bow that belongs to this set is of Osage backed with sinew and is described in detail in Chapter III, (No. 1, Bow with rectangular cross-section).



Details of mouths of quiver and bowcase showing beadwork on the double tails.



Three otters and a months work went into this Nez Perce outfit.

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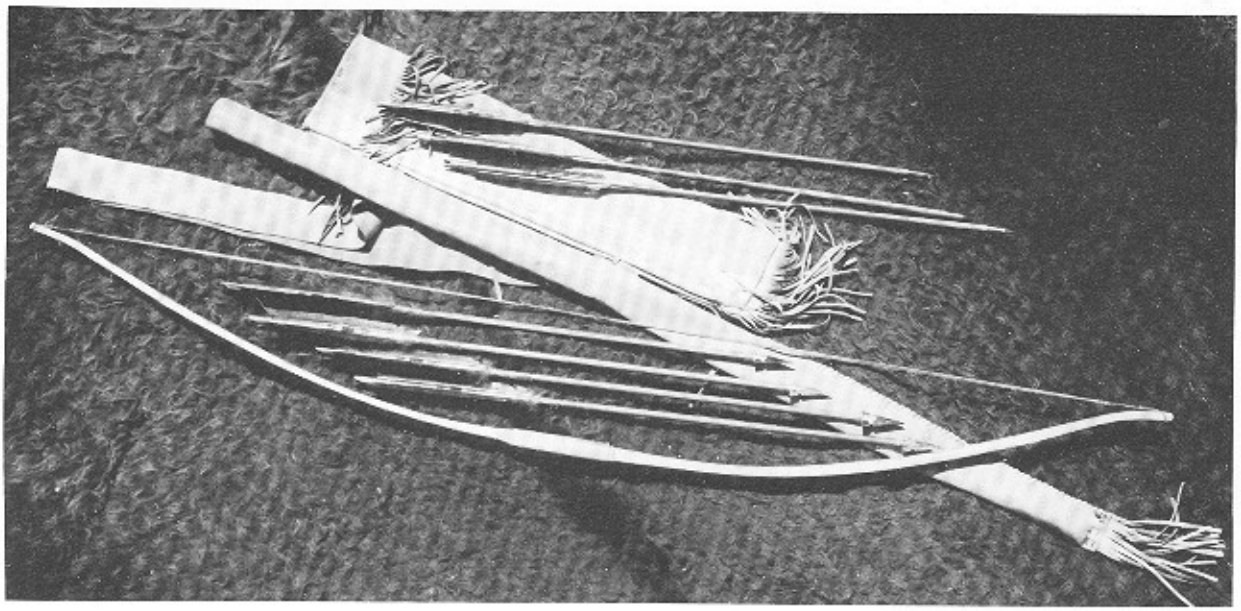

Now that you're finished reading this book you should be able to make a simple Plains outfit like this one. The 52 inch bow is of Osage orange, the quiver and bow case is made of split cowhide, the three target and four stone tipped arrows have Port Orford cedar shafts.

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