The Essentials Of Archery: How To Use And Make Bows And Arrows

L. E. Stemmler

THE ESSENTIALS OF

ARCHERY

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HOW TO USE AND MAKE

BOWS AND ARROWS

by

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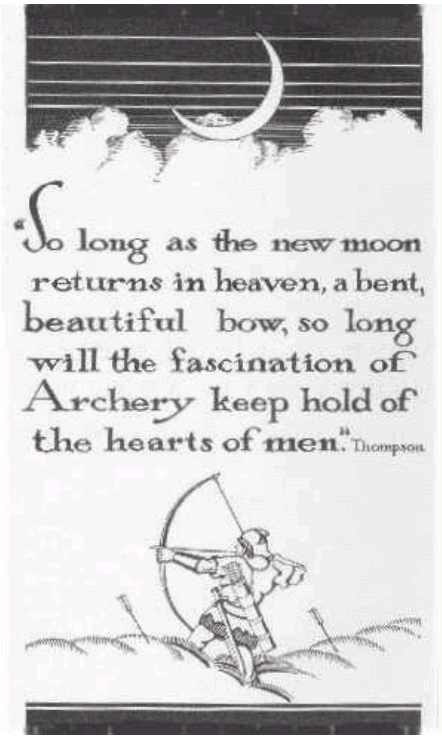

FORWARD

"THE ESSENTIALS OF ARCHERY", "How to Use and Make Bows and Arrows" is an attempt to present the fundamentals of Archery to those who wish to take up the sport. It tells how to use bows and arrows, gives rules and regulations of the game, and contains a variety of other archery information.

For those who like to do something in their spare time, it contains information on the making of tackle which may help them to employ their leisure in a profitable and pleasurable manner.

Archery as a sport is growing, there is no question of that. Archery matter in the press, in sport news, rotogravure section and cartoon is common. Articles in the better magazines appear frequently, and each year sees some new book on the subject. Every National Tournament has been larger than the one before; every season sees more clubs, and individual archers are everywhere. The famous double York Round record of the Englishman, Horace Ford, which remained a mark to shoot at for over fifty years, has been broken so many times that one rarely alludes to it any more. Scores that are well nigh impossible have been set up - only to be broken again and again. Interest in archer is widespread and genuine.

Hunting laws, specifically mentioning Bows and Arrows, indicate how widely these primitive weapons are used for taking game. Many states, Oregon in particular, have set aside forest preserves where hunting is permitted only with Bows and Arrows. The archer's implements are the true weapons of the real woodcrafter and conservationist. Deer and all manner of small game are constantly being taken by the archer. It is indeed a proud moment when your hunt with the bow and arrow is successful. You knew the quarry had every chance, and it was your own skill and strength of arm that won.

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ARCHERY

The urge to shoot bows and arrows is latent in all of us. Bows and arrows standing in a corner or hung on the wall draw people like honey does flies. Pick up a bow, brace it and place an arrow on the string. Go through the motions of shooting, and everybody is at once interested. They just itch to try it. The use of the bow goes back to the days of early man, to the reindeer hunters and to the caves of our ancestors. No wonder the desire to pull a strong bow and loose a keen shaft survives.

Primitive bows and arrows were very crude. Arrows were neither feathered nor straight. They were tipped with sharp flints, splinters of bone or had fire-hardened points. The bows probably had every possible fault that a finicky archer of today can discover even in a fine yew, osage or lemonwood weapon of modern make. Yet the men of the Neolithic age met beasts of all kinds - and conquered; for we, their descendants, are alive today. The love of the bow is our heritage.

When we consider that guns, as effective weapons, are only four to five hundred years old, we can easily realize how those first crude bent sticks and rather pitiful arrows eventually became the glorious weapons of the English yeoman, the crossbows of Europe and the amazing works of art that the Turks, Persians and East Indians called bows. Man can do a lot with an idea in fifty thousand years; a conservative estimate of the age of archery.

Every nation used the bow and arrows and, as time progressed, developed its own individual type of tackle. Early Saxon and Norman archery grew up to be the famous English long bow and cloth-yard arrow. Germany, France, Spain and Italy seemed temperamentally unsuited to long bow archery and developed the cross bow. When we see the workmanship of these weapons, we marvel at the craftsmen who did the work. Exquisite carving, inlay work and decoration beautified the stocks. The steel prods or bows were made by master metal workers, and those that have survived can still drive a quarril or cross bow arrow four to five hundred yards.

With their composite bows, the Orientals reached perfection in the bowyer's art. How long it took them to discover that animal sinew, wood and horn combined, make weapons of exceptional cast and power is a mystery. Shredded sinew, laid in a specialized glue, formed the backs. A very thin strip of wood separated the back from the horn belly. The sinew back, the thin wood core and the horn were all glued together skillfully, and the ends of their short weapons were reflexed.

The Turks, who produced the most beautiful weapons, left the polished horn belly exposed, while the Persians and men of India covered the whole bow with rawhide, birch bark or thin shark skin. Artists vied with each other in decorating the masterpieces of the old bowyers. Gold leaf, brilliant lacquer and colored embellishment of fantastic design enhanced the work of the bow maker. They were fit gifts to and from sultans and shahs.

The bows of the American Indian were all shapes and sizes. They were usually quite crude but nevertheless effective. The Indian was a hunter rather than a long distance archer. His knowledge of woodcraft and his ability to stalk game made up for what his weapon lacked in range. African bows and arrows also are all forms and lengths. The pygmies of the Iturbi forests have little implements three feet long, while the Ikoma bows are regular long bows.

No wonder then, that all youth, when it reaches the tribal stage of development, similar to that lived through by ancient forebears, wants to shoot the bow. The hunting, fishing and camping urge is strong in him, and the thrill he gets when his arrow whistles to the mark is a

survival of the savage joy of that ancestor of centuries ago, who watched his feathered stick plunge into the heaving side of reindeer or wild horse.

History is full of tales of the bow. Regiments of sturdy English archers met and conquered panoplied and armored knights at Crecy, Poictiers and Agincourt. When the masses of the English got the long bow, along with it they got liberty, confidence, pride and self reliance.

Archery is a grand sport and knows no age limit. Sixteen or sixty may shoot the bow and arrow. You may go in for formal target shooting. You may take your cherished bows and arrows on hikes and camping trips. You may stroll over the landscape with a good friend and shoot at anything, trees, stumps, bunches of grass, a conspicuous bush or what you will. That sort of shooting is called roving, and is the finest training for hunting. You may try for distance. The record is over 500 yards, so you have something to look forward to. You may experiment with trick shooting, or else see how many arrows you can keep in the air at one time. Archery-golf is played over a golf course.

Shooting the bow naturally falls into three classes - Formal Target Shooting, Field Shooting or Roving, and Hunting.

Target Shooting

Formal Archery is Target Shooting, and the game, as a sport, is very old. Courtesies, rules and regulations, hallowed by time, are part of it. In America we pattern ourselves after the English system, but have added many ideas of our own. Competition at the targets is keen, enjoyable fun. The National Tournament, at which the champions of the United States are chosen is based on the following Archery Rounds.

FOR MEN. York Round: 72 arrows shot at 100 yards, 48 arrows shot at 80 yards, 24 arrows at 60 yards. American Round: 30 arrows at 60 yards, 30 at 50 yards, 30 at 40 yards. Team shoot (four archers): 96 arrows at 60 yards.

FOR WOMEN. National Round: 48 arrows at 60 yards, 24 at 50 yards. Columbia Round: 24 arrows shot at 50 yards, 24 at 40 yards, 24 at 30 yards. Team Shoot (four archers): 96 arrows at 50 yards.

FOR JUNIORS. (Young people not passed their sixteenth birthday): Boys-junior American Round: 30 arrows at 50 yards, 30 at 40 yards and 30 at 30 yards. Girls-junior Columbia Round: 24 arrows at 40 yards, 24 at 30 yards, 24 at 20 yards. Team Shoot for Boys (four archers): 96 arrows at 50 yards. Team Shoot for Girls (four archers): 96 arrows at 40 yards.

The Standard 48" Diameter Tournament Target is used at Archery Meets. The standard target is a round bast of spirally sewn straw, covered with a face divided into a central disc, 9 3 /5 " in diameter, and four concentric rings, each 4 4/5" in width; painted respectively, from within out, gold, red, pale blue, black and white.

The target values shall be: gold, 9; red, 7; pale blue, 5, black, 3; white, 1.

The targets shall be placed on easels made of soft wood, the center of the gold being four feet from the ground.

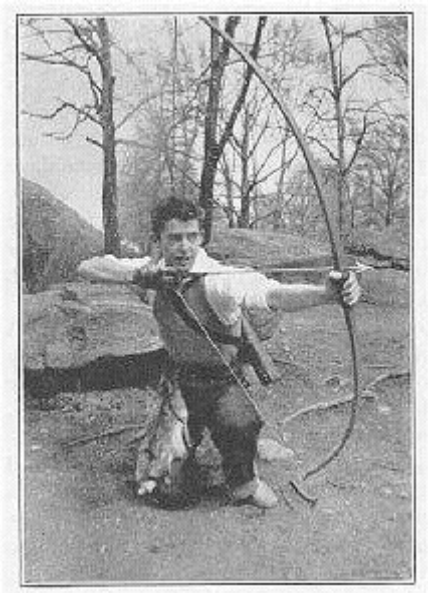
If an arrow cuts two colors it shall count as having hit the inner one. An arrow rebounding from, or passing through, any part of the scoring face of the target shall count as blue.

Until one does a little figuring, the exercise enjoyed and the energy expended, is not realized. Let us assume that you shoot a Single American Round (90 shots) with a bow weighing or pulling forty-five pounds-about the average for men. Ninety shots means pulling ninety times forty-five or 4,050 pounds. That's about two tons. Each time you loose the arrow, that 45 pounds for each shot is taken up by your bow arm, the arrow and your shoulders. In walking to the targets and back again, after each six shots, in running about looking for misses, you walk at least a mile. If you use a stronger bow, say fifty pounds, you can see that the poundage mounts up. Shooting the York Round, since the distances are longer, requires a bow of respectable weight. Fifty and fifty-five pounds is not unusual. A hundred and forty four arrows at fifty pounds pull each makes a tidy sum - 7,200 pounds-and you walk about two and a half miles.

A National Tournament is a never-to-be-forgotten sight. A hundred gay targets all in a row! Flags and pennants joyously fluttering from tall bamboo poles! Lines of bowmen in action! The arrows hiss through the air and strike the targets with a “puck", "puck", "puck". The picture is all color, graceful action and romance. Old friends meet year after year, new ones are made and ideas on tackle and shooting are exchanged. After the tournament a banquet is held and the prizes awarded. Everyone goes home sure that there are no finer ladies and gentlemen, no better sports and no nicer people generally than archers.

Roving

Get yourself a good long bow and go roving. Tuck half a dozen tough birch shafts, fletched with long, low turkey feathers, under your belt or slip them in your quiver. Adjust your leather armguard and put the "tab" in place. If you have a dog, take him along, he'll get as much fun out of it as you will. Saunter down the lane or strike off across the fields. The first target that catches your eye is a corner fence post. Draw, hold a second and away whistles your arrow. You miss by an inch, but you secretly figure it was a darn close shot at that.



Next there is a burdock bush. "Now if there was a rabbit right at the base of it, I'll bet I'd get him." A quick draw, a snappy release and the arrow speeds clean and true-right through the imaginary bunny. "That's shooting," say you. You walk a bit more and catch up with a friend. "Let's see you hit that telegraph pole, bet you can't." You nock a shaft - a favorite one, for now you're shooting under the eyes of a skeptic and critic. You take careful aim, loose perfectly and-a real thrill - you hit the pole dead center. "Gosh, you hit it!" "I'd like to shoot

too, must be lots of fun." You affect indifference, as if socking a pole at that distance - all of forty yards-is nothing at all, and begin telling him something about bows and arrows.

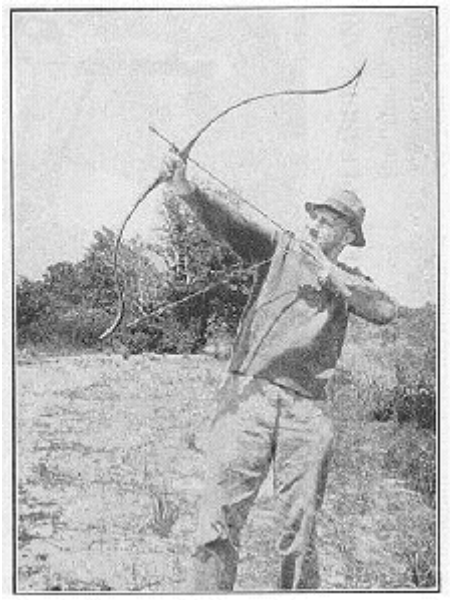
After four or five of your friends are equipped, you can have real fun. You plan a roving course through the woods and over a hill. You lay out targets of various kinds. A corrugated box full of sod, a small flour sack full of leaves and dirt, a whitened stake, a wooden figure cut to resemble a bird, a toy balloon. Each one is placed from twenty to fifty yards apart, down the road, through the woods and up the hillside. You start at number one and shoot from mark to mark. He who gets around with the least number of shots, wins.

Years ago, in England, the home of the yeoman and long bow archery, elaborate roving courses were laid out. One of the famous ones, built about 1594, was near London and was called Finsbury Fields. The names of the butts or targets breathe romance and adventure. From The Castle to Gardstone was 185 yards: from Turkswale to Lambeth was 75 yards; from Bloody House Ridge to Arndol was 154 ,lards. From the Scarlet Lion to Jehu was 82 yards.

The course had hundreds of marks and could be shot over from many directions. After an exhilarating round of the course, the merry party could drop off at the Egg Pye or Whitehall for a tankard of ale and a cut of cold beef.

HUNTING

The logical outcome of Roving is Hunting. During the Spring and Summer months all your roving is a preparation for hunting. Hunting rabbits becomes a more than fascinating sport. A cottontail goes bounding away. Cautiously you are after him, and finally locate the game hunched against the roots of a maple. To get a clear shot is important. Any little twig will deflect your arrow. You back away and work to one side. By crouching a little you get your shot-a good twenty yards and everything in his favor. Your loose is faulty and you miss, but does bunny scamper off into the next county? He does not - he very suspiciously sniffs at the thing that plunked down two inches from his nose.



That gives you another shot. This time you are careful. You draw until you feel the small broadhead touch the knuckle of your bow hand; the shaft leaps from the bow, and you know the second you loosed that you have him.

A fat grey squirrel in a hickory tree - he's smart and wary, and keeps a limb between you. You stand still. You don't move for what seems hours and his curiosity gets the better of him. He peeks over the limb and you have a fair shot at his head. A blunt shaft this time, so you won't have to climb for an arrow sticking in a limb. You don't get him, but the thrill of the fine shot you made is there. Better luck next time.

ARCHERY GAMES

SHOOTING FOR FUN, THRILLS, PLEASURE AND SATISFACTION

Archery furnishes clean and companionable enjoyment and is perhaps man’s oldest sport. Once, man depended on the bow and arrow for his livelihood and protection. Now, he is thrilled to find he has latent ability to user archery tackle. Feeling the tug of the bow string, hearing the whiz of the arrow and the "thuck" as it hits the target gives pleasure to any outdoor-minded person. Satisfaction comes when you see your arrow speed away to stand quivering in a difficult target. Even a near miss gives you the hope that the next shot will hit. Once intiated, few ever escape the "Witchery of Archery".

DEER. A fascinating book for boys is "Two Little Savages" by Ernest Thompson Seton. It was the writer's bible. In it is described a splendid archery game called "Deer". A dummy deer (a bag stuffed with leaves or straw will serve) is carried from a starting point by the archer being "it". The "deer" leaves a trail of cut up paper or one made with tracking irons. After a prearranged interval the others follow the trail and locate the "deer". The one sighting the hidden "deer" counts ten points and gets first shot. Each hit counts five. If no one hits from the first sight of the "deer", everybody moves in ten paces. Moves are made until the "deer" is hit (but not closer than fifteen paces) and then all shooting is done from that point. If the "deer" is so well hidden that it is not found, the "deer" (the one carrying it) scores twenty-five.

INDIAN GAMES. The Indians used to make wooden hoops two feet in diameter with gaudy feathers tied around the rim. These were rolled down a hillside or along a level place and the object was to shoot through the moving hoops. In winter a frozen pond or a flat piece of hard-surfaced snow was picked out. One archer would skim his arrow along the slippery surface and another at right angles to him would try to hit the sliding arrow. Keeping arrows in the air was another stunt. The one who could keep the most in the air, won. Seven is considered exceptional.

ARCHERY-GOLF. This is played over a golf course. Instead of driving a ball from hole to hole, arrows are shot from target to target. The one getting around in the smallest number of shots, wins. Official Rules for this game may be had from The Ohio Archery Golf and Hunting Association, Mr. Paris B. Stockdale, Secretary, Department of Geology, Ohio State University, Columbus, Ohio.

ARCHERY TACKLE

One who shoots the bow and arrow is called an Archer. His equipment or tackle consists of:

THE BOW. Nine-tenths of all moderately priced, good bows are made of Lemonwood. More expensive ones are made of Lemonwood Staves backed with hickory, rawhide, fibre, fibre glass and plastics. Self Osage Orange and Yew, Osage Orange and Yew backed with various substances, are also in the upper price range. Hickory and Ash are also used for beginners' and youngsters' bows. For the novice, a moderately priced lemonwood bow is recommended. Whether you choose a Flat Bow or a Long Bow is immaterial; both are good. Later you may want a, fine Osage bow or a backed or laminated lemonwood.

Men and grown boys take a 5'6" to 5'8" Flat Bow. (6'0" Long Bow). Your bow should not be too strong. You should be able to pull and loose it without too much effort. Thirty-five to forty-five pounds pulling weight is sufficient. Grown girls and women take a 5'6" Flat Bow. (5'6" Long Bow). Weights (pull in pounds) of twenty to thirty-five pounds are enough. juveniles take bows the same height as themselves and with pulls of fifteen to twenty-five pounds.

THE ARROW. Modestly priced arrows are recommended for beginners. Arrows are perishable, and while learning, it is best to use and abuse a low priced set. After you become more proficient, better, straighter arrows of Port Orford Cedar are necessary. Footed Tournament Arrows are for the more advanced target shot. The following scale gives the proper length of arrow for bows: Length of Bow Length of Arrow 4'0" 21" 4'6" 23" 5'0" 24" 5'3" 25" 5'6" 26" 6'0" 27" or 28"

The arrows of the Field Archer or Rover are usually fletched with long, low, triangular turkey wing feathers and the heads are heavy steel piles or rounded roving heads. The Hunter's arrows too, have long, low, rakish feathers and his shafts are headed with keen bladed hunting heads.

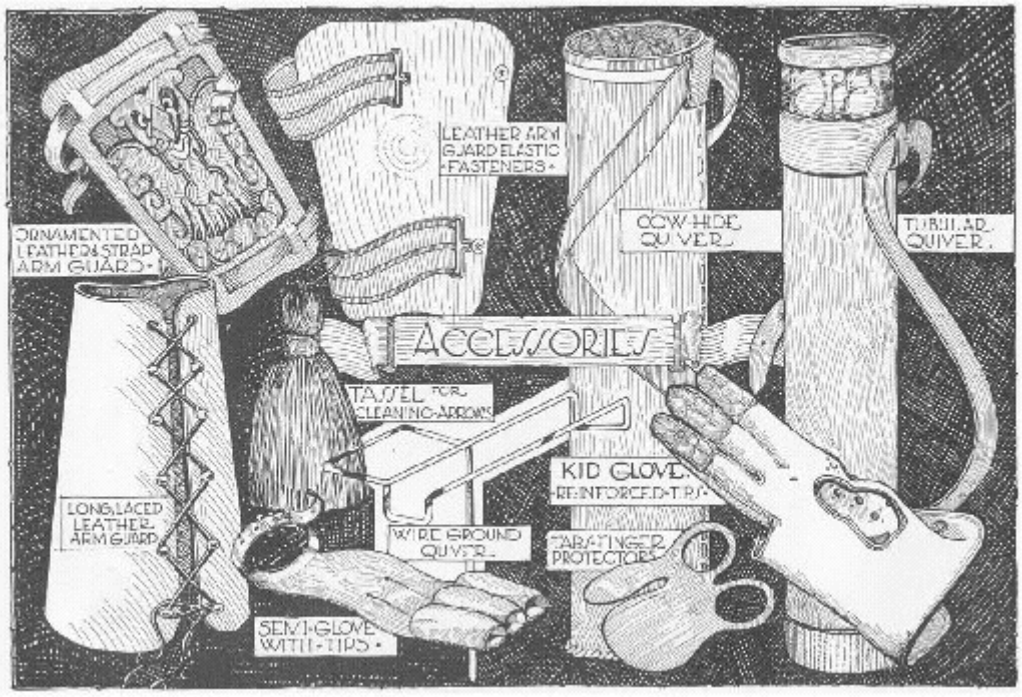
THE ARMGUARD. It is a heavy leather guard for the left wrist and covers the inside of the left arm from the hand almost to the elbow. Its use is to protect the left wrist and forearm from the bowstring's strike after the arrow is shot. A good Armguard is a very essential part of an archer's tackle.

FINGER GUARDS. They are also very necessary. They protect the first three fingers of the right hand-the shooting fingers. Constant friction with the bowstring causes soreness unless they are protected by a glove padded on the first three fingers, semi-gloves or "tabs".

THE QUIVER. A receptacle for conveniently carrying arrows. It is a long, narrow bag, in which arrows are placed. It has a belt for the waist, or a shoulder harness when worn on the back.

THE TARGET. Archery targets, with the standard target rings of gold, red, blue, black and white come in various sizes 24", 30", 36", and 48". The scoring, beginning with the gold or center counts 9, 7, 5, 3, and 1. The tournament size is 48". There are two kinds of targets - the regulation, hand-wound, rye straw targets, and those made of rye straw or other filler, covered with burlap.

THE TASSEL. It is a worsted or woolen tassel and is used to wipe arrows clean when soiled or muddied after a shot. It is hung at the belt.



STRINGING OR BRACING THE BOW

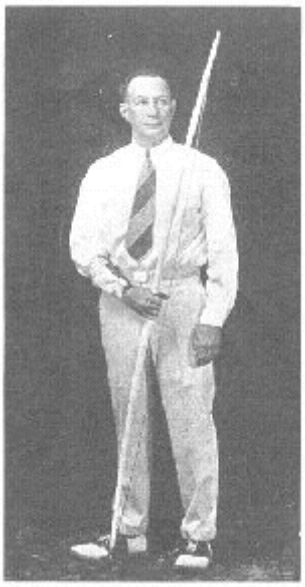


Figure 1

If you buy a bow, it will come to you unstrung. The bow will be straight and the string will run limply along the belly, held in place by the string keeper. Whether you bought your bow or made it, before it may be shot, it must be strung or "braced". In other words, the string must be in position so that the bow is sprung, and will be held that way by the string, which is shorter than the bow. "Bracing" or stringing a bow means putting the top loop or "eye" of the string into the notch at the top of bow. The notch may be cut into the wood itself, as in plain ended bows, or in horn, fibre or metal as in tipped bows.

Figure 2

THERE IS ONLY ONE PROPER WAY TO STRING A BOW ANY OTHER PROCEDURE INJURES IT

When a beginner comes to my shop, one of the first questions is: "Do you know how to string a bow?" The answer invariably is: "Sure," whereupon the eager novice either tries to climb the bow like a monkey does a stick, or grabs it by the top and attempts to drive it into the

floor like he would a nail into a board. Others contort themselves into horrible shapes, wrap one leg around the bottom limb and yank the top limb east by west. You can spoil a good bow by bracing it improperly. The ways just mentioned will spring the lower limb all out of shape and the result is usually a bow that will no longer bend evenly. More bows are broken or spoiled by improper bracing than by any other abuse. The proper method is an easy, simple, graceful maneuver. The bottom of the bow has the string permanently attached to it. Place it on the floor, inside the instep of your left foot.

Take hold of the grip with your left hand. The flat side of the bow, or back, is toward you. The rounded side, or belly, along which the loose string hangs, is away from you. See Figure 1, above.

Place the heel of the right hand four inches below the loop or eye of the string, and on the flat back. Your thumb tip and second joint of the bent, first finger of the right hand should be just under the loop. Your other three fingers should be raised and not under the string on the belly side, where they are sure to get badly pinched. Now, pull with your left hand toward and against your left hip; push with the heel of your right hand against the upper limb of the bow, just under the loop. The bow, since it is stopped at the bottom by your left instep, will bend. It ought to bend quite a good deal, and as it bends, run the loop of the bowstring into the notch with the tip of your right thumb and second joint of your bent first finger of the right hand. See Figure 2. Some people find it easier to string a bow by grasping it about six inches above the handle.

You unstring your bow by reversing the above operation. Place the bottom of the strung bow inside the left instep. Get a firm grip on the handle with the left hand. Place the heel of the right hand under the nock. Pull with the left hand and push with the right so the bow bends and as it does, lift the loop of the bowstring out of the notch with the fingers and let the bow spring straight. Bows should always be unstrung after a shoot to preserve their cast.

SHOOTING THE BOW

In 1545 Roger Ascham, the grand-daddy of archery, wrote a book called "Toxopbilus", "The Schole of Shootinge Conteyned in tvvo Bookes". In it he states that "fayre shootynge came of these thynges: Of standynge, nockynge, drawynge, howldynge and lowsynge". Every writer since has reiterated these essential five points:-Standing, Nocking, Drawing, Holding and Loosing.

Figure 1

STANDING. Stand naturally and squarely on your two feet; don't try to toe in or out, and at right angles to your mark - your left shoulder toward the target, your bow in your left hand. The arrow is held in your right hand at the nock end, just above the feathers, and between your thumb and first finger. Figure 1.

Figure 2

NOCKING. Which means placing the arrow on the string. Pick up a shaft by the notch, carry it over the string while your bow is in a horizontal position so that it lays on the knuclde of the first finger of the left band. If you look down an arrow, you will see that the three feathers are placed so there is a free space between two of them. This permits the arrow to leave the bow without any feather hitting. The feather that is colored differently than the other two is

the cock feather, and it is at right angles to the nock. When the arrow is properly nocked, it is also at right angles to the string. Arrows are shot from the left side of the bow (right banded archers), and they must be at right angles to the bow and string. They must not be tilted either up or down. Figure 2.

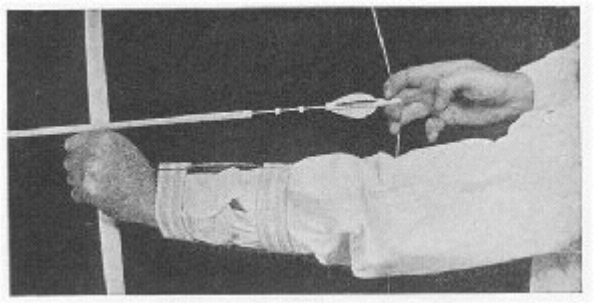


Figure 3

The bowstring is drawn or pulled with the first three fingers of the right hand. These three fingers are hooked around the string. The arrow goes between the first and second fingers. The bowstring cuts across the middles of the first phalanges or palm side of the tips of these fingers. With the string in place, as shown on Figure 3, you are ready to draw your bow.

Figure 4

DRAWING. You are standing at right angles to the target, and you are looking at it down your left shoulder and left arm. The draw is accomplished by a simultaneous movement of both arms-the left pushing out and the right pulling toward you and across the upper chest or should ers. You extend your left or bow arm and pull with the three shooting fingers hooked around the string. It is absolutely essential that you always draw the arrow to the head no matter what distance you are shooting, and that you draw the arrow so your right hand always comes to rest under your jaw or on the jaw or cheek, whichever suits your nature best. Figure 4.

Figure 5

HOLDING. After you have completed the draw, hold this position for a few seconds, during which time you get your aim and release the arrow, called "loosing". A common failing with beginners is to have the arrow fall away from the left side of the bow. Only practice in drawing will overcome this fault. Figure 5.

Figure 6

LOOSING. Means what it says-you loose or release the arrow and the bowstring propels it. Quickly straighten the three fingers hooked or curled around the bow string. You must learn to snap these three fingers straight at the same time, so that the release is true and smooth. Figure 6.

HOW TO AIM

The first time you shoot a bow and arrow, the whole business feels awkward. Your shooting glove or the "tabs" feel thick and clumsy, the arrow may keep falling away from the left side of the bow, and your first shots will seem futile. Persist in your efforts and you will soon be

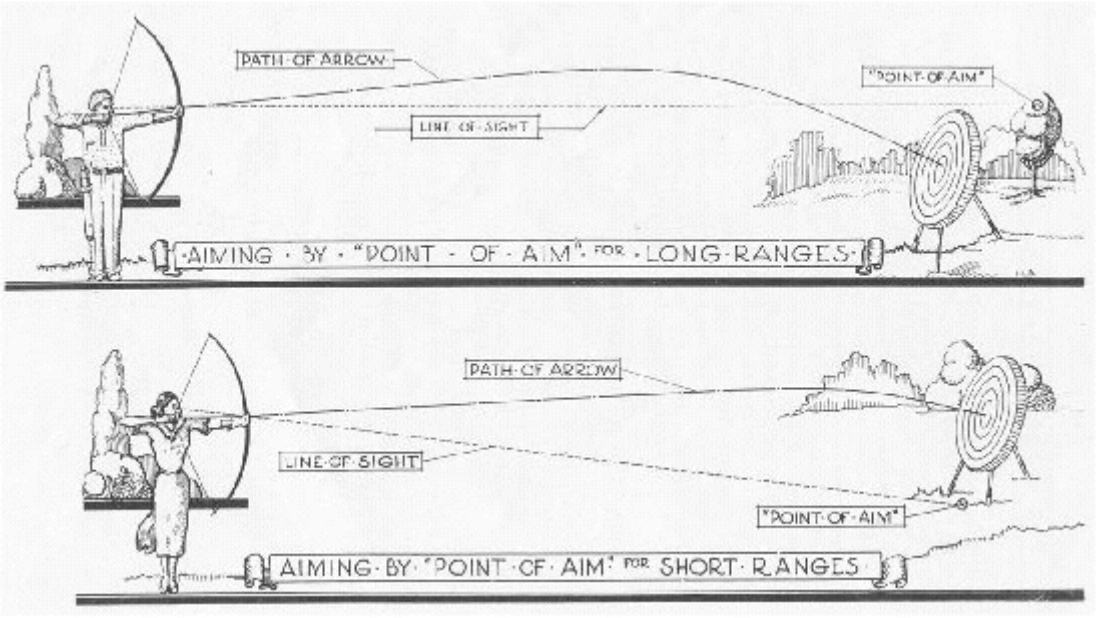
able to shoot an arrow in the general direction of your mark. To shoot with a fair degree of accuracy means practice and lots of it. Sometimes a novice will pick up a bow and at once shoot with some precision-it is instinct with some others must follow the slower road of practice.

INSTINCTIVE SHOOTING. We don't know just exactly how we aim a stone or a baseball when we throw it. Some coordination of muscle and mind directs the missile and with practice we become accurate throwers. Just so with the natural or instinctive method of shooting a bow. This "snap-shooting" is used in roving, hunting and by some target shots. The arrow is usually drawn to the cheek or jaw, and the pull and release is quick and snappy. The writer has a quiver full of assorted arrows, no two of which are alike, but, because the peculiarities of each arrow are known, excellent snap shooting can be done with them. The writer has always admired a good snap shooter or an archer who is an instinctive shot. It is real archery, and if a fellow can go out and hit rabbits, stumps or any other mark at from thirty to fifty yards and do it regularly, then he is an archer of the true breed.

POINT OF AIM SHOOTING. This is the only method to use if you expect to become a proficient target shot. All the top notchers either use "Point of Aim" or a sight of some sort. Study the Plate "Aiming by Point of Aim." What you do is to find a spot on the ground (for short ranges-say 60 yards and under) or a spot in a tree (for long ranges-say 80 to 100 yards) on which you rest the pile or tip of your arrow. If you always rest the tip of your arrow on this spot, your arrows, if they are all the same in length and flying qualities, will fly and land in the same place. Suppose you want to find your "Point of Aim" at 40 yards. With a 6'0" bow 45 pounds drawing weight, it may be halfway between you and the target. Go back to where you first stood. Draw the arrow under your chin, sight down diagonally across the head. Follow this imaginary line to the ground. It may rest on a tuft of grass or bunch of clover. Place a point of aim, marker, a wad of paper or a stone at this spot. Draw your arrow under your chin, rest the tip of your arrow on the "point of aim" which you just marked with some object, and release your shot. If your arrow flies over the target, move the marker in closer. If it falls under the target, advance your marker. You also can control left and right direction by moving the marker either way. An important point to remember: Keep your eye on the "Point of Aim". You see the target only vaguely or not at all. Experiment until you get the idea. The Plate shows the method quite clearly. Once you have mastered "Point of Aim Shooting", your target scores will go up by leaps and bounds, you will begin to find fault with your arrows, and demand better and better matching until you have driven honest fletchers crazy.

SHOOTING WITH SIGHTS. During the past ten years, a great variety of sights and sighting devices have been developed. There are so many different kinds that it would be useless to attempt to describe them all. Some evidently are excellent, for very high target scores have been made with them. Sights generally fall into two classes; one includes those where the point of aim would be below the target, as in short ranges, and the other where it would be higher, as in longer distances. From the diagram entitled "Aiming by point of aim for short Ranges", imagine the bow held in exactly the same position, where the same arrow flight would hit the bullseye, and imagine a point on the upper limb of the bow, above the arrow plate which would be in the line of sight, if the archer were looking at the bullseye. This point would be about two inches up the handle from the arrow plate. Anything might be used as a sighting point, such as a match or a wire, or a brad-headed nail. Some archers actually paint lines on the belly of the bow, their position being determined by experimenting and practice, to help them in odd range shooting where they judge the distance from the mark and look at it across the line corresponding to the distance they think they are from it. There are many mechanisms for sighting purposes, of which the main requirements are ease of moving and

stability of position, once set. Any cross bar with a small knob on the end will serve the purpose while an elastic band makes a good position fixing member. We make a very simple sight which will do anything that more complicated ones will do.



MAKING ARCHERY TACKLE AS A HOBBY

THE CAMP PROGRAM AND ARCHERY

Every archer should also be something of a craftsman. He should at least be able to make minor repairs to his gear. He ought to know how to whip a bowstring, how to re-tiller his bow, how to put on a needed feather or re-head his arrows. If you want to get all the fun possible out of this Sport of Archery, you should investigate the handicraft aspect of making bows and arrows. The writer strongly recommends that everyone seriously intending to make Archery his hobby, learn to make his own bows, arrows and accessories. There is genuine satisfaction in making your own tackle. To see a shaft made by your own hands, speed from a bow fashioned on your own workbench, gives you a bit of sound, honest happiness. The joy of creating is real and lasting.

Camp, to those youngsters who are fortunate enough to be able to go, is a grand summer adventure. Home government is far away, and they can go "native" or "Indian" in a big way. Naturally, they look forward to all the sports and games that go with camping. Swimming, horseback riding, hiking, shooting, archery, etc., are all part of the picture.

Archery is unique in that it combines sport and handicraft. It offers interesting exercise, competitive play and makes hikes doubly interesting. As a handicraft project, the making of bows and arrows is well within the abilities of boys and young men. Bow staves may be bought in the square or so shaped and fashioned that very little work is required to turn them into excellent bows. Arrow materials, too, may be had in various stages of finish, so that making a set of decent arrows is not too much work. The fabrication of quivers, armguards, shooting gloves and "tabs" offers the camper leather work on which he may exercise all the ingenuity and craftsmanship of which he is capable.

All camps have a building or part of the mess hall or recreation room set aside for handicrafts. Facilities for those who wish to make bows and arrows can easily be provided. Only simple hand tools are needed-small block planes, coarse and fine wood rasps, a hack saw, a six inch flat file with thin edge, two or three round, rat-tailed files six to eight inches long, a scraper (The Hook Scraper is fine), a jackknife or two, medium and fine sandpaper.

For making arrows you need a couple of small flat containers for mixing glue, assorted paint brushes and enamels for decorating the arrows, some large headed pins for holding feathers in place on arrows, scissors and penknives. Ten or fifteen years ago, it was rather difficult to find councillors who knew anything at all about archery or the making of bows and arrows. Now, among those who go in for camp work, the archercraftsman is not a rarity. Making archery targets is a project that will save money. Round burlap sacks may be bought. These come in various sizes 24", 30", 36" and 48" diameter. Straw, hay, leaves, etc. are always available in the country, and with this material the sacks are stuffed. Then they are tufted or sewn like a mattress. A slip-on target face, with draw string, fits over these backs. In laying out your target range, it is well to use the tournament size 48". Beginners in archery should be permitted to get quite close to the target so they hit it promptly. Later they may be moved off, and eventually the junior American Round for boys and junior Columbian Round for girls should be shot. Whether the bows are "boughten" ones or made in camp, they should be lengths as described under "The Bow" in "The Fundamentals of Archery". Arrow lengths should also conform to the scale given.

MAKING BOWSTRINGS

The simplest kind of a bowstring is made of linen or flax twine prepared especially for this purpose. All that is required is to splice an "eye" in one end and fasten the string to the bow.

A bowstring is usually affixed to the bottom of the bow, in the lower nock or notch, with a timber hitch. It is better, however, to have two "eyes" on your string. The bottom one may be made small so that it fits tightly. The upper "eye" should be large enough to permit it to slide easily down the bow limb. The "eye" of the string, and the middle, where the fingers and arrow touch, should be whipped or wound with linen thread. These are the wearing points and should be protected. Good whipping is tedious work, but it doubles the life of a string.

In my shop we use strings of various kinds; strings of prepared linen or flax twine; strings made of linen thread, handmade in three plies; strings made of three lays of linen threads, thickened at the upper and lower ends; strings made of linen threads, one lay for the body of the string, three lays for the thickened top and bottom.

Linen is the best fibre of which to make a string. It is very strong and does not stretch. Stretch in a fibre is an objection, a bowstring must always maintain one length.

Making a Bowstring of Linen or Flax Twine

Cut off a piece of flax twine. Allow 18" more than the length of your bow. This twine is made of four lays or plies. Open the lays in one end for a distance of 6". Leave 3-1/2" of twine, and open the twine again. Insert an ice pick, fair sized nail or small marlin spike so that two lays are on each side of the instrument. In this opening insert two of the opened end lays, pull them down and you will have an eye about 1-l/4" in diameter. Open the twine again under the insertion and pull through the first pair of lays and then the other pair so they cross each other. Continue this opening and crossing of the lays down the twine. The last two inches of the loose lays you can thin out so the crisscross splicing tapers into the body of the string. Whip the eye, and under it for a couple of inches, and wax well.

Making a Simple Three Ply Hand Laid String

This string looks like a little rope, and that is what you really are making-a small three ply rope. Eighteen threads of No. 10 Linen makes a string strong enough for the average 5'6" and 6'0" bow. Drive two nails in a board. These nails are to be 18" further apart than the length of the string you wish to make. For a 5'6" string this would be 7"; and for a 6'0" string it would be 7-1/2". Run out 6 strands of thread between the nails. Fasten one end to a nail and twist the threads 20 to 25 times clockwise or until it begins to kink from twisting. Wax the strand well. Clip a spring clothespin on each end of the strand and put it aside. The spring clips will keep it from untwisting while you work on the other two strands. Prepare your three strands of 6 threads each, fasten them to a nail, pull them all even and carefully roll the three strands counter-clockwise. Any kinks in the strands will work out during this process. Wax well. The result should be a smooth round rope. Open six inches of this rope into three strands, and back splice an eye about l-1/4" in diameter. Thin out the strands so the splice flows into the rope in a neat taper. See Plate 1. Whip the eye and the bottom of the splice.

Making a Three Ply Hand Tapered String

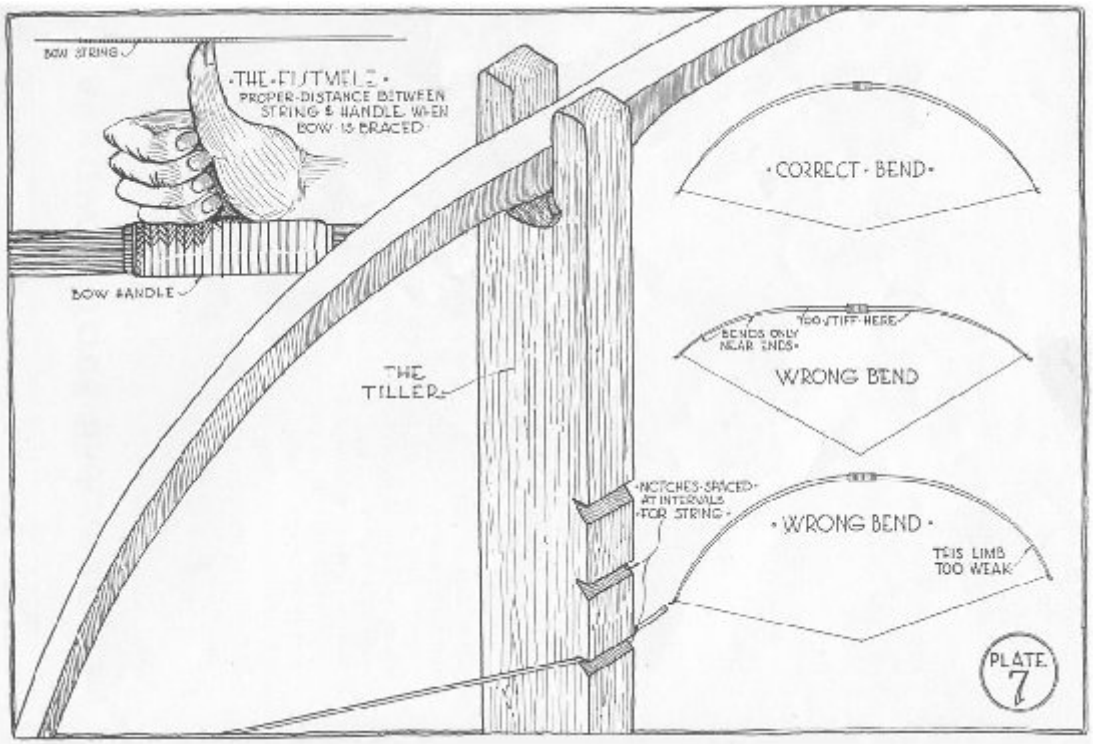
This string is made the same as the Three Ply Hand Laid String, except that it is thickened at the loop or eye and at the bottom for additional strength. Run out six threads of No. 10 Linen. Now cut off four threads each 12" long. Wax each of these 12" threads. Beginning 4" down from the nail, apply a waxed thread to the six on the nails; 6" from the nail apply and work in another; 8" down another and 10" down another. Cut off four more 12" threads and do the same to the other end of the untwisted six strands. After you have thickened both ends with the addition of these four staggered threads, wax over them. The wax is to make them stick in place. Now loosen one end of the strand and carefully twist it clockwise about twenty-five times. Prepare your other two strands the same way. Fasten the three well waxed strands to a nail, pull all even and straight and roll the three strands counter-clockwise until you have a nice little rope thickened at both ends. Eye splice your loop as described, wbip it well around the eye and below it. See Plate 1.

Making a Tapered String, Simple Strand Center

Run off 18 threads of No. 10 Linen between two nails as described. Remove one end, and twist or roll all eighteen threads clockwise about twenty-five times. Wax the strand well. Nineteen inches down the strand bind it with a piece of cord, so that you can open the strand above this tie. Be careful that you make a tight tie, yet one that may be easily cut off when ready. Open up the strand to this tie. Divide it into three parts-6 strands to a part. See that there is no twist in anv third. Cut 4 threads each 12" long. Beginning at the tie apply one thread. Wax it in with the other 6 strands. Two inches down wax in another 12" thread; 4" down another and 6" down another. Thicken each 6 thread strand this way. Fasten the cord at the tie to a nail. Roll each thickened strand counter-clockwise until it begins to kink. Clip on a spring clip clothespin to hold it, and twist the other two strands the same way. Pull the three well twisted strands out straight and roll them clockwise so they assume the form of a rope. Do both ends of your string this way. Make your loop or loops and wax well over all.

Wax is to a string maker what tar is to a sailor. A string should be always well waxed and the best wax for a bowstring is pure beeswax to which sufficient resin has been added to give it body and stickiness.

A bowstring is always shorter than the bow. The distance between the taut string, when the bow is strung, and the handle is called the "fist-mele", and is the distance between the edge of the clenched fist and the tip of the extended thumb. See Plate 7.



There is a certain amount of stretch in a laid bowstring, and this must be pulled out before the string is used. The bow itself usually does this the first time you put on a new string. You then take up a little on the string by twisting it a few times or taking in on the timber hitch.

Fifteen threads of No. 10 Linen are sufficient to hold 5'0", 5'3" and 5'6" bows up to 35 lbs. pull. Eighteen strands are sufficient for 6'0" bows with weights up to 45 pounds; twenty-one threads holds up to 60 lbs., and for very heavy bows of over 60lbs. 24 threads are enough.

On unstrung 5'0" and 5'3" bows the loop of the bowstring should be 3" below the nock. This gives you about 6" between the string and handle when the bow is braced. It should be 3-1/2 " down for a 5'6" bow. This gives you a fist-mele of 6-1/2". The loop should be down 4" on an unstrung 6'0" bow. This gives you 7" between string and handle when the bow is braced.

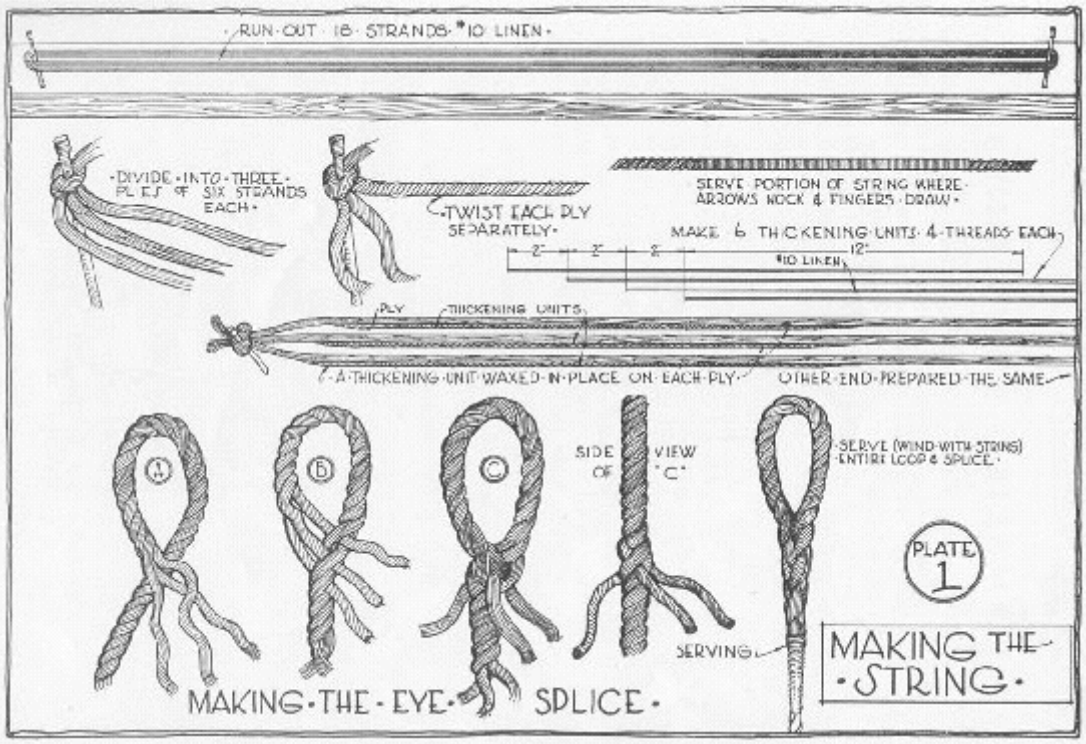


Plate 1

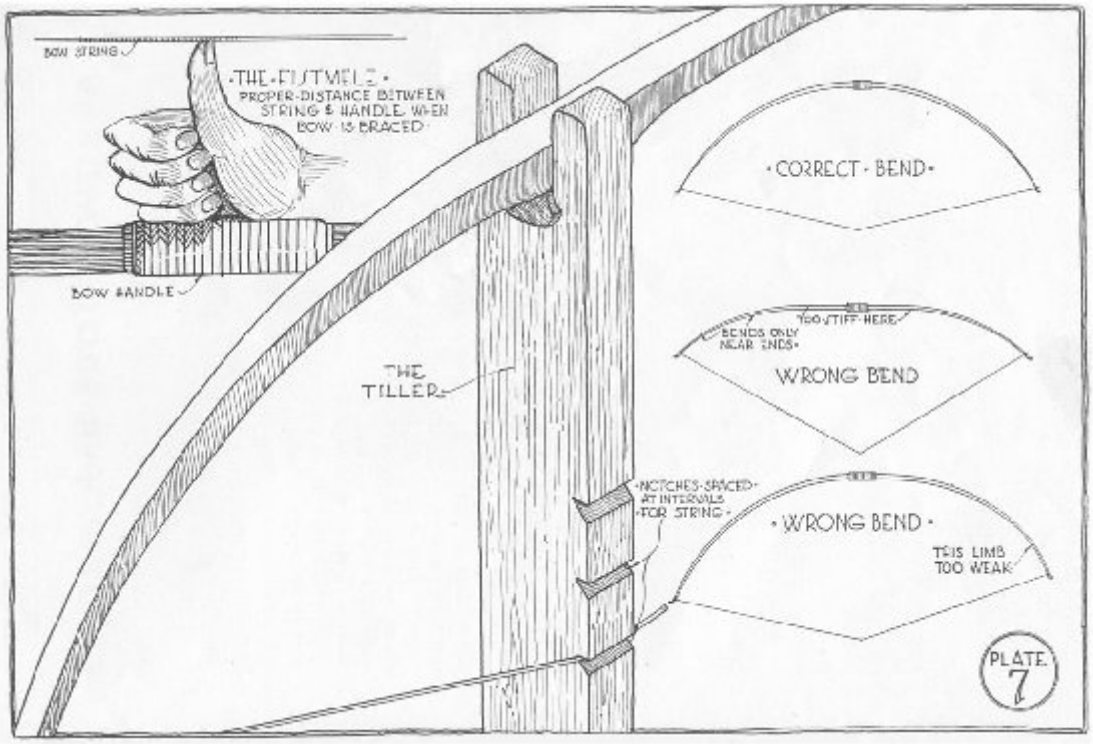


Plate 7

BOW WOODS AND BOW STAVES TOPICS

Making Lemonwood Bows
Horn and Fiber tipped Bows
Backed and Laminated Bows

How Backings Are Applied
Demountable Bows
Flat-Limbed Lemonwood Bows
Making Yew and Osage Orange Longbows
Flat Osange Orange Bows
Reflexed Bows
Hunting Bows

LEMONWOOD (Calycophyllum candidissimum), the degame of the wood importers, is a native of Cuba. It is hard, heavy, tough and springy. It comes in small logs or spars and is straight enough to be sawn into bowstaves. It is the most satisfactory and reasonably priced wood of which to make a bow. It grows in the mountains, and most of it is carted by oxen to a port for shipment by steamer. The bark is a reddish brown, rather stringy and somewhat resembles red cedar bark. It has nothing to do with lemons; the name refers to its color. It varies from a light yellow to a light brown and is often mottled. We have found that the spars yielding the very best bowstaves have a distinct apple green streak just under the bark. Lemonwood is a true bow wood, and for an all-around bow, as good as any that comes. The fact that the highest score ever made in tournament for the American Round was made with a lemonwood bow speaks well for its qualities.

OSAGE ORANGE (Maclura or Toylon) belongs to the mulberry family (Moraceae), and is one of our finest native bow woods. It seems to grow throughout the whole of the United States, and is known in many sections as the Mock Orange. Years ago this tree was planted extensively for hedges. The best of it comes from our Middle West. It is a very hard wood, ranging in color from a very pale yellow to chocolate brown. Sometimes it comes in a light yellow prettily mottled with dark brown spots. Since the wood takes an exceptionally fine polish, such a piece results in a bow of unusual beauty.

Osage Orange bowstaves, unlike Lemonwood, come directly from the log section, with the bark, heartwood and sapwood intact. Before the staves are stored away for seasoning, the bark is removed and the staves given a coat of shellac. This permits them to dry out slowly and prevents warping and checking. As an all-around bow wood, Osage Orange ranks high. Good staves yield hard shooting, tough, sturdy bows that will stand lots of abuse. This wood possesses none of the temperamental aspects of yew, and for a bow that is equally good in the heat or cold, one good for target work, hunting or roving, Osage Orange is the wood. Osage Orange Staves may be worked up into Standard Long Bows, the shorter, semi-Indian type flat

bows, and the Flat Reflexed Bows. All are good; the maker's personal preference alone being the guide.

YEW (Taxus) is a soft wood. Compared to Lemonwood and Osage Orange, which are hardwoods, it is light in weight. The heartwood of yew is reddish, and ranges in color from light to nut brown. Our American supply comes from Oregon, Washington and California. The yew staves are split or sawn directly from the trunk and come with the bark, sapwood and heartwood intact. After the staves season, the bark, which is quite thin, readily chips off.

During the past couple of years advocates of various inethods of seasoning have pushed their pet claims -some are for kiln drying, some want to place the staves in running water or streams until the sap and resin is washed out. These methods may have merit, but why go to all that fuss when you can pile it up in a nice dry attic and leave it alone for a year or two. Turn it over once or twice for luck if you wish.

Generally, the ner or more grain lines to the inch, the better the wood is. Yet I have seen a yew bow with six grain lines to the inch that shot better and harder than any close grained stock. After making a thousand yew bows in my shop, the writer is of the opinion that the excellence of each bow depends on the individual stave and the care with which it has been handled by the bowyer.

Yew may lose weight and cast in hot weather, it picks up in cold; in freezing weather it may break in your hand, it develops crisals (a peculiar crack that works at right angles to the grain of the wood) which occurs with Osage or Lemonwood only in rare instances, and may prove cussed beyond belief in more ways than one. Yet we are frank to confess that a fine yew bow is a joy to shoot and something to cherish.

Perfect six foot staves of Yew are rare. Most staves will have small pins, the grain is sure to dip at some spot and little knots may appear. Since it is easier to secure this wood in lengths of 3'6", two such pieces are joined to make one six foot piece.

OTHER WOODS

Ash, hickory, black walnut, sassafras, ironwood, mulberry, apple and many other native woods have been made into bows. These woods are not true bow woods, but have been used only because nothing better was at hand. They produce bows that shoot fairly well in the beginning, but they soon lose cast and become flabby and weak. When they dry out thoroughly they become brittle and break.

This is true of the average run of these woods, but sometimes a bow of northern ash or hickory yields a fair weapon. There is a tree called hop hornbeam, with a white, very tough wood resembling hickory. This makes a fair bow.

MAKING LEMONWOOD BOWS

Nine-tenths of all good bows made in this country are Lemonwood. Lemonwood bowstaves are different from yew and osage staves. They are sawn from the spar. The trees grow straight and round and the grain runs true, making it possible to saw out staves with the grain running from end to end. While it may be better to make a Lemonwood bow with the grain running flat, in practice it doesn't seem to make any difference whether the grain runs flat, diagonally or some other way. This is such a hard, dense, close grained wood, that the direction may be ignored.

In my shop Lemonwood Bowstaves are prepared in various ways. There are plain square staves, square staves backed with rawhide or fibre, roughed out or semi-finished plain staves, and roughed out or semi-finished staves backed with rawhide or fibre.

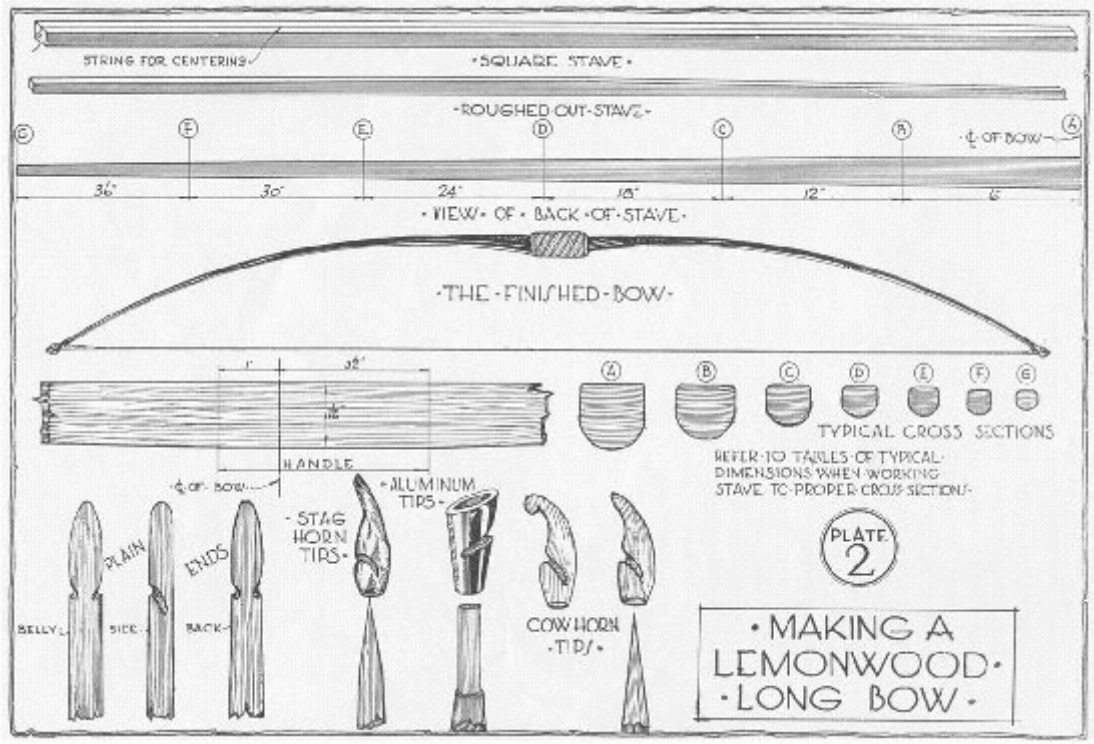
Staves are also selected for quality, as you will see in the catalog. The Blue Ribbon Staves are the cream of the crop. From these staves self and backed bows may be made. Your bow may be plain ended, that is, have the notches cut into the wood itself, or you may tip it with cow horn, stag horn or fibre.

Semi-finished bowstaves have a good portion of the preliminary work done. Their general outline is that of the finished product. Square staves must first be planed to the approximate shape of the bow. If you are going to make a plain self bow, the first work is done on the back. Staves from us have the backs marked. No work need be done on the back of a rawhide or fibre backed stave, since the backing is smooth and ready for sandpapering and polish. A self bow is one that is made of a single piece of wood, without backing.

The tools needed are-two small steel block planes, one set fine and one set very fine, (and they must be sharp), coarse and fine wood rasps, fine wood file, six inch round rat-tailed file, coarse, medium and fine sandpaper, steel wool, jackknife and a scraper. (The Hook Scraper No. 25 made by the Hook Scraper Co. is excellent.)

Making a Plain Self Long Bow, Plain Ended

With a square stave in your possession, smooth the back with the plane set very fine. If the plane digs in, turn the stave around. Plane the back smooth and finish it with the scraper. Around the middle of the stave draw a pencil line. One inch above this line draw ahother. Three inches below the center line draw another. This four inches will be your handle, and it is so placed to permit the arrow to leave the bow one inch above the true center.



Now look down along the stave. While Lemonwood bowstaves are reasonably straight, very few of them are absolutely true. There is bound to be some side warp. Straighten the stave by planing. If the warp is to the right, take off sufficient on that side to straighten it. At the same time you will, of course, be tapering the stave. On most staves a little planing is sufficient; more work is necessary with others. A stave with a concave or reflexed back is sought after. The bow is built against the natural tendency of the stave to warp in this direction, and usually results in a better casting bow. When your bow has been straightened as to side warps, you want a true center line penciled down the back, so that you may lay it out according to the following tables of measurements. Insert a pin or thumb tack in each butt end of the stave, and stretch a string between them. See Plate 2.

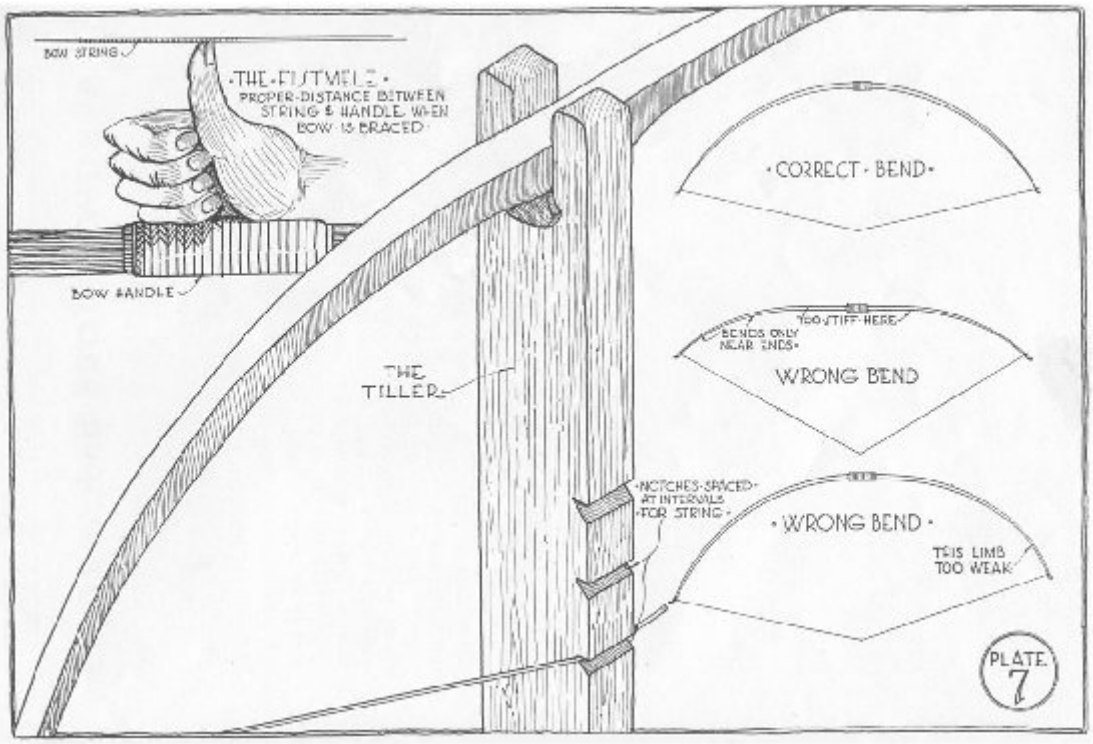
The following tables give actual measurements, in sixteenths of an inch, taken from finished Lemonwood bows 5'0", 5'6" and 6'0" long. The weights (the pull in pounds) are given. Since bow making is a non-dimensional art, these figures are not absolute, and the measurements of a 60 pound bow may result in one of 45 pounds, or some other weight. You can always take off wood, hence it is better to figure on making your bow stronger-four or five pounds more than the finished bow will be.

Now, using your center line, measure off on each side of it half of the figures given under the heading "across back", depending, of course, on whether you are making a 6'0", 5'6" or 5'0" bow. Connect up these measurements and plane down to this line-just up to the line, not past it-this will give you a little leeway. See Plate 2.

Then, on the tapered sides, pencil in the belly measurements - that is, the distance from back to belly, or thickness of the bow you propose to make. Plane down on the belly side up to these lines. Round off the handle section until it looks like cross section "A", Plate 2. Continue this rounding of the belly to the ends, so that cross sections look like those on Plate 2.

One of the commonest faults of amateur bow makers is to take off too much wood in the upper limbs and not enough just above and below the handle. The result is that only two or

three feet of the entire bow works or bends, undue strain is placed on these weak spots and the bow breaks. A good bow should be stiff at the handle, a distance of about 6", and then the entire limb should bend evenly to the tip. A long graceful curve is to be striven for. See Plate 7.



A distinct dip should be made above and below the handle-called the Buchanan dips. The handle or grip proper takes up 4", then the dips begin and the dips take up about 1" on each side of this 4". Look at the finished bow on Plate 2.

If you bought a roughed out stave, practically all the prelitninary work has been done for you, and making the bow is a far simpler job. It is best to work slowly and cautiously, always remembering that it is a simple matter to take off wood, but impossible to put it back on. When you have one limb about finished, place the tip on the floor and bend the limb. You can tell if it is far too strong or about right. Look at the curve the limb is assuming. There may be spots in your stave that are difficult to plane. The wood rasp may be used on them to advantage. Keep your bow wider than it is thick, or, after you have strung it, it may turn. When you have both limbs worked out, you are ready to cut the notches in the ends of the bow.

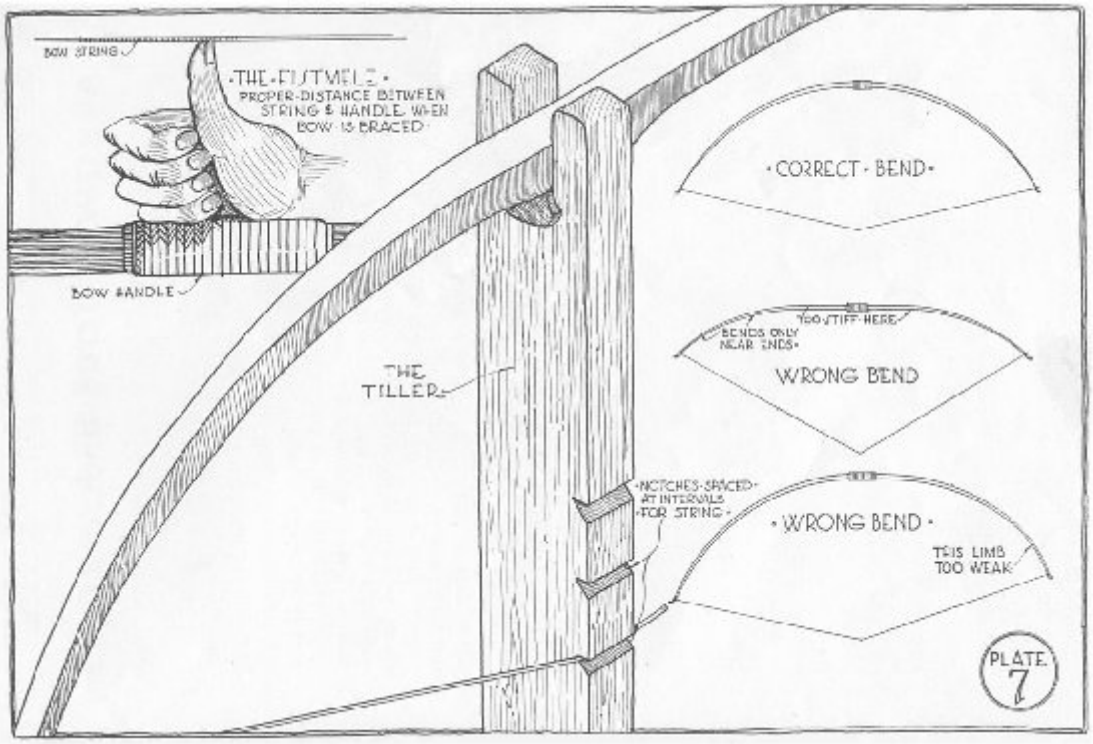
Begin an inch down from each end, and with the round file, cut notches diagonally on each side on the ends as shown on Plate 2. Do not cut the notches across the back, because the grain of the back must be left whole and without breaks. The notches should be at least Ys" deep. After you have finished with the notches a preliminary stringing or bracing of your bow is in order. It is assumed that you have made, or now will make, a bowstring as described under string making. Read carefully "Stringing or Bracing the Bow". Slip the loop or eye of the string over the top limb, run it down the bow the proper distance (given under "Making Bow Strings"), fasten the lower end to the bottom notch, and brace the bow. Lay the strung bow on the floor and look at it. If the limbs bend evenly and both alike, you are ready for a trial draw. If they do not bend evenly, it will be necessary to unstring your bow and scrape

away wood from the stiff portions. Scraping is safer than planing, as you may easily take off too much.

You should also look down along your strung bow and see if the string bisects the belly. If it does not, but throws off to one side, your bow has a turn in it. This is corrected by taking off wood from the side of the bow opposite, i.e., if your string bears to the left, take off on the right side of the bellv and vice versa. Turning is usually caused by "stacking" a bow, which means it is thicker from back to belly than it is wide. Flat, Semi-Indian Type Bows have no tendency to turn because they are ever so much wider than thick. While it is said a bowstring should bisect the belly of a long bow, in practice a bowstring that throws off to the left-the arrow side of the bow-is no objection, at least, that is the writer's opinion. Many fine osage hunting bows I have used were made with this in view. Then the plane of the arrow nock and the string are about the same, and the arrow goes straighter to the mark

After your bow has been corrected where needed, string or brace it again. The next step is tillering it, which means working on the limbs until they bend evenly and are well balanced at full draw. There are two ways to do this. First, pull your bowstring five or six times a distance of twelve to fifteen inches. This settles the wood a bit. Now have a friend draw the bow about half the arrow length and get off and look at it. You can easily see if it is bending nicely. If it isn't, mark it with a pencil, and take off wood where needed. (Whenever you scrape off a bit of wood, pull your bow a few times to settle the new bend.) Continue this until the bow is at full draw. Lengths of arrows are given under "The Arrow" in the "Fundamentals of Archery". When, at full draw, the bow bends evenly and the limbs have a graceful arch, you are ready for a final very light scraping, coarse and fine sandpapering and finishing.

The second method of tillering is to make yourself a tiller. This is a wooden instrument with a notch at the top to hold the handle of your bow and other notches cut in the side to which you can pull the bowstring. See Plate 7.



Space the notches for the string three or four inches apart until the last one is the proper draw length from the handle. Now, by stringing your bow and drawing it to the top notch you can get off and look at the bend. Pull it up notch by notch until the full draw is accomplished and you can see your bow at full arc.

The finish on your bow is a matter of taste. The smoother you sandpaper and steel wool the wood, the finer will be the polish. A good one is orange shellac and a bit of linseed oil. Dip a soft rag in a drop or two of the oil, then dip in the shellac and rub it on the bow. Dip and rub, dip and rub, until the whole has a fine polish. A couple of coats of good varnish, steel wool rubbed between coats, is good too.

An attractive handle on a bow dresses up the whole weapon. Colored cords, braids or tapes may be used. Fancy dyed leather with a narrow binding of a contrasting hue is fine. A grip of heavy calfskin, laced up the back with a thin leather thong looks sturdy and businesslike.

You laid out the handle when you started the bow. For guides draw these pencil lines in again. The back of the handle is padded so that the grip is thick and comfortable. A block of soft wood, 4" long and as wide as the back of the bow and half an inch thick is glued or tacked to the back of the handle. Then it is tapered off and rounded so the grip feels right. Your handle material goes on over this wooden pad and belly of the bow. Glue it on with waterproof glue and wrap it tight.

A string keeper adds the last neat touch. Drill a very small hole in the upper extremity of your bow, run a leather thong or fancy cord through it and tic it to the top of the eye in your bowstring. Pull it up so the string lays along the belly of the bow. This string keeper prevents the string from sliding down the bow limb.

HORN AND FIBRE TIPPED BOWS

Horn or fibre tipped bows are made exactly the same as plain ended bows. The only difference is in the tips. The traditional shape of horn tips is shown on Plate 2 - "Cow Horn Tips". The top has a scroll and the bottom is pointed. Stag horn tips are pointed while fibre and aluminum tips are shaped as shown on the same plate. Cow or Steer Horn and Stag Horn Tips have tapered holes, and the ends of your bow must be tapered to fit them. With the wood rasp and file, taper the ends of your bow, so that they fit 3/ perfectly inside the horns. Five foot bows take a horn with a 8" hole, 5'3" and 5'6" takes 7/16" holes and 6'0" bows take horns

with 1/2" holes. The holes in fibre and metal tips are usually 3/8" and are bored straight. The illustrations on Plate 2 depict this and show how the ends of the bow should be worked to fit these various tips. It is well to both glue and pin the tips to the bow. A very small hole to take an 18 gauge brad is large enough, and the brad should go right through and be filed off even with the sides of the tip.

BACKED AND LAMINATED BOWS

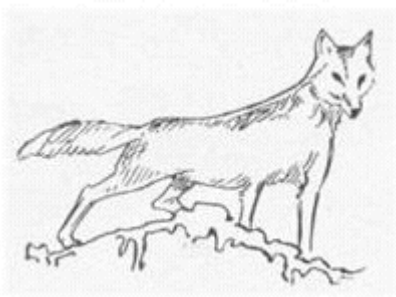
A backed bow is any bow-flat or long type-that has been backed with a substance intended to prolong its life or improve its shooting qualities. The bow consists of two pieces; the bow itself and the back. A laminated bow is a bow made of three or more pieces, joined or laminated together. Wood, rawhide, fibre, fibre glass, sinew and various plastics are used for backs and for laminated bows.

A wood backing is a piece of fine, straight grained, tough white hickory, ash, elm or lemonwood. It is one-eighth to a quarter of an inch thick and adds strength and cast to the bow. If the wood back is put on so that the stave has a reflex toward the back (in other words, the back is concave) this adds to the cast. Before the new resin and plastic glues were developed, backing a bow with wood was a chancy business and there were many failures because of the back and belly of the bow parting company. Now, with these new glues, joints are actually stronger than the rest of the stave. The secret of making good joints is to be sure the back and stave are absolutely flat so that contact between the two pieces is made everywhere.

The rawhide for backing bows is drum head rawhide, a clear parchment-like calfskin. This is exceedingly tough and strong and makes an excellent backing. The black or red fibre used in bowmaking is quite thin and makes a very pretty back. The fibre polishes very well and the colors are attractive. Neither rawhide nor fibre increase the strength of a bow much. Their principal function is to protect the back of the bow from hard knocks and to keep splinters from lifting.

Sinew is what the Indians used to back their bows, but it is difficult to get, unless you have access to the dead animal itself. The longer the strands of sinew the better, and the longest comes from under the back bone. The hock tendons are good too, but are much shorter.

Fibre glass backings are made of spun glass fibres laid in a plastic to hold them in place and thus make a workable product. Plastics have been developed that are hard and horn like and make fair backs and facings for laminated bows.



HOW BACKINGS ARE APPLIED

Wood-See that the back of your stave is absolutely flat. Sand it well with coarse sandpaper. See that your backinp, piece is absolutely flat also, and well sanded with coarse abrasive too. Apply glue (Casein, Weldwood or any resin glue) liberally to both backing and bow back. Cut a pressure board of pine or other wood Y4" thick and Y4" narrower than your wood

back. Place this over the back and bind your pressure board, wood back and bowstave together with rubber strips cut from an inner tube. Cut the strips Y2" wide and use plenty. See that glue squeezes out all along the joint. Let it dry for at least a day before working on your backed stave.

Rawhide-Scrape or plane the back of your stave smooth and sandpaper it with coarse sandpaper. Clarified calfskin or rawhide comes in various widths. Two pieces are used on a bow. Each length covers half the back. Soak the two strips in cold water for ten minutes and wipe off the excess moisture. The strips will now be soft and pliable. When you take the calfskin out of the water stretch it very carefully. It will have a tendency to curl-apply the concave side to the bow back. Apply smooth, thick, creamy waterproof glue along the back of your stave. At the center tack one piece to the back, run the rawhide up to the end, smooth out all air bubbles and tack it at the tip with a thumb tack. Butt your second piece against the first, tack it, and run it down the second half of the back of the stave. Be sure all air bubbles are worked out and the rawhide adheres everywhere. Watch it for half an hour or so and keep working it down where needed.

Fibre-Fibre comes in strips and is glued directly to the back with waterproof glue. It is best to cut a thin slat (Y4" thick) exactly the width of your bow back, for a pressure board. Lay the fibre in the glue on the back, press the slat on, and bind down with rubber strips Y2" wide cut from an inner tube. Let it dry overnight and remove the slat.

Sinew-Secure three to four dozen Achilles heel tendon sinews. These will run from 6" to 12" long. Shred them fine by pulling apart with flat jawed pliers. Rough the smoothed back of your bowstave with very coarse sandpaper. Apply Special Formula Glue (a glue developed by the writer for glueing sinew to sinew, sinew to wood, horn to horn and horn to wood) liberally along half the back. Take a handful of shredded sinew, work it in lukewarm water for a few minutes, squeeze out all water, and pull out a soft strand. Lay it lengthwise in the glue, and continue this process until you have covered the back with the strands of sinew. Lap them, and so arrange them that the back is covered. Then do the same to the other limb. Apply another layer and continue this process until you have 1/8" to Y4" of sinew and glue on the back. Apply glue between each layer. Let it dry for at least two weeks, and you will have a hard, hornlike back. The longer this back dries, the harder it gets and the more cast it develops.

Fibre Glass-Fibre Glass comes in the form of strips ly2 wide by 1/16" to 3/32" thick and about 5'6" long. It isglued to the flat back with a resin glue. Some fibre glass backs come already glued to a very thin strip of wood, and the thin wood piece (plus fibre glass) is glued to the bow back. A pressure board should be used-as described under Wood Backs. To get a good glue joint with fibre glass is quite a job.

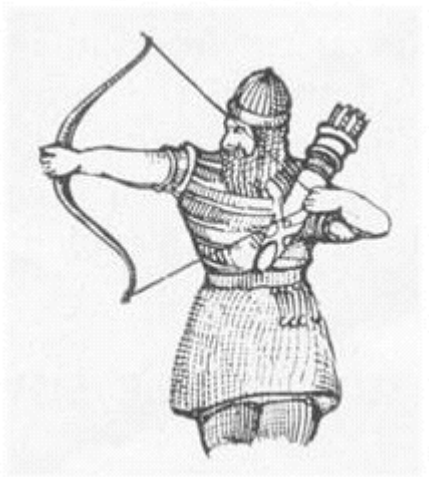
To improve the cast of the finished bow, backs are glued to the stave while it is held in a reflexed position. Make a wooden form 2" thick, 2" longer than the stave you are working with and 6" wide. One edge of this wooden form piece is worked into an arc, the cord of which is 3" to 4". By bending around this form, your stave will come out with a concave back. The backing goes on the form first, stave on top. Start at the center, and with rubber strips (spaced I" apart) cut from an inner tube, tightly bind down one limb. Bind all around the form. Then bind down the other limb. Before binding to the form, the stave should be tapered on the flat belly side. Begin 20" down from the ends and taper to 3/8" at the ends. This will make bending around the form a lot easier.

DEMOUNTABLE BOW

A demountable bow, or carriage bow, is a bow that is made to come apart. The two limbs are joined under the handle in a stee! tube, which acts as a ferrule, so that the top limb may be pulled out. The advantage of a bow of this kind is its convenience in packing and carrying. A 6'0" bow reduces itself to a package a little over three feet long.

The handle consists of three pieces of seamless steel tubing - one piece 4" long and two smaller pieces 2" long. The two shorter pieces are fitted to the ends of your limbs; and care must be taken to see that the billets of lemonwood, yew or osage, whichever wood you are using, fit snugly and perfectly into these 2" pieces. A hole 3/32" in diameter is drilled through steel and wood and a long thin nail driven through and filed off even with the tubing. This is to hold the tubing securely in place. Then the two limbs with their steel ends are inserted into the longer tube and lined up; another long nail is pinned right through the large 4" tube and the lower section, which is held permanently in place. A socket and post is made from a nail 3/32" in diameter for the top limb so that it lines up easily each time you assemble the bow. See Plate 4.

It is essential that when the two 2" pieces of tubing are fitted to the bow ends that you do not cut shoulders of any kind. The wood of the limbs must fit inside the tubes, so that there is no chance of a break starting at a shoulder.



FLAT-LIMBED LEMONWOOD BOWS

The Flat, Semi-Indian type bow merits special consideration. Although the idea is not new, its present growing popularity is due to the many advantages it possesses. The fundamental principle of this type of bow is that a wide, thin, flat slat will bend easier and be less liable to fracture than a square stick of the same volume of wood. This feature makes it possible to use a 28" arrow in a 5'6" bow, and, naturally, since a shorter bow of the same weight will shoot farther and faster than a longer bow, you get a flatter trajectory. Further, a well proportioned flat bow is easy to string, sweet to use and has lots of punch. It is well established that the nearer to the center of a bow the arrow can pass, the less side variation there is in its flight- hence the narrowed handle of the flat bow, thickened from back to belly for the necessary stiffness and strength. See Plate 3.

MAKING THE FLAT LEMONWOOD BOW

The Flat Bow is the easiest of all bows to make, and is, therefore, an excellent type for the beginner to attempt. It presents fewer problems than the making of a long bow, yet the finished bow is entirely satisfactory and a worthwhile weapon in every respect.

The Flat Side of the stave is the Back. The side with the handle riser is the Belly. Caution: Do not attempt to bend your stave until you have tapered the limbs on the sides and belly, as described below, otherwise the riser may pop off. If it should loosen, take it off, smooth off the surface of the riser and stave, glue it back into place with casein glue. Use rubber strips cut from an old inner tube to hold it in place while the glue is drying.

Since a 5'6" Flat Bow is the proper length for the greatest number of archers, let us begin with that size stave. The Flat Bowstave you get from us will look like that shown on Plate 3.

It will be 5'6" long, IY2" wide and 9/8" thick in the limbs. The handle riser or thickening piece will be glued in place and be sawn to the approximate shape of the finished handle. At this point it will be I Y2" thick, ample bulk to result in a stiff middle.

The back of the bow is left flat. Smooth it up with a sharp hand plane set very fine. At each end of the stave, measuring from side to side, place a dot. These marks will be Y4" from the edges. Measure off Y4" from each side of the center mark and make two more dots. Eighteen inches from each end of the stave draw a line across the back. Connect the ends of this line with the two dots which are Y4" from the center point. Plane off the wood on either side of these lines. This gives the limb taper. See Plate 3.

Note: Sometimes your stave will not be absolutely straight, but may have a side warp. In this event the above measurements would not hold, because it would then be necessary to take off more wood on the side toward which warp curves, i.e., the concave side. When you finish tapering the limbs, however, each should be a long, narrow, triangular figure measuring ly2" wide just above the handle riser and continuing this IY2" width for about a foot, then tapering to Y2" wide at the ends of the stave.

The Belly side of the bow is tapered from the handle riser, where it is @/8" thick to Y4" at the ends-just a slight taper. Then round off all the corners on the belly side, so that the cross section is a low, flat arch. The handle of the Flat Bow is accomplished by making an abrupt, sharp dip in the riser, rounding off the corners and working the wood into the limbs. A coarse file is good for this work. Plate 3.

Next comes the notches for the bowstring. These may be cut into the wood, or be of stag horn, cow horn, or metal. Plate 3 shows how the ends will look when the notches are cut into the wood. A round, rat-tail file 8" long is excellent for this work. If you wish to embellish your bow with cow or stag horn tips, the ends of the stave must be carefully tapered and rounded into a cone that will snugly fit into the horn bow tips. Be very careful not to force the wood into the horns, or a split will result. Work slowly and carefully, and when the horns fit perfectly, glue and pin in place.

Put the loop of your bowstring over what is to be the top limb of the bow in such a fashion that the string lies along the belly. Slide the loop down a few inches below the notch (3y2"), lay it out straight along the bow and fasten at the bottom with a bowyer's knot (timber hitch). After the bow is strung or braced the string should be 5y2" from the top of the handle riser.

When your bow is cut out, and before you apply the final finish, it should bend evenly in both limbs and its shape should be a segment of a circle with a flattened middle of about 6". One of the commonest faults of amateur bow makers is that their bows are stiff for about two feet

in the middle. Too much wood is cut from the upper limbs which leaves them too weak. The result is that only about 24" of the whole bow does the work of bending. This sets up undue strain on your weak limbs and breakage occurs. Plate 7.

The following measurements are taken from finished flat bows of Lemonwood. The lengths of the bow and weights are given, but since bow-making is non-dimensional, these tables are not absolute. In other words even though you might work closely to these figures, the bow may or may not be the weights given. It is better to leave a bit more wood all around, and then scrape down to the weight you wish.

25 Lb.—5′0″ Flat Bow

	Width	*Thickness Back to Belly*
At the middle of the bow	15/16″	1 4/16″
4″ above middle (at widening of limb)	1 5/16″	8/16″
8″ above middle	1 5/16″	5/16″
12″ " "	1 5/16″	4/16″
16″ " "	1 4/16″	4/16″
20″ " "	1 1/16″	4/16″
24″ " "	15/16″	4/16″
28″ " "	11/16″	3/16″
Just under the nocks	9/16″	3/16″
At the extreme tip	5/16″	2/16″

45 Lb.—5′6″ Flat Bow

	Width	*Thickness Back to Belly*
At the middle of the bow	15/16″	1 4/16″
4″ above middle (at widening of limb)	1 7/16″	11/16″
8″ above middle	1 6/16″	9/16″
12″ " "	1 6/16″	9/16″
16″ " "	1 5/16″	8/16″
20″ " "	1 3/16″	8/16″
24″ " "	1 1/16″	7/16″
28″ " "	14/16″	6/16″
32″ " "	11/16″	5/16″
Just under the nocks	10/16″	5/16″
At extreme tip	8/16″	3/16″

40 Lb.—5′6″ Flat Bow

	Width	*Thickness Back to Belly*
At the middle of the bow	15/16″	1 1/4″
4″ above middle (at widening of limb)	1 6/16″	8/16″
8″ above middle	1 6/16″	8/16″
12″ " "	1 6/16″	8/16″
16″ " "	1 4/16″	7/16″
20″ " "	1 3/16″	11/32″
24″ " "	1 ″	11/32″
28″ " "	14/16″	6/16″
32″ " "	12/16″	5/16″
At the nocks (cut in wood)	10/16″	4/16″
At the tip	8/16″	4/16″

65 Lb.—5′10″ Flat Bow

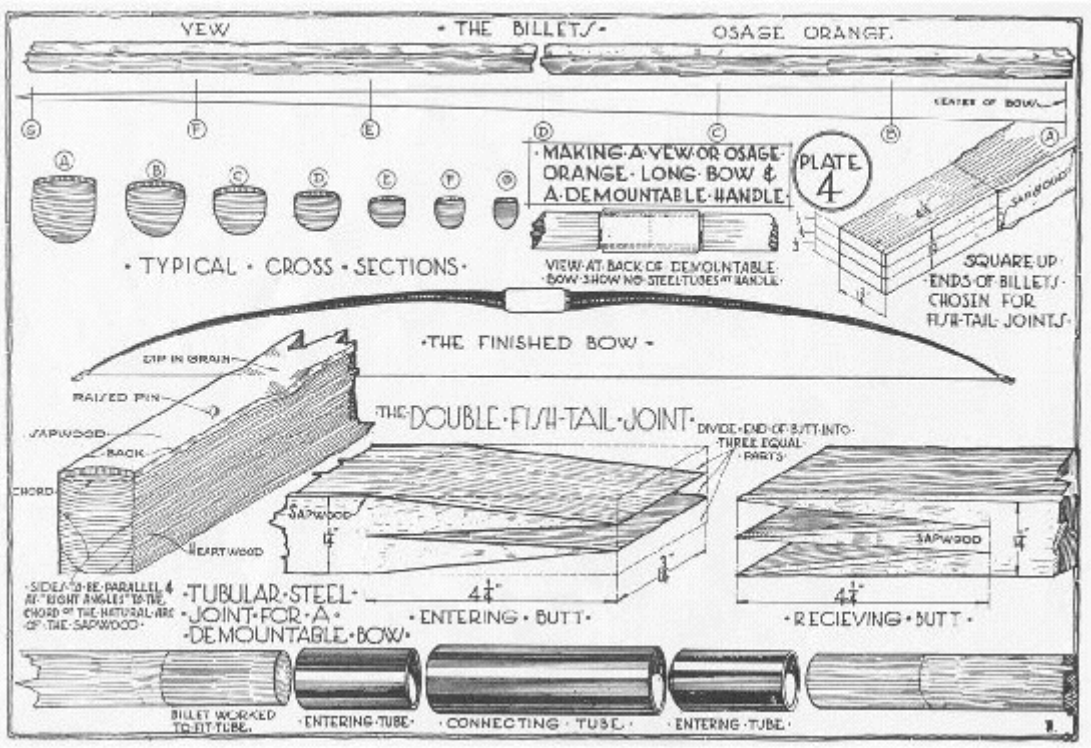
	Width	*Thickness Back to Belly*
At the middle of the bow	15/16″	1 6/16″
4″ above middle (at widening of limb)	1 6/16″	12/16″
8″ above middle	1 7/16″	10/16″
12″ " "	1 7/16″	9/16″
16″ " "	1 7/16″	9/16″
20″ " "	1 6/16″	9/16″
24″ " "	1 4/16″	8/16″
28″ " "	1 1/16″	7/16″
32″ " "	13/16″	6/16″
Just under the nocks	12/16″	5/16″
At extreme tip	6/16″	4/16″

MAKING YEW AND OSAGE ORANGE BOWS

Yew and Osage Orange bowstaves differ materially from those of Lemonwood. They are cut directly from the log and have the bark, sapwood and heartwood intact when first cut. The bark is usually taken off the osage orange staves to help them season. The bark on yew is thin and after a year's drying can be taken off with a draw knife quite easily. Both of these woods may be had in full length staves of from 5'0" to 6'0". They also come in billet form. Billets are two pieces cut preferably from the same wide short piece. Since these woods have small

knots, pins and other minor defects, it is easier to get two clear pieces 3'6" long than it is to get a single long, sound clear stick. If you intend to make your bow from billets, they must be joined to give you sufficient length. There are two methods of joining yew and osage billets. The simplest way is to join them in a seamless steel tube lys" in diameter. The ends of the billets are carefully rounded so they fit perfectly in the 4" tube. After they are in place, and the two billets lined up for straightness, two pins of metal are driven through tube and wood and riveted in place. Drill a hole I" from the tube end right through and insert your pins-one in each billet end. Any nail 3 /32" in diameter will do. The other method of joining is by means of a bowyer's or double fishtail joint. See Plate 4. Square up one extremity of each billet so that you have ends 4y4" long, IY4" from heartwood to sapwood, and ly4" wide, as shown on Plate 4. Paste a piece of paper on the back of the sapwood side of the squared ends on which to pencil the outline of the joint to be made. First measure down 4y4" and draw a line. The joint you are going to cut is a dove-tailing of two ends. One end of your billet will have two points; the other three. The two pointed end goes into the three pointed end. To make the two prongs, divide the end of your billet into three equal parts; make pencil points at these divisions. Draw lines from these two points to the outside of the bottom of your first line across the back, which is 4y4" down the ends of the billets. Place a point in the center of this cross line, and draw two triangles as shown on Plate 4. With a band-saw or hack-saw cut out the center and side pieces as shown. This gives you the two pronged end. The receiving end is three pronged as shown. Divide the tip of the other billet in half, and the cross line in thirds. Draw in your lines as shown and saw out the wood where required. If you make the joint carefully, it should fit perfectly. No light should shine through. If it isn't a perfect fit, you may work it in with a file. When the joints fit nicely, apply heavy, creamy waterproof glue liberally. Force the joint together and tightly bind the whole joint with rubber strips Y2" wide cut from an inner tube. Leave about a quarter of an inch between the rubber strip wrappings so the air can get at the glue. After the joint is wrapped with rubber strips, line up your stave carefully. See that it is straight. A very slight tilt or reflex towards the back is permissible. You may shift the joint while the glue is wet and the rubber will hold the shift in place. Leave your work tightly wrapped for two days, remove the rubber and let the joint dry for a week. When the joint is perfectly dry, it is a good idea to round it off to approximate handle shape and bind it tightly with thin linen fish line or linen twine. This is an insurance against accidents which might open up the sides of the double fishtailed joint. After your stave has reached this point you may proceed to make the bow the same as if it were a single stave. The most important thing to remember in making both yew and osage bows is that the GRAIN MUST BE FOLLOWED. Place your stave in a vise, and with a draw knife take off the bark if it hasn't already been done. With osage, removing the bark is all that is necessary. Scrape the back clean and smooth with a Hook Scraper No. 25. With Yew it is necessary to reduce the white sapwood to 3/16" thick evenly along the back. Do this with a sharp draw knife and be sure to folllow the grain; dip when the grain dips, let it rise where it rises, don't try to flatten the back or you will cut across the grain and your bow will break. Your guide line is the separation point of the red heartwood and wbite sapwood. Next look along the stave from end to end. if it has a side warp or is not straight, take off wood from whichever side needs it. Measure down 1" from the end of your joint or metal tube. Consider this point the true center of your bow. Measure from this point 3'0" in either direction and cut off any excess material. The joint or metal tube will now come under your handle and the arrow will leave the bow I" or ly4" above the true center. Plate 4 gives you various steps in the making of 6'0" Yew and Osage Orange bows, and the following tables of measurements give you actual figures on which you may lay out your stave. Base your back measurements from side to side of a true center line arrived at by means of a string and thumbtacks as described under

the section, "Making a Lemonwood Long Bow". Bear in mind that the figures were taken from finished bows, but that is no guarantee that if you follow them your bow will weigh the same. If you wish a 45 pound bow follow the measurements for the next higher weight given, and then you may scrape your bow down a bit if it results in too strong a bow. You can always take off wood, but you can't put it back on.



Following the grain on the backs of both yew and osage is very important. Be sure you do it, regardless of dips and rises. On the belly of yew bows, it is well to leave a little more wood where there is a pin or small knot. When the bow is finished, these look like small warts about a quarter of an inch in diameter. This is necessary to prevent crisals at these points.

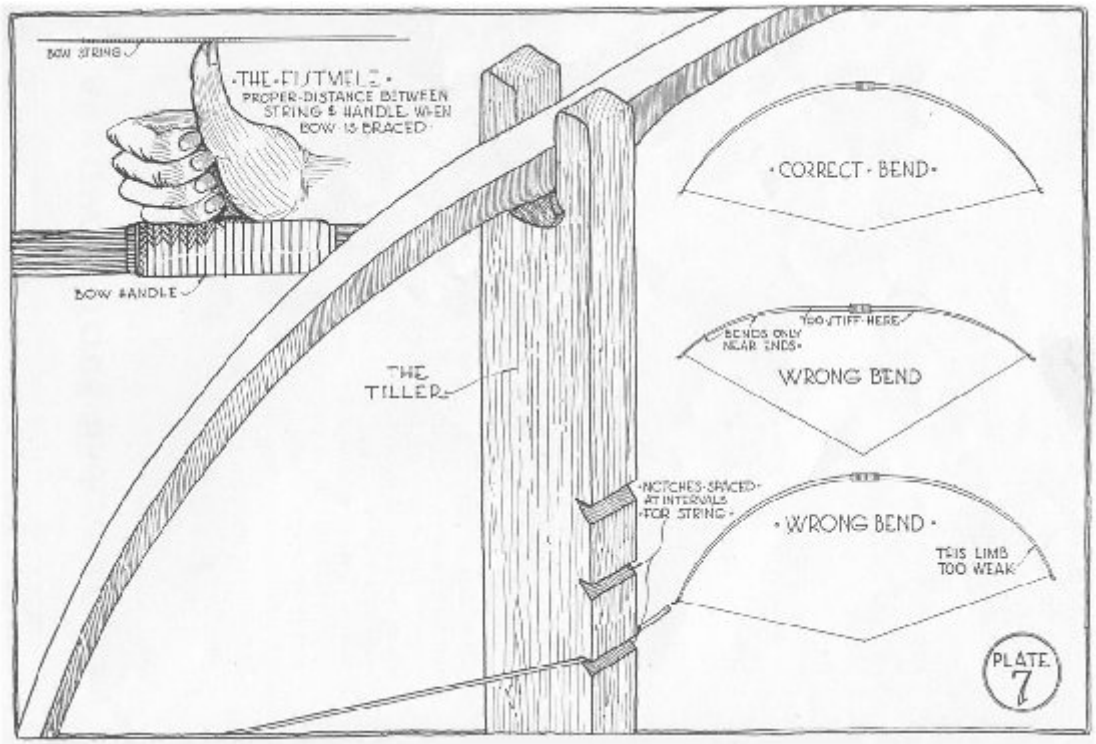
OSAGE ORANGE LONG BOWS—6′0″ LONG

	43 Lbs.		45 Lbs.		55 Lbs.	
	Across Back	Back to Belly	Across Back	Back to Belly	Across Back	Back to Belly
At the Handle.....	17/16″	16/16″	18/16″	16/16″	19/16″	19/16″
6″ Above Handle ..	16/16″	13/16″	17/16″	13/16″	18/16″	15/16″
12″ " " ..	16/16″	12/16″	17/16″	13/16″	17/16″	13/16″
18″ " " ..	15/16″	10/16″	16/16″	10/16″	15/16″	12/16″
24″ " " ..	14/16″	9/16″	14/16″	9/16″	14/16″	11/16″
30″ " " ..	10/16″	8/16″	11/16″	8/16″	11/16″	9/16″
At the Nocks.....	7/16″	7/16″	8/16″	8/16″	8/16″	8/16″

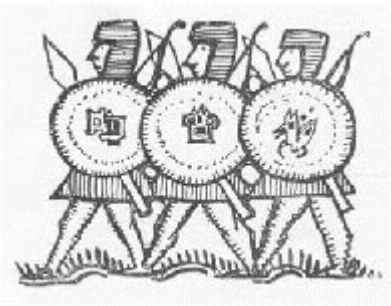
YEW LONG BOWS—6′0″ LONG

	40 Lbs.		45 Lbs.		50 Lbs.	
	Across Back	Back to Belly	Across Back	Back to Belly	Across Back	Back to Belly
At the Handle.....	18/16″	17/16″	20/16″	18/16″	20/16″	20/16″
6″ Above Handle ..	17/16″	12/16″	19/16″	14/16″	18/16″	16/16″
12″ " " ..	17/16″	10/16″	19/16″	12/16″	17/16″	13/16″
18″ " " ..	16/16″	9/16″	17/16″	11/16″	16/16″	12/16″
24″ " " ..	15/16″	9/16″	15/16″	9/16″	14/16″	10/16″
30″ " " ..	11/16″	8/16″	12/16″	8/16″	13/16″	9/16″
At the Nocks.....	7/16″	7/16″	7/16″	7/16″	9/16″	8/16″

Since you have plenty of depth at the handle, you can make it IY4" from back to belly and cut quite sharp dips just above and below the grip. This makes for softness in shooting. Be sure when your bow is tillered, as described in making Lemonwood Long Bows, you achieve a long graceful arc from the handle to the ends. See Plate 7

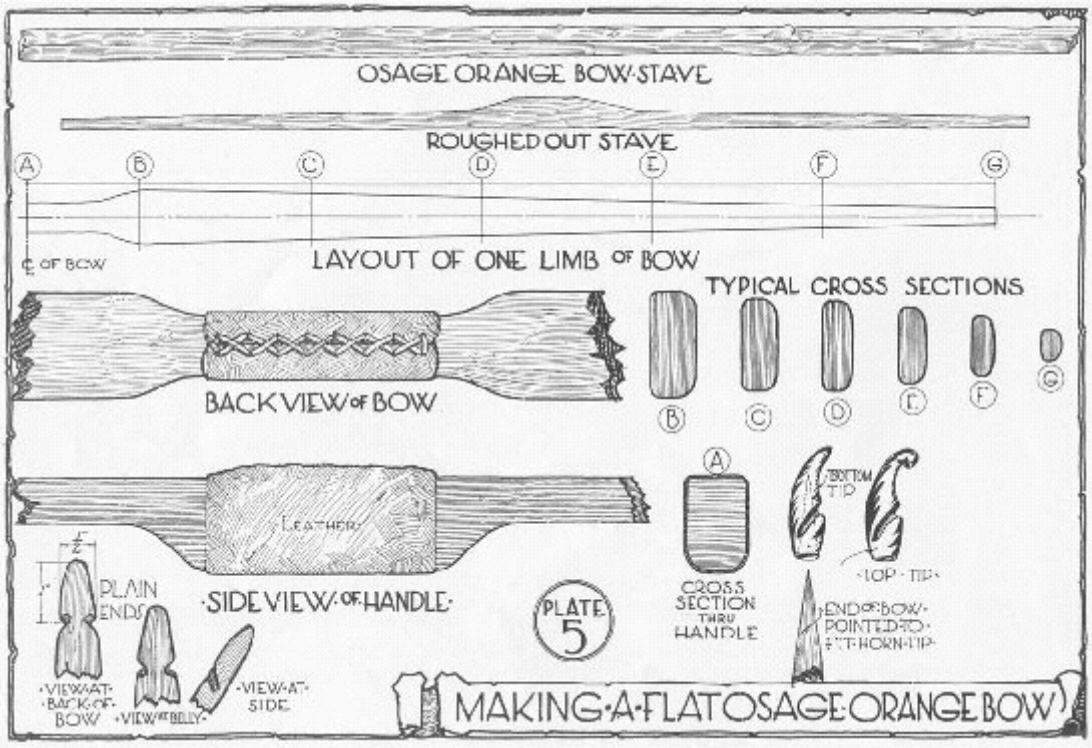


When working on the belly side of your bow, the rough work may be done with a sharp draw knife. Some staves may be finished with a hand plane while others may have to be worked into shape with scraper and wood rasp. With some osage staves it may be necessary to practically fashion the entire belly with coarse and fine rasps. The actual making, finishing and handling of the bow is similar to those of lemonwood. Naturally, it is impossible to foresee and advise against every possible contingency in bow making and it is expected that the craftsman will have sufficient intelligence to help him over rough spots.

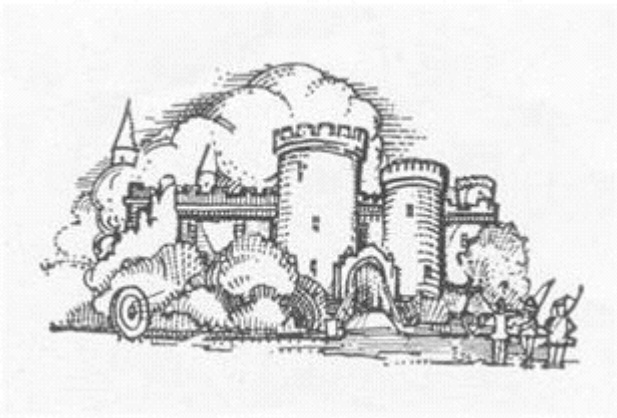


FLAT OSAGE ORANGE BOWS

Osage Orange lends itself beautifully to the Flat, Semi-Indian Type of bow. Read again the section on making the Flat Bow of Lemonwood. With an osage stave 5'6" long in your possession, the first step is to transform it into a Flat Bowstave.

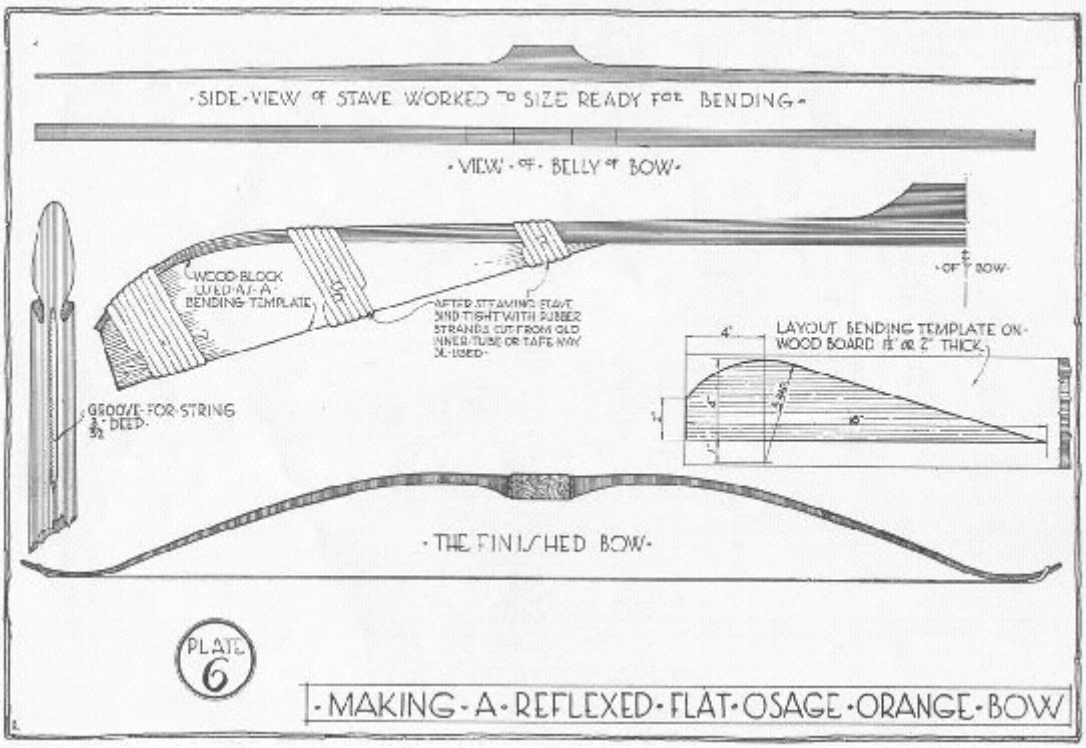


Remove the bark if it has not already been taken off, and clean up the back; be sure to follow the grain when using the draw-knife. Determine the center of your stave. One inch above the true center draw a line around the bow; 3" below the center draw another line around the stave. This is where your handle will come. Refer to Plate 5 and note bow the handle looks. With draw-knife and coarse wood rasp, work your handle to this shape. The abrupt dips at either end of the handle riser flow gracefully into the flat limbs. At the widest part of your limbs-just a bit below where the handle riser dip disappears into the limbs, your stave should be IY4" to IY2" wide, depending on how wide your original stave was. It should be Y4" through from back to belly, and taper off at the ends 5/16" from belly to back. Next taper your sides. Measure in from each extremity 18", and draw a line across the back. Place a dot at each end. Measure Y4" to either side of this dot. Connect up the ends of the line across the back 18" down, and you will have a triangle with its base the width of the stave and the apex Y2" across. Plane down to this line and lead into the sides so there are no harsh lines. Consult Plates 5 and 7. Round off the belly into a low flat arch, cut your notches, brace your bow and tiller as described. Finish and handle to suit your fancy.

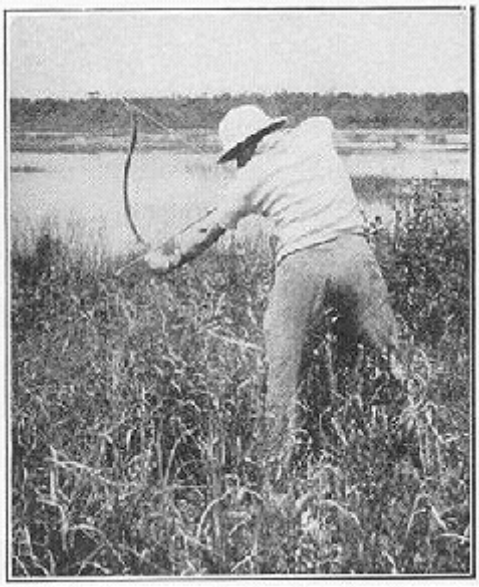


REFLEXED BOWS

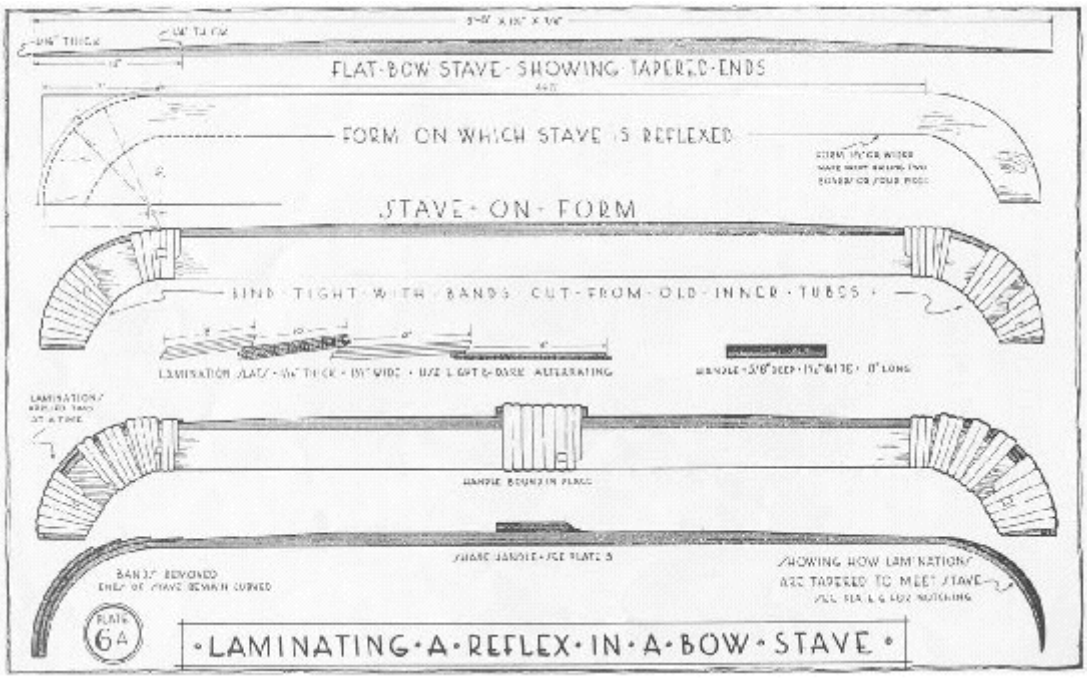
Reflexed bows have the ends reflexed or bent back in a pleasing curve. Reflexing adds beauty and grace to the outline of a bow. Reflexed bows may be Long Bows or Flat Bows. There are two methods of reflexing bows. Osage and Yew may be reflexed by means of steam and boiling water. Lemonwood is very difficult to reflex this way. It does not absorb moisture readily and is prone to split and check from the heat. The other way is to glue a reflex in the ends-it is done by laminations. Flat bows are easiest to reflex, and most reflexed bows are of the Semi-Indian Flat Type.



First Method - Assuming that you have a flat osage or yew stave, proceed the same as if you were making a flat bow, but before you cut your notches in the ends, they are reflexed or bent back. A water pail, two wooden forms, and about two dozen rubber strips cut from an old inner tube constitute your bending equipment. Rubber strips should be I ' wide. The wooden form is made from boards 1312" thick, or two 1" boards nailed together. The shape with measurements is given on Plate 6. Boil the ends of the limbs, one end at a time, until the wood is soggy, soft and pliable. This takes three to four hours. Bind the ends to the wood forms with the rubber strips. Stretch the rubber well and bind tightly. As you bind, the rubber will pull the ends down along the curved forms. Begin binding at the bottom of the curve and work up (towards the ends of the stave) so the wood is always covered with rubber in order that splinters may not lift. The stave ends should be left in the forms in a dry place, not too hot, for three or four days. All exposed parts of the stave should be shellacked to prevent possible checks from drying. After the rubber binding and forms have been taken off, allow the stave ends to dry out for four or five days to be sure they are perfectly dry and set. Then cut the notches, brace or string the bow as described before, tiller the limbs to a perfect bend, scrape, sandpaper, handle and finish.



Second Method - This, in the writer's opinion is by far the best way. It results in a reflex of beauty and grace, and is in to stay; the reflexes made by the first method may eventually pull out. Assuming that you are going to reflex a 5'8" Flat Bowstave either of Lemonwood, Yew or Osage, the first step is to flatten the ends of your stave with a long 12" taper. The tips or ends of the stave should be thinned down to 1/16" and increase in thickness to Y4" at the 12" mark. This permits bending the tips around a form as shown on Plate 6-A. Prepare two sets of lamination slats (ten slats in all). These are to be about 1/16" thick. Each set consists of: I piece 14" long, 2 pieces 12" long, I piece 10" long, 1 piece 8". If these slats are of contrasting colors-for instance, lemonwood and black walnut, or lemonwood and rosewood, the finished bow will be very handsome. Prepare a wooden form as shown on Plate 6-A. Place the stave on the form and bind the thinned ends down around the curved extremities of the wooden form. Use strips of rubber Y2" wide cut from an inner tube. Leave the stave overnight so the ends take a set. Prepare good, thick, lumpless, creamy waterproof glue. It is possible to glue on two lamination slats at a time. Apply glue liberally to the 14" piece, place it over the end; apply glue liberally to one of the 12" pieces and bind these down around the form ends with strips of rubber. Be sure the ends are lined up evenly with the tips of your stave. Continue glueing these slats on around the form ends until you have built up about a half inch of laminations in a reflexed or curved form. Let the glue job dry at least a week before shaping the bow. After the laminationg are well set, the step-like ends of the slats are all tapered off as shown on Plate 6-A.



HUNTING BOWS

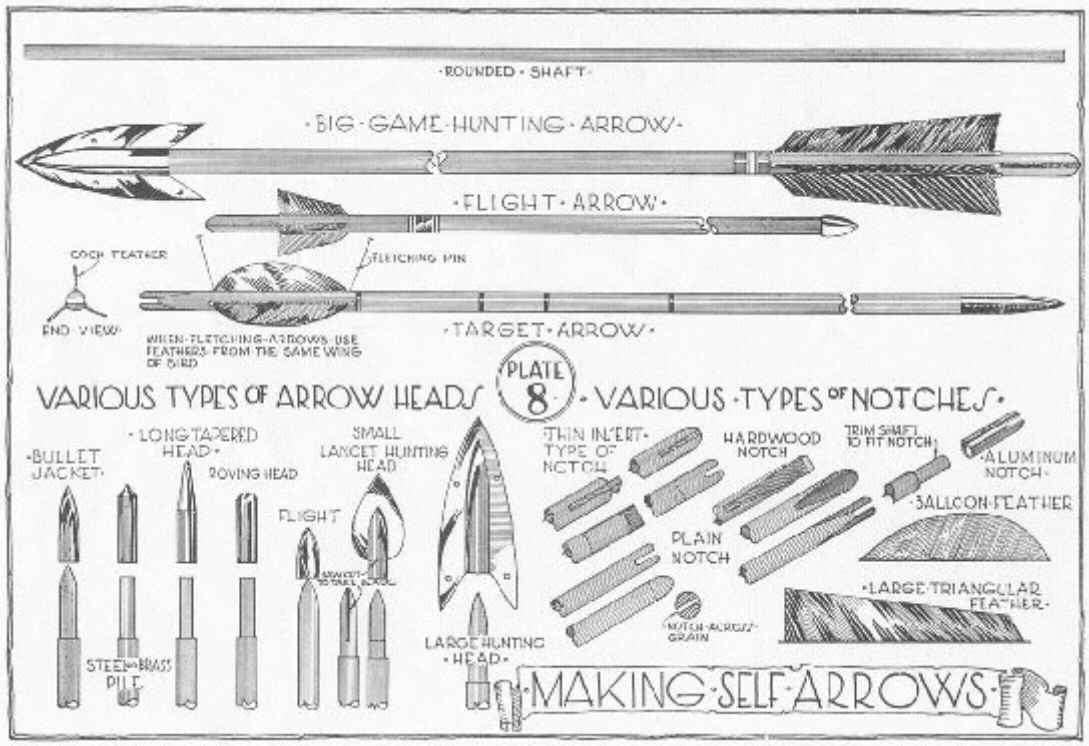
The typical Hunting Bow is about 5'8" long, Flat, Semi-Flat or Long Bow type. Bois d'arc (osage) is tough and dependable. The bow is plain ended and backed with rawhide. The string is oversized for safety and the handle is of heavy calf-skin or cowhide.

There are no frills on a good hunting bow -sturdiness and dependability are what count. For big game hunting the bow is around 70 lbs., some go as high as 80 lbs. Osage Orange is the most dependable wood at these heavy pulls. These bows are intended to drive big, broadheaded arrows with 3/8" shafts swiftly and surely to the mark and are made accordingly. For hunting small game, any kind of a bow 45 to 55 lbs. pulling weight will do. They may be plain ended, tipped with horn, fibre or metal and be either the long bow or flat bow type. Whether the bow is made of Lemonwood, Osage or Yew is immaterial. The arrow used in these lighter bows is 5 /16" or 11 /32" in diameter, is tipped with a small bunting head, and is fletched with long low triangular feathers.

ARROW WOODS and ARROWS

Arrows have different work to do, and are, therefore, made of different woods. Knock-about arrows, beginner's arrows, roving, field and hunting arrows are made of birch. Better target arrows are made of imported Norway Pine and Port Orford Cedar. Excellent hunting arrows are also made of these woods. Birch:-Is a hard, tough, white wood, and the best of it comes from the New England States, especially Maine. If birch could be had straight, and if it stayed straight, it would be the ideal arrow wood. Birch used in my shop is specially selected, and is as straight as this wood comes. Even though arrows made of birch may not be as perfect as fine target arrows made of the soft woods, when fletched with long triangular feathers, they whistle straight and true to the mark. Birch has one distinct advantage; it may be straightened with the fingers when out of line. My quiver full of sturdy birch field arrows have been in use for a long time. They get lost, but they stand up and rarely break.

Port Orford Cedar:-Is a light, straight grained, soft wood. It has a delightful odor, and makes excellent self and footed arrows. It comes from the West Coast. Norway Pine (Pinus Sylvestris): -This comes from the Baltic Sea forests, where the cold, stern climate makes for slow growth and splendid "spiney" wood. It is the old "red deal" of the English yeoman and there is no finer arrow wood than good Norway Pine. It is used for both self and footed target arrows. Shafts in the 3/8" size make the verv finest hunting arrows for big game. There are two kinds of arrows-self arrows and footed arrows. Self arrows are arrows made of one piece of wood. Footed arrows are arrows with an inlay or "footing" applied to the head end of the shaft. Norway Pine and Port Orford Cedar are "footed". The footing is a hard, tough wood that strengthens the head end of the arrow, gives it a hard wearing tip, makes for balance and beautifies the arrow. Footings are of beef wood, lemon wood, purpleheart, hickory and birch.



Arrows also have various shapes. The cylindrical shaft is most common. Chested arrows are thicker below and under the feathers and taper to the nock and head. Barrelled arrows are thicker in the middle and taper to each end. Bob-tailed arrows are thicker at the head end and taper from the pile to the nock. There are target arrows, flight arrows, roving arrows, field arrows and hunting arrows.

MAKING SELF ARROWS

The simplest way to make a dozen plain, self arrows is to buy a set of arrow materials intended for this purpose. They may be bad already nocked and headed. All that is necessary is to fletch them, or put on the feathers. Casein, waterproof glue is recommended for feathering arrows. This comes in the form of a white powder, which is mixed with cold water. It should be thick, creamy and free from lumps. It should stand for fifteen minutes after it has been well mixed to allow the ingredients to set. Prepare it in small batches-it will not keep overnight. Good casein glue is really waterproof. Feathers, on arrows that have been lost for months, are likely to be still on. There are two common shapes for feathers. The balloon shape, as shown on Plate 8 is used on target arrows. The long, low, triangular feather is used on field, roving and hunting arrows. You may buy feathers already prepared or you

may make your own from the whole turkey wing feather. Stripped feathers are those which have been stripped from the quill. See Plate 9. Cut feathers have been cut out with a sharp knife and have a thin portion of the quill remaining. Either sort is good. Arrows should be the right length for your bow. The table given under "The Arrow" ("Fundamentals of Archery") should be followed. These sizes are not absolute, but it is well to follow them. Arrows entirely too long for your bow will result in breakage. The first step in making self arrows is to put on the head. Plate 8 gives various types of target heads, and your shafts should be shouldered to fit the head used. They should be pinned or knurled on when firmly seated. After your heads are on, cut off your shafts to the desired length. If you use birch, cut the notch in the shaft itself. Notches should be Y4" deep, wide enough for your string, and should be sanded smooth and be nicely rounded. If you are using a soft wood-Port Orford Cedar or imported Norway Pine, it is well to reinforce your nock with an inlay of fibre or hardwood, as shown on Plate 8. Then cut your notch across both the grain and inlay. Sandpaper all your shafts very smooth. Feathers come in pairs, and an archer's pair is three. A pair of feathers consists of two of any color and one of another. The odd colored feather is called "the cock feather" and is to be put on first, whether it is balloon shaped or triangular. Feathers go on I" below the bottom of the nock. A pair of three must all be from feathers from the same side of the bird. You cannot mix lefts and rights. Feather shapes are given on Plate 8. Balloon feathers are 2y8" along the vane and Y2" high at the highest point. A good size of triangular feathers is 3y2" along the vane, 3/8" high at the back or nock end, and 3/16" high at the lowest point. With your feathers cut and ready, lay out six pairs. If they have a tendency to curl, place them between warm, damp cloths for a couple of hours. This takes the curl out of them and they will go on straighter. Apply waterproof glue liberally to the vane of all six pairs. Pick up a cock feather and glue it to the shaft I" down from the bottom of the nock. It is well to run a pencil line around the whole batch of shafts I" down from the bottom of the nock, so you'll get all your feathers on evenly. The cock feather goes on at right angles to the nock. The other two are spaced equidistant around the shaft,.as shown on Plate 8. It may be necessary to pin them in place as shown. Large headed pins are best, since they can be stuck into the wood better, but any pin will serve. After your shafts are feathered, varnish or shellac them and decorate or crest them to suit your taste.

MAKING HUNTING AND ROVING ARROWS

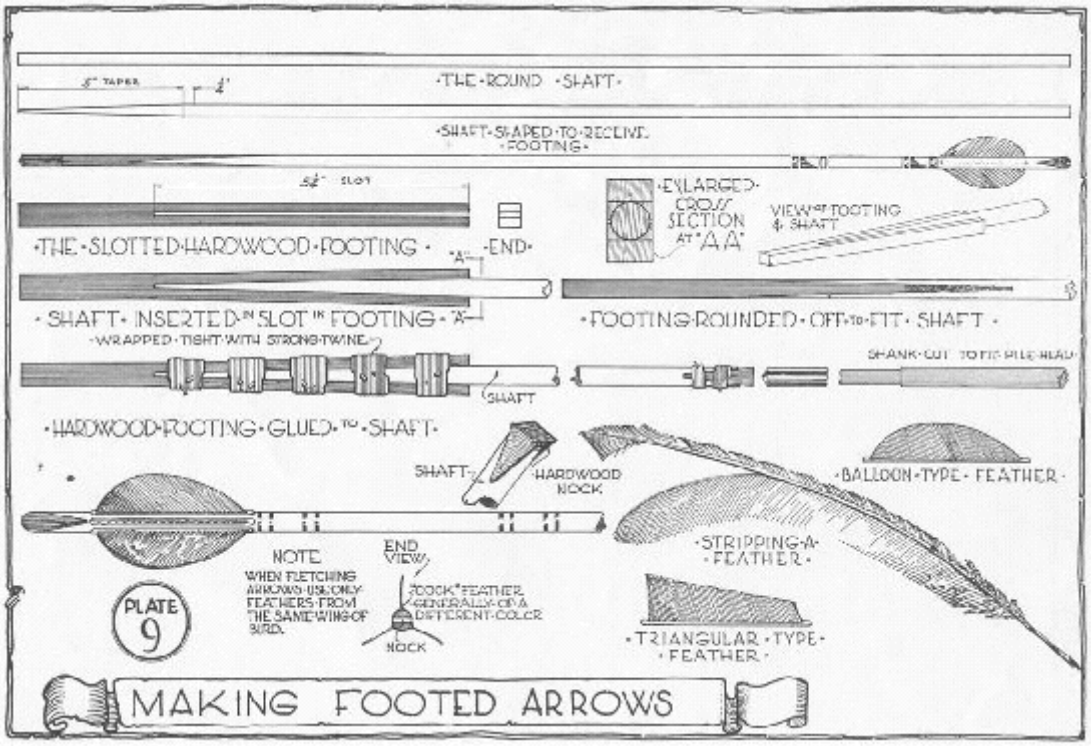
These are made the same as any self arrow, but long triangular feathers are used. Roving arrows have blunted heads. The long, tapered steel head is a good field arrowhead. Hunting heads are of various shapes and size. The small broadheads,the small lancet shaped heads, etc., are usually affixed to 5/16" and It /32" shafts. The big broadheads are for 3/8" shafts, and imported Norway Pine in this size is best, as it is straight and tough enough when inlaid at the nock for real u e with heavy bows. The hunting heads go on the shaft with the blades in line with the nock so you do not see the wide flat side. See Plate 8.

FLIGHT ARROWS

These are long, light arrows, with very small feathers and little heads, and are intended for distance shooting only. They may be made of Port Orford Cedar, imported Norway Pine and be either self or footed. An exceptionally fine flight arrow is made from thin bamboo shoots. Flight arrows are from 28" to 30" long, sometimes longer.

MAKING FOOTED TARGET ARROWS

There are various ways to make footed target arrows, but, in the writer's opinion, the following method is the easiest. Assuming that you have a dozen straight 5/16" x 30" Port Orford or imported Norway Pine shafts, and a dozen square footings Y8" x 8y2" long, slot the footings with a hacksaw to a depth of 5y4". See Plate 9. Lay them aside. Taper the ends of your shafts with the flat of the grain, beginning 5" from the end as shown. The footing is slotted 5y4" and the extra Y4" will help you to plane your square footing round with the round shaft. The taper should go down to a feather edge. See that each taper fits a footing. Apply casein glue liberally to the taper and inside the slot. Push the taper into the footing, as shown, and bind tightly with rubber strips cut from an inner tube. Look down your shaft and line up your footing with it, so that the footing and shaft is absolutely straight. While the glue is wet this can easilv be done with the fingers. Let the footings and shafts dry for a day-two is better, and with a sharp block plane round the square footing to the same size as the shaft. If you buy round footings, it is a simple matter to work down the prongs to the shaft. Study Plate 9. After you have your footings rounded down and all straight with the shaft, put on your heads, and cut off all your shafts to the length that fits your bow. Inlay your nocks as shown on Plate 8, being sure to cut with the grain lines, so that you may finish your nock across the grain. Fletch your shafts with balloon feathers and finish up the same as you would self arrows.



MATCHING ARROWS

When you have progressed to the point where you take your target shooting seriously, it is absolutely essential that you have a set of six, eight or a dozen footed arrows that are "matched". That means that they should all fly the same, or fly as nearly the same as it is humanly possible to make them. In our shop we match by shooting. Footed arrows are made up in batches of a gross and are then shot at 55 yards in a 45 pound bow. Groups of twelve are picked, Naturally the same point of aim is used, and these groups are tied out in bunches. Then each bunch of twelve (sometimes more) is shot again and again until we are reasonably certain that the twelve are matched and fly and perform the same. If you are making your own footed arrows this method is impractical because it involves the making of too many arrows. When you are working with a dozen or eighteen, it is necessary to have a set of grain weights and a jeweller's scale-the sort of scale that blind justice holds in her hand. It is a simple matter to make a pair of balances that will answer your purposes. All you need is a cross bar of thin hard wood with a hole in the center so that it may be suspended on a wire. A small tin pan with four holes punched in its rim and four strings to suspend it about ten inches below one end of the beam and a wire hook, with two widely separated prongs, on which you can rest an arrow, hung from the other end of the cross bar, will do. Bring your scale to an even balance by pasting adhesive tape bit by bit to whichever side needs it. Now discover your lightest arrow. Place its weight in grains in the tin pan, pick up your next arrow and bring it to the same weight by taking off wood very carefully toward the nock end. Do this with all your arrows until they are within ten grains of each other. Then finish up as described for feathering. This way you have a much better chance to get eight or nine out of the dozen to fly the same. The English weigh their arrows against newly minted silver coins-shilling and pence. In America, while some still use these weights, it is fast becoming the custom to use grains. A shilling is 87 giains and a pence is seven and one-quarter grains. Men's 27" to 28" arrows vary between 410 and 425 grains; ladies' 25" to 26" arrows are between 300 and 325 grains.

HOW TO TAKE OF YOUR BOWS AND ARROWS

After you are through shooting, unstring your bow. If you leave it strung overnight it may lose cast. It is best to keep your tackle dry. If you get caught in the rain, wipe your bow and arrows with a soft dry cloth. If the feathers on vour arrows get mussed, run them through the steam from the spout of a briskly steaming water kettle. They will fluff out at once. Don't overdraw your bow, or try to see how far it will bend without breaking. It is said that a drawn bow is seven-eighths broken. Bows are wood, and wood breaks. The flat side of your bow is the back; don't draw it or string it any other way than flat side out. Your bow will become accustomed to your particular style of draw. It is poor policy to let others use your pet bow. It won't do it any good. The best way to store your bows is to hang them on pegs on the wall. Keep them away from radiators. Do not jam too many arrows in a quiver; it spoils the feathers. It is best to keep them in a wooden box with spaces for each arrow. Almost all wooden bows "follow the string", or take a set in the drawing direction. A set is no real objection, so do not try to straighten a bow by bending against this natural set. It is a good plan to wipe arrows clean and dry after you are through a day's shooting. Be sure the whipping in the loop or eye and in the center of the bowstring does not fray. Replace it if it does. Wax your bowstring frequently. Don't pull your bow and let go. That is an excellent way to snap the string and break your bow. It is a good plan to have an arrow on the string whenever you draw; then you can't draw too far and strain the bow.

COMMON ARCHERY TERMS

Arms-The two limbs of a bow.
Armguard-A protection against the bowstring's strike, worn on the inside of the left forearm. It is usually of heavy leather padded with felt.
Arrow Case-A box of wood or other material in which arrows are transported. Each arrow is usually held separate from its fellow.
Arrow Plate-A piece of horn, pretty shell or leather just above the handle on the left side of a bow, where the arrow passes as it leaves the bow.
Arrowshaft-The wooden shaft or steel of an arrow.
Arrowsmith-One whose business it was to make metal arrowheads.
Artillery-The old time word for bows and arrows.
Ascham-A tall, narrow cabinet in which bows and arrows are kept.
Back-The outer or flat side of a bow.
Backed Bow-A bow which has been backed with rawhide, wood, fibre or sinew.
Backing-Any substance which is used for backing bows.
Balloon Feather-A feather that has been cut parabolic or curbed.
Barb-A projection on a hunting head which prevents its easily being withdrawn.
Barrelled-A barrelled arrow is heavier in the middle and tapers toward each end.
Bass or bast-The twisted straw back of a target.
Belly-The belly of a bow is the rounded side, held towards you when shooting.
Bend-You bend a bow when you brace or string it.
Bobtailed Arrow-An arrow that is thicker at the pile end. It tapers to the nock.
Bow Stave-The stick, stave or piece of wood from which a bow is made.
Bowyer-A maker of bows.
Brace-To string a bow.
Bracer-Another name for an armguard.
Brash-Wood is called brash when it is brittle. Broadhead-A large flat hunting head.
Butt-A hillock or mound of earth or sod on which target faces are attached to be shot at.
Carriage Bow-A bow joined under the handle in a ferrule so it comes apart and makes for easy transportation.
Cast-The ability of a bow to throw or cast an arrow.
Chested Arrou-An arrow is chested when it is thickest toward the nock end and tapers to the pile and nock.
Chrysal-or Crisal-A crushed line of fibres running across the grain, usually in the belly of a bow.
Clout-A small white faced target with a black bull's eye used in archery-golf and clout shooting.
Cock Feather-The feather placed at right angles to the nock. Usually of a different color from the other two.
Crest-The decoration on an arrow. Each archer has his own color scheme which identifies his particular arrow.
Crossbow-An old time weapon made with a short steel or horn bow set crosswise on a stock.
Crow Bill-An arrow head of horn, as used in Northern France.
Curl-A curl or swirl in the grain of a bowstave.
Dead Shaft-An arrow that has no life or spine. One that flies sluggishly.
Down Wind-When the wind is on the archer's back.
Draw-Pulling an arrow the proper distance.
Drawing Fingers-The fingers used in pulling a bow-the first three of the drawing band.

Drift-The drift to either side of a mark caused by a cross wind.
End-Six arrows shot one after the other is an end.
Eye-The loop at one or both ends of a bowstring.
Finger Tips-Leatber stalls or protectors for the three tips of the shooting fingers.
Fistmele-The distance between handle and string when the bow is strung. It is an old Saxon measurement. The distance from the base of the hand when clenched to the tip of the extended thumb.
Fletch-Putting the feathers on an arrow.
Fletcher-An arrowmaker.
Flight Arrow-An arrow used for distance shooting. It is long and light and has very small feathers.
Flight Shooting-Distance shooting; to see how far you can send an arrow.
Flirt-An arrow flirts when it jumps out of its steady line of flight.
Follow the String-When a bow takes a set or bend in the drawing direction, it is said to have a set or to follow the string.
Foot-The piece of hardwood spliced to an arrowshaft.
Footed Arrow-An arrow which has been footed with a piece of hardwood at the head end.
Fret-The same as a crisal.
Grip-The same as a handle of a bow.
Handle-Where the bow is held when being shot.
Head-The tip or head of the arrow.
He! He!-The call of ancient archers. We get our "Hey, Bill" from it. Used the same as "fore" in golf.
High Braced-When the distance between handle and string of a strung bow is over seven inches. It is better to high brace a bow than low brace one.
Holding-The slight pause just before you loose the arrow. Home-An arrow is home when it is fully drawn and ready to be shot.
Horns-The tips of a bow made of cow, steer or stag horns in which the notches for the string are cut.
Jointed Bou-A carriage or two piece bow.
Kick-A bow is said to kick when a jar is felt after a shot. It is due to unevenly tillered limbs.
Long Bow-Any bow of 5'6" in length or over.
Loose-To let go the string with the shooting fingers; to shoot the arrow.
Nocks-The grooves cut in the wood of the bow itself or in horn, fibre or metal tips, in which the loop of the bowstring fits. The notch in arrows.
Nocking Point-That point on a bowstring where the arrow is nocked or placed when you are ready to shoot.
Overbowed-A bow too strong for its user.
Overshoot-To shoot beyond your mark.
Overstrung-When the string is entirely too short for the bow.
Pair-An archer's pair has come to mean three, i.e., two arrows and a spare is a pair of arrows. Three feathers are called a pair.
Petticoat-The rim of the target. It is outside the last or white ring, and has no value in the count.
Pile-The head of an arrow-its point.
Pin-A small black knot in yew or osage.
Pinch-The same as crisal.
Pin Hole-The exact center of the gold of a target.
Point Blank-The range is said to be point blank when the arrow flies flat to the mark.

Quiver-A receptacle for holding arrows. They are of various shapes, sizes and materials. Some are worn at the waist and some at the shoulder.
Reflexed Bow-A bow with the ends reflexed or curved back in a graceful arc.
Release-To let the arrow and string go; to shoot an arrow.
Round-The number of shots at given distances, as in the American and York Rounds.
Rover-One who indulges in field shooting or rovers.
Roving-The act of shooting over fields and woodland with no particular target-stumps, trees, bunches of leaves, etc., being the marks.
Run-When one of the strands in a bowstring lets go the string is said to have a run.
Sap Wood-The wood right under the bark. It is white in yew, about the same color as the heartwood in both osage and lemonwood.
Self Arrow-An arrow of only one piece of wood.
Self Bow -A bow made of one piece of wood; a single stave.
Serving-Whipping or winding with thread.
Shaft-The arrow.
Shaftment-That portion of the arrow to which the feathers are glued.
Shake-A crack in a bowstave running lengthwise with the grain.
Shooting Glove-A glove so made that the three shooting fingers have protection across the tips.
Spine-That quality in an arrow that permits it to get around the bow and straighten itself efficiently.
Spine is not stiffness alone, but some other elusive quality.
Steele-The shaft of an arrow; the body of the arrow.
Tackle--All the equipment of an archer-his bow, arrows, arm- guard, finger guards, quiver, etc.
Tiller-See Plate 7.
Toxophilite-One who loves, studies and practices archery.
Turn-A bow is turned when it has a twist to right or left of the string.
Underbowed-Too weak a bow for the archer.
Upshot-A final round or return end. A reckoning.
Vane-A piece of a feather. Wand-A stick set up as a mark to shoot at.
Weight-In actual grains, the weight of an arrow. The number of pounds pull a bow has.
Whip Ended-A bow is said to be whip ended when it is too thin or weak at the tips.
Whipping-A wrapping with thread to protect the loop and middle of a bowstring.