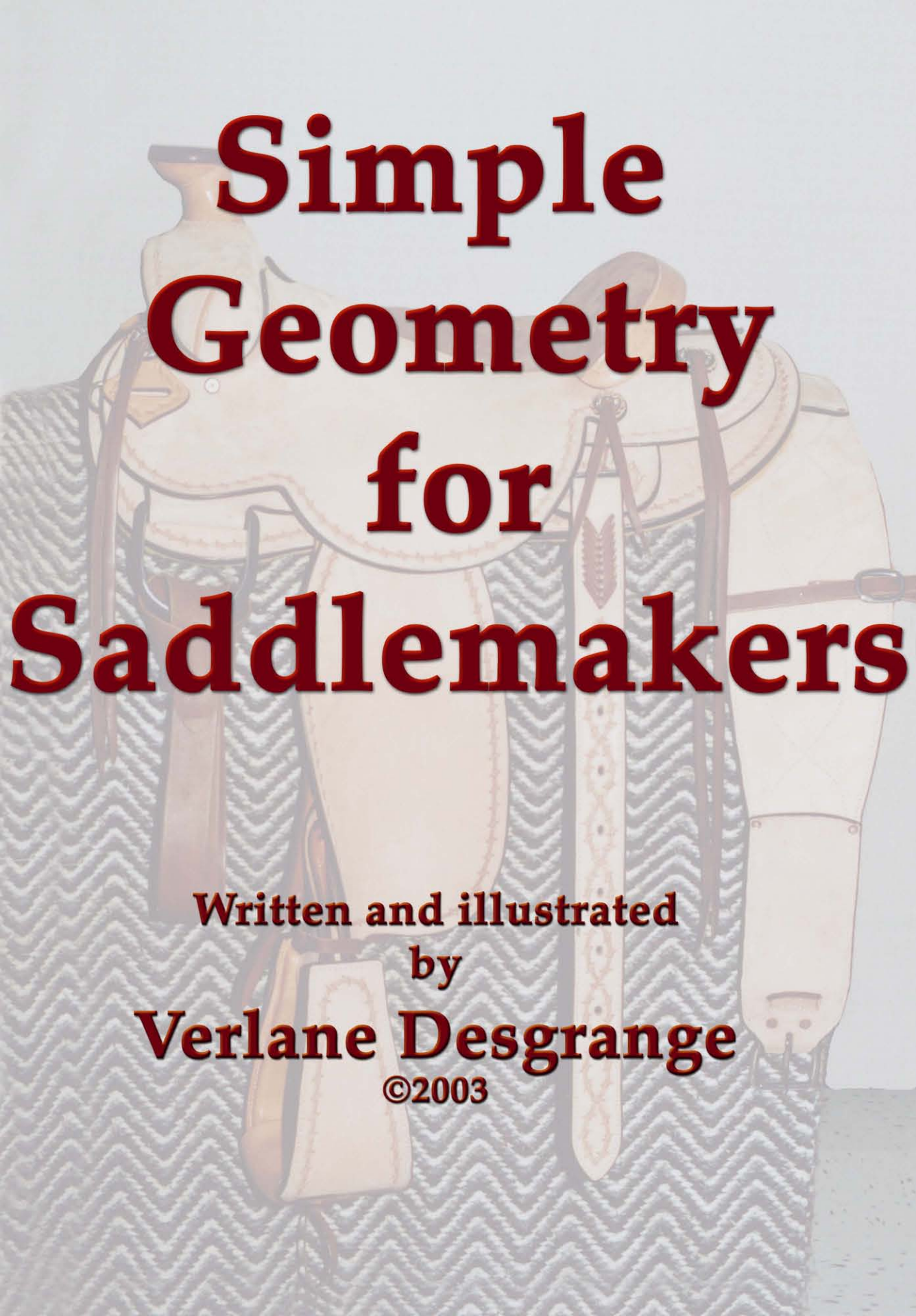

Simple Geometry for Saddlemakers

Written and illustrated
by
Verlane Desgrange

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Most saddlemakers fear the word "geometry" as they believe it is complicated and not useful for their purposes. This is far from the truth. In reality, simple geometry concepts can make for rapid and very accurate measurements that are not possible with a ruler. In fact in saddlemaking, rulers are not always used to measure things, since many distances need not be in feet and inches but rather both sides of a 3-dimensional object must be the same. It matters not that something is 14 7/8 inches distance from the horn, but whether it is the same distance on the left and right sides from the horn (see photo #1 for names of the parts of a saddle tree).

The tools to "measure" with are simple and have been with humanity since the Egyptians built the pyramids. To do these measurements, you'll need:

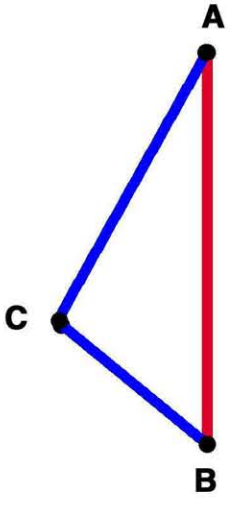
1. **Compass or dividers**
2. **String, which is in reality your #5 cord unwaxed linen thread that needs to be coated with beeswax before it is useful. Cut a length of about 4-5 feet and thoroughly wax the whole length.**
3. **Make a "bead" from leather by taking a #10 round punch and punching a hole in a piece of 10 ounce or heavier leather. Save the little round plug in the punch tube to act as the "bead". With a sharp stitching awl, stab a hole in the middle of the round plug.**
4. **To make the "bead string" combination, take your catch hook and pull the linen thread through the hole in the bead, leaving a closed loop on one side of the bead and two loose or open ends of the thread on the other side of the bead. On each end of the "open" end of the thread, tie a loop with a simple overhand knot. This way, you'll have two small loops on one side of the bead and one large closed loop on the other side. You now have the most precise measuring tool a saddlemaker can have! (See drawing on next page)**
5. **Tacks: Use #3 or #4 lasting tacks to place in horn and cantle.**
6. **Scratch awl with sharp point for setting initial hole in tree for tacks.**
7. **Hammer for tacks and scratch awl**
8. **Permanent magic marker for drawing on rawhide tree. Use the small tipped variety for more precise lines.**
9. **Large circle template from drafting supply store.**
10. **Homemade flexible straightedge made from 1/16 inch thick LDP.**
11. **Plumb line made from more waxed linen thread and a heavy object such as a nail.**

Congruent triangles

Establish point A

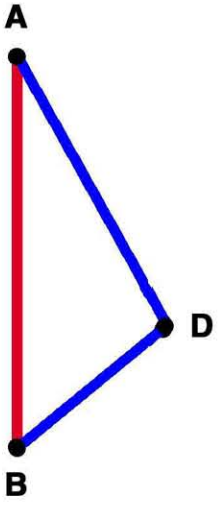
Establish point B

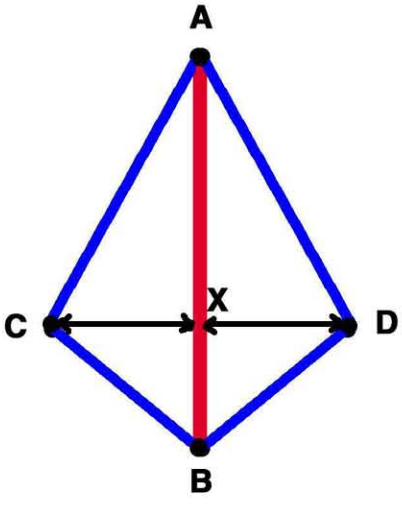
Connect point A to point B, creating line AB (shown in red)



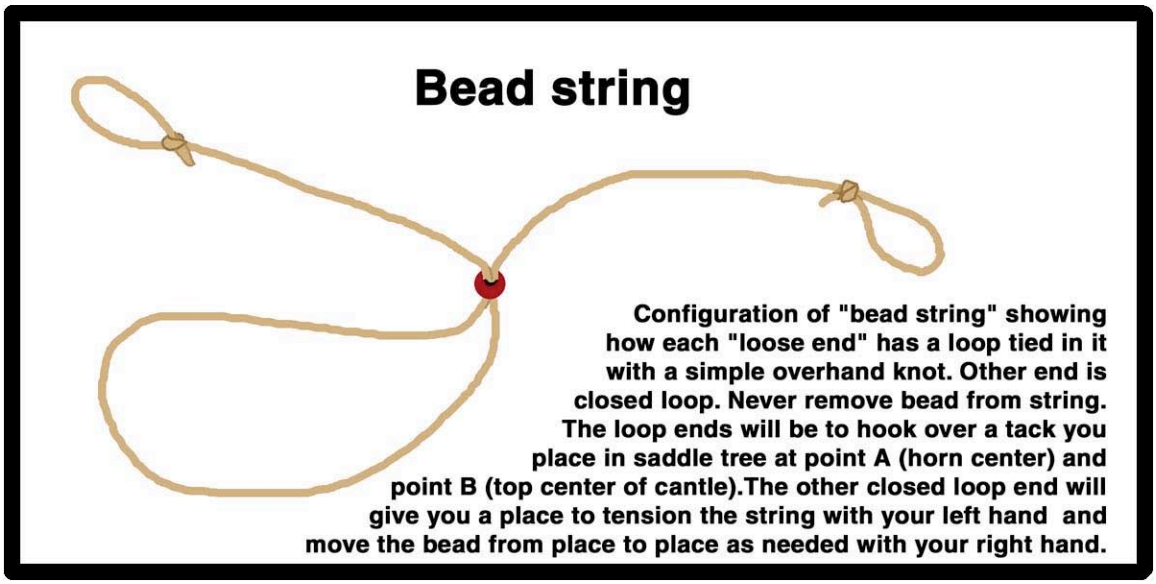
Establish point C. Connect C with A, creating line AC. Connect point B with point A, creating line BC. You have formed a scalene triangle, where all angles and lines are different.

To make the same triangle on the right as you did on the left, make sure line AD is the same length as line AC; at the same time make line BD the same length as line BC.





When these triangles share the same center line AB and AC=AD and BC=BD, you now have congruent triangles. Triangle ABD is a mirror image of triangle ABC. All their angles match as well. You can do this simply by putting a pin at A and then at B, take two pieces of string with a bead on them, and then decide where point C is. Without moving bead so string lengths remain the same, flip bead over to right side. Point D's location will be a mirror image of point C's location. Both points C and D will be EXACTLY the same distance from line AB. This is a fast way of establishing a symmetrical distance from a given line: CX=DX.



Quick geometry background

The photo on Photo page #1 shows how we will develop our geometry. Do this on a piece of cardboard or foam core board to put the pins in. If the board is white, you can take a fine tipped marker and draw the lines as you progress, just as was done on the photo page.

The first step is to find a Point A and then a Point B. Connect them with a Line AB. Establish a point C where ever it suits. Draw lines AC and BC. You have now formed a scalene triangle, meaning that there is no right angle in the triangle and all angles and lines are different within this triangle.

To make a mirror image of this triangle without measuring, set a pushpin at A and at B. Put your bead string loop ends on each pin. Slightly tension the string and slide the bead to coincide with point C while holding the closed loop with your left hand. When the bead is perfectly aligned with Point C, flip it over to the right hand side, taking care that you did not move the bead or tangle the thread on the pins. Where the bead lands should be Point D, an exact mirror location of Point C. You can test this by taking rulers to measure your lines and protractor to measure your angles.

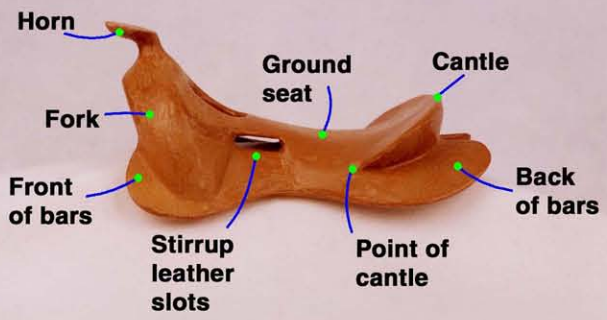
Since the triangles both share a common centerline, they are called *congruent triangles.* Since you did not move the bead on the string when you established Point D, both triangles have the same measurements. Measure Line CX and Line DX to prove this to yourself.

This simple act of creating congruent triangles with two points, a centerline, and piece of string with a bead on it, are the cornerstone of most measurements on a saddle regarding the symmetry from left to right. The only difference is you will be doing this on a 3-D object instead of a piece of flat cardboard. Before doing it on a

Photos 2-7

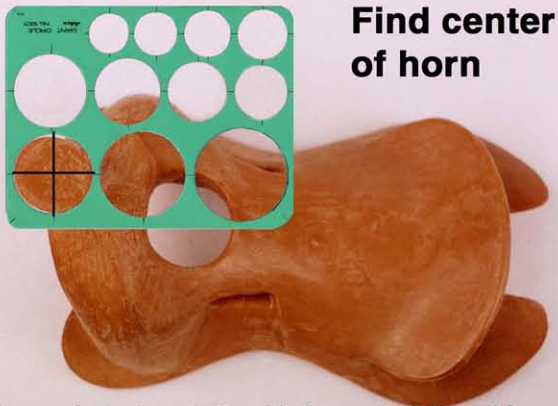
Parts of the saddle tree
(with ground seat installed)

2.



Find center of horn

3.



Use a circle template with "crosshair" markings. At the intersection of the crosshairs, is your horn center. Use a circle size that approximates the diameter of the horn as shown.

Center of horn

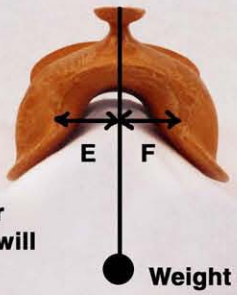
4.

Horn now has center marked. Put a small hole here so you can put a tack in it later.This will become point A from diagram.

Establish center of fork

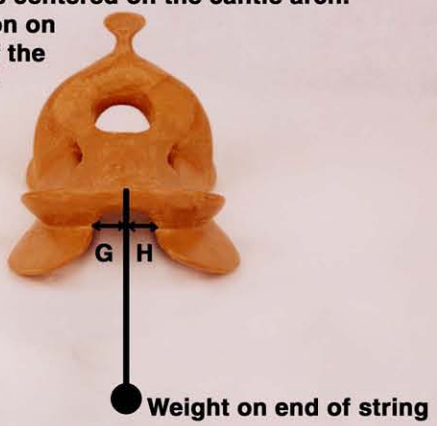
5.

Take a weighted string and drop stright down. Using dividers, make sure distance E = F. Be sure saddle is level for all measuring. Level means level from side to side and level from front to back. If not level, your measurements will be inaccurate.



Determine center of cantle by holding a string with a weight on the end of it where you believe to be the center. Take dividers and measure G and H. If G=H, then the string is centered on the cantle arch. Mark that location on the top center of the cantle arch. That mark on top center will be your working point for future measurements. Again, make certain saddle tree is level.

6.



Back of cantle marked with Center line

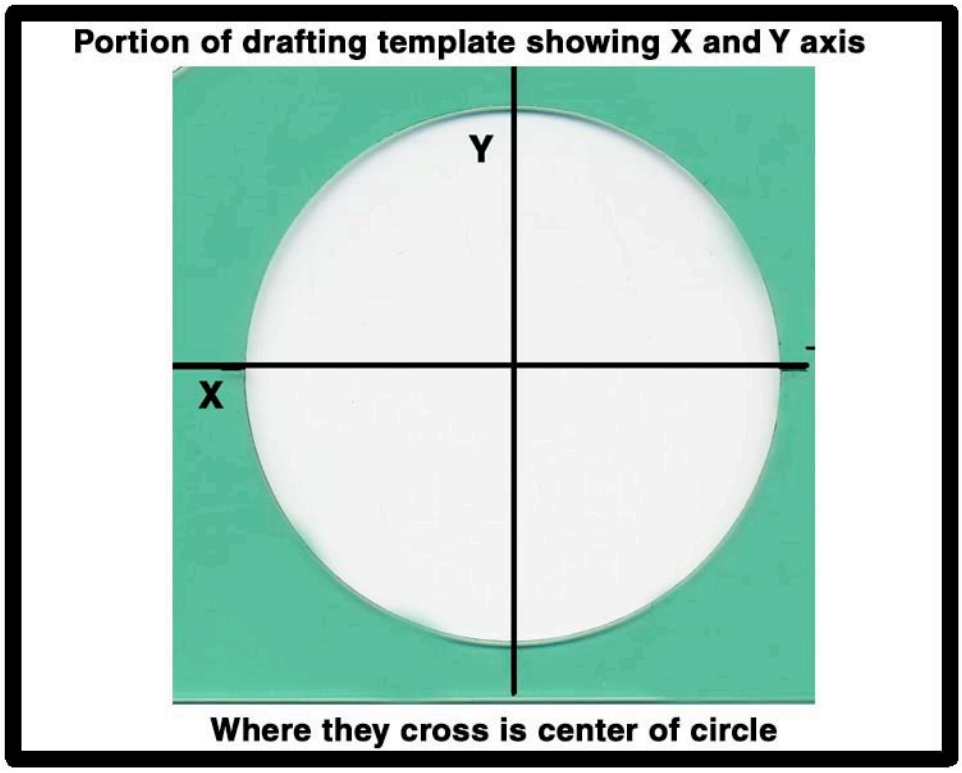
7.

saddle, though, first try this exercise first on a piece of cardboard so you understand how it works.

Establishing initial center points

Now, let's do this on a saddle tree. For purposes of demonstrations here, a Ralide® tree was used, for the molded plastic is smoother to draw on and the areas are sometimes easier to see. Know the parts of the tree before you begin, as the remainder of this article will use them without explanation (see photo #2).

First find the center of the horn. Since the cap of the horn is circular in most cases, it is easiest to find the center with a draftsman's template (photo #3). These translucent templates have various sizes of circles that all have both X and Y axis of the graph on them, thus forming "crosshairs" where these axes meet (see below). If you choose a circle that matches the size of your horn, lightly mark with a fine tipped marker all four of these lines. Connect the centerline (X) with each end, and then connect the cross line (Y). Where they intersect is the center of the horn cap. Mark the center with a marker (photo #4) and give the mark a light tap with your scratch awl to puncture a small hole in the cap.



Your entire fork and gullet must be also center lined. Hold a piece of string with a weight on the bottom of it, similar to a carpenter's plumb bob (photo #5). You can initially eyeball where the center probably is. Hold the weighted string there. When the string stops swaying back and forth, take your compass or dividers and measure from the intersection of the gullet and top of bar on one side (Distance E). Now check to see if Distance F matches that of distance E. If so, put a small

Photos 8-11

Tree with both center of fork and cantle marked

8.

Center of horn becomes point A
Center of cantle becomes point B

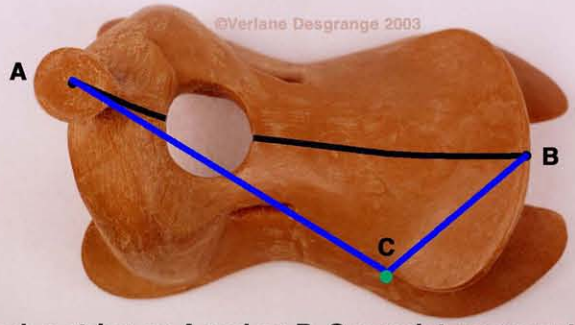
Center reference line

9.

Centerline from horn to cantle with a flexible straightedge. Line AB becomes your main refrence line while building a saddle.

Determing if saddle is symmetrical Step 1

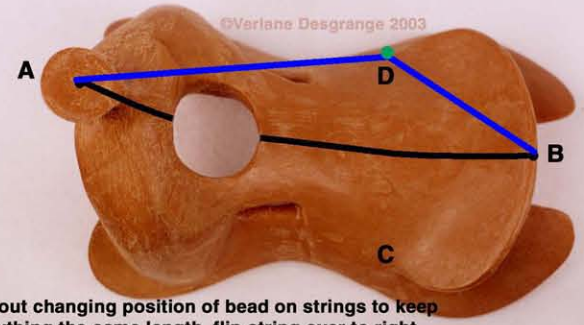
10.



Attach a string on A and on B. Green dot represents a bead on strings to keep them together. Place bead on point C, point of cantle on left side as shown.

Determing symmetry of saddle Step 2

11.



Without changing position of bead on strings to keep everything the same length, flip string over to right side of saddle to point D, point of cantle. If saddle is symmetrical, the bead should be exactly at point of cantle on both sides. If saddle is uneven, bead will be in different locations on each side.

Go back to first page that explains the basic geometry. What you've done so far is establish center points on horn (A) and cantle (B). From those you made a centerline down the fork, cantle, and ground seat when installed (shown). Put a tack in the center of the horn and top center of the cantle. Attach a string to horn and cantle. Slide a leather "bead" on the two strings to keep them in place. The bead will keep the strings together and the waxed linen thread you use for this is sticky enough that the bead will remain in the same place when you shift the strings from left side (photo #10) to the right side (photo #11). It is VERY important that the bead not move when you reposition the strings to get an accurate measurement. Since you have a common centerline and the length on the strings do not change, you can tell in a moment's notice that the left side and the right side are exactly the same. If your tree or rigging is off, the distance from the bead tells you how much off your work is. The tree you cannot adjust, but any subsequent leather you put on it can be repositioned until both sides are symmetrical (photos #12 and #13).

mark on center of gullet arch in front. To mark the line, take your flexible homemade LDP straightedge and wrap it around the fork, gullet, and finally up back of horn. While holding in the center position, mark a line all the way around the fork and horn. You can use the center mark on horn cap to line up straightedge on neck of horn.

You need to repeat the procedure on the cantle (photo #6). Using the same weighted string, mark the center of the cantle, from the rim down to the base (photo #7). Always use the flexible straightedge to mark a straight line on a curved surface. From above, your saddle tree should resemble photo #8.

Establishing symmetry of tree parts

Too many times, handmade production rawhide trees will have some parts out of alignment. You need to know what parts are out of alignment and make note of them before ever beginning to build the saddle. One area that will be a huge problem later on is the cantle points on each side. It's not uncommon for the left point to be placed in a different location on the bar than the right one. If you know in advance which parts are off and by how much, you can note them and work around it later on when you cut out the seat cover.

Look at photos #10 and #11. To check for the symmetry of the cantle points, place a tack in the horn center and in the top center of the cantle. Make sure the tacks will not move during this operation. Now, place one loop of your bead string on the horn tack and the other loop on the cantle tack. Tension the string and slide the bead to the point of the cantle on the left side (photo #10). Without disturbing the bead, flip it over to the right side to see if the bead lands in exactly the same location on the right side (photo #11). If it does, your saddle tree is perfectly even on both sides. If not, make a note of how far off the actual point is. Many times the point will be lower on the bar or further forward. That is common in handmade trees unless lots of extra work was done to insure that both sides are alike.

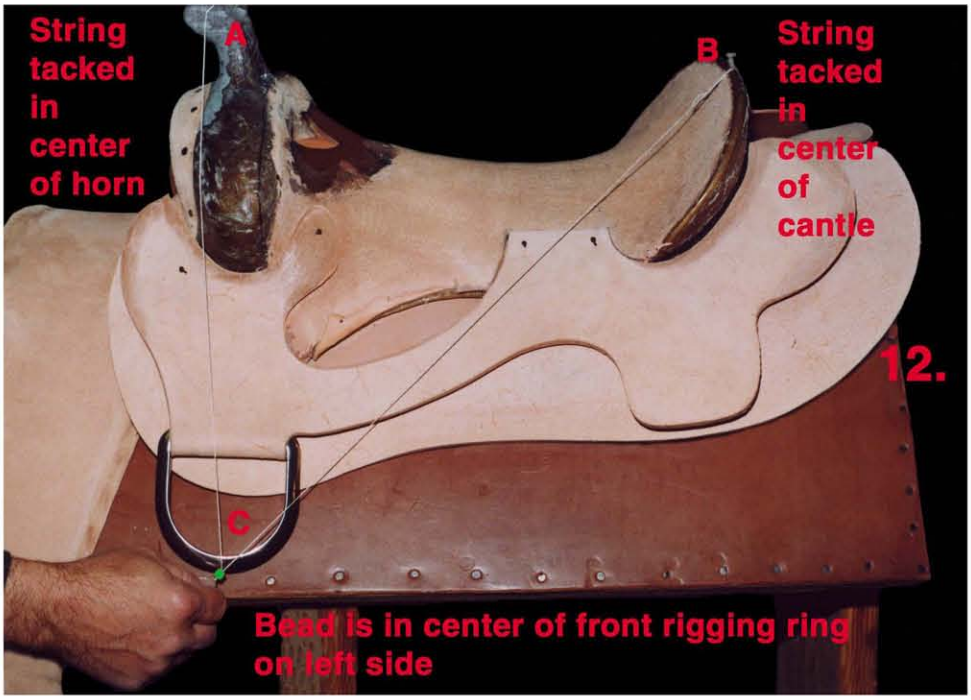
Unless you know this in advance, cutting the initial cuts on the seat cover will be problematic. Remember: <u>the seat cover is the most expensive piece of leather on the saddle. You cannot afford to ruin it.</u>

Again, you are using the principle of congruent triangles to determine the symmetry of the cantle points. With two points and a centerline, your bead string will be accurate down to 1/16", which is more accuracy than saddlemaking demands!

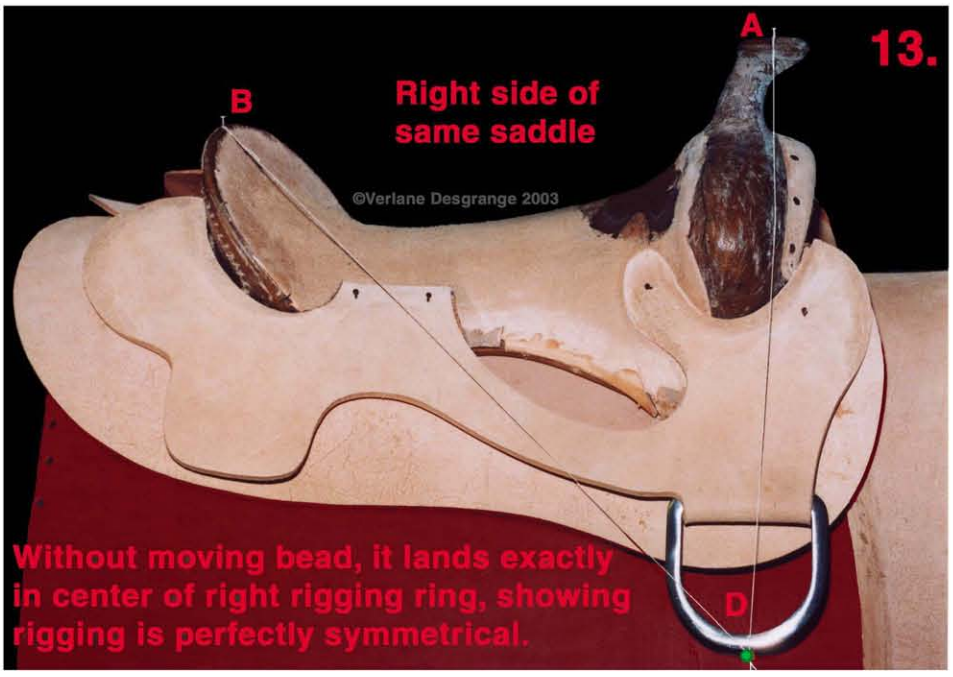
Ground seat center line

From the moment you begin work on the ground seat, you must work off a centerline or the seat will be lopsided. Centerline your strainer plate sheet metal

Photos 12-13



A real life situation to check for symmetry in the rigging system



By the time you've reached this stage, you've already drawn the pattern for the rigging type that is needed for the type of saddle you're building. You've already established the rigging position as well. Now your job is to test for symmetry from left to right sides. IT IS CRUCIAL THAT THE RIGGING POSITION BE EXACTLY ALIKE FROM LEFT SIDE TO RIGHT SIDE.

Put a tack in the center of the horn cap and another tack in top center of the cantle rim. Attach your strings with the bead to each tack. Slide the bead (shown in green here) to the bottom center of the left front D-ring. Hold taut (photo #12). Without disturbing the location of the bead on the strings, flip the strings over to the right side (photo #13). If you did the work properly, the location of the D-ring should be the same on the right side. Notice that both rigging plates are only temporarily tacked down to allow for adjustment if it should be needed. If the rigging is symmetrical, mark where it goes, using the tack holes on the rigging leather for guides. If the location of the rigging is correct, go ahead and screw it down permanently. The bead string, which uses congruent triangles for its principle, is the fastest and most accurate way to determine symmetry from left to right.

before even you transfer the pattern to it. Then lay the pattern centerline over the metal centerline and trace off the pattern on the sheet metal. Since the pattern is accurate, your metal will be accurate as well.

When you nail down the strainer plate, align the centerlines on the back of the fork and the front face of the cantle. This assures your strainer plate will be centered on the tree.

Each successive layer of leather that you put over the strainer plate will have to be center lined before you cement it down. That way, you always have a handy reference line to determine if one side is wider or heavier than the other. It is easier to look at a ground seat and see differences from left to right with a centerline than without.

When the ground seat is laid in, you need to mark a final centerline on it as shown in photo #9. If you are using a Ralide® tree, mark center of the ground seat immediately before proceeding further.

Rigging symmetry

The rigging is one area that must be absolutely even from one side to the other. This includes position on the saddle and the distance from tree bars. If the rigging is not even from one side to the other, the saddle will sit crooked on the horse's back causing him to get a sore back and possibly pinched skin. By virtue of a crooked sitting saddle, you too will sit crooked, exacerbating the problem. Again, our bead string can give us both dimensions simultaneously. This makes your job easier and extremely accurate.

Let's refer to photos #12 and #13 for the rigging. At this point in your saddle's construction, you've already decided on the type of rigging and the position for the saddle you're building. In this case the rigging design is a cross between a standard D-ring and a flat plate. The pattern was developed on paper and then transferred to leather. The leather was cut out and temporarily tacked on the tree for a final check with the bead string for position before anchoring it permanently.

Again, set a tack in the horn cap center and top center of cantle. Position the bead string in the center of the left D-ring as shown in photo #12. It is important that the point of the triangle (Point C in photo page #1) be exactly in center of the ring. Tension the string slightly to get the most accurate measurement. Without changing the position of the bead, flip the bead around to the right side to see if it lines up in the *same* place (photo #13, which is Point D) on the triangle). In this case, it does.

Should the rigging not line up on the right side, un-tack it and move it around until it does line up. Then reset the tacks and measure again. Be sure you

completed student saddle

14.

have a good attachment point on the tree if you move the rigging plate around more than 1/8".

If your saddle resembles the one in photos #12 and #13, you are ready to first anchor the D-rings to the rig plate, stitch or lace the rigging and lining pieces together, cut the slots for the flank billets, and lastly edge and polish the edges. Now you can permanently attach the rigging plates. Screw them down to the tree with the correct stainless steel screws and washers. You are now ready to go to the next step of building your saddle.

The finished saddle in Photos #12 and #13 is pictured in photo #14. Speed and accuracy of measurement figure prominently in saddlemaking to give a beautiful finished result. Learn to use this ancient geometry principle of congruent triangles to give the best results each time. It works on any kind of saddle and rigging configuration. But first try it on cardboard to get the hang of it. After that, you'll have a useful skill forever.