STAKED HIGH STOOL & ARMCHAIR

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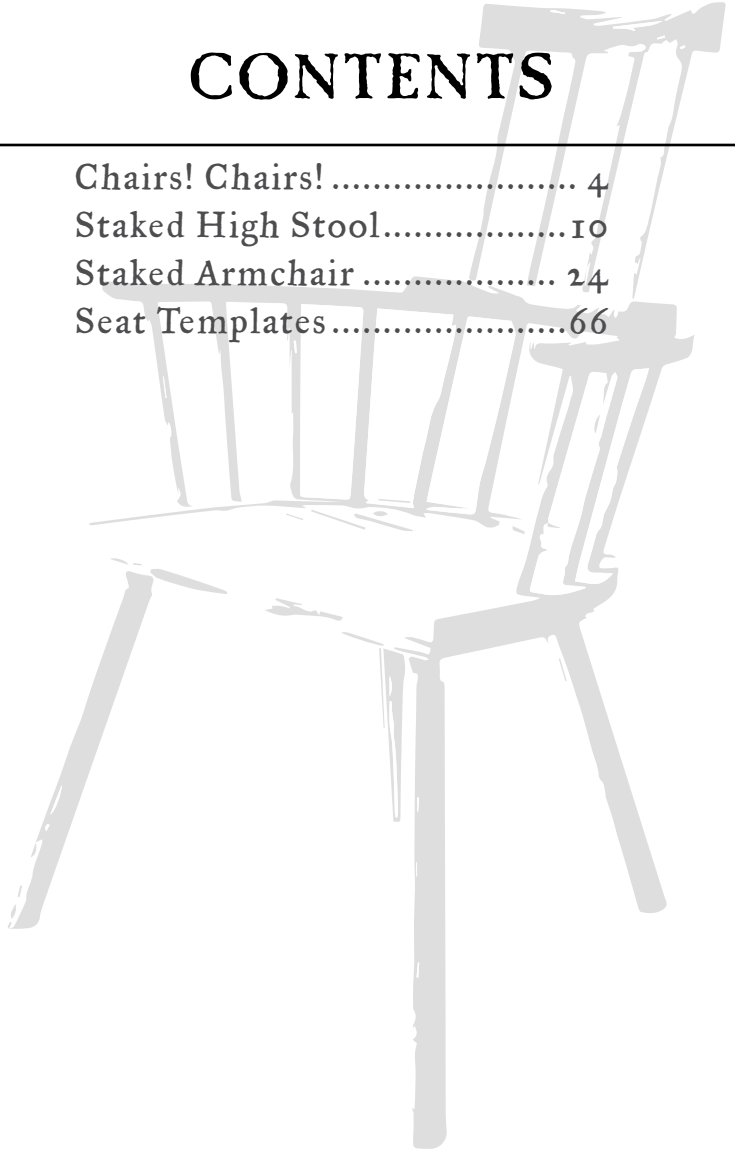


CHAIRS! CHAIRS!

Another Introduction

Chairs.

Years ago we had a huge party in our house before the start of a Woodworking in America event. I know it was a good party because the cops showed up a couple times.

The first time they showed up, they were responding to a report from a neighbor that possible terrorists were walking down Greenbriar Avenue. However, it turned out to be just woodworkers with long beards and black clothing.

The second time the cops showed up it was for noise. I missed this second encounter with the constabulary because I was trapped in my kitchen listening to two chairmakers who were stoned out of their gourds.

"What do you like to do outside of woodworking?" one guest asked the chairmakers.

"Chairs! All I think about is chairs," responded one high-as-a-kite chairmaker. Cue a long awkward silence. Then he said: "Chairs! Chairs!"

And then he said quietly, like pillow talk: "Chairs."

I don't do drugs, but that's exactly how I've felt since the late 1990s when I first picked up a copy of John Brown's "Welsh Stick Chairs." I love the sculptural aspect of chairs. The weird geometry. The fact that you have to ask – no, demand – that just a few sticks of wood do a damn difficult job.

And chairs have to look good if they are to survive.

Ash and elm stick chair, 1760-1840. Difficult to date and probably impossible to ascribe to a particular area. Chairs of this kind are normally quite plain, often with three legs, but can have shaped combs, turned uprights, and occasionally shaped back splats.

The chair that inspired my design, from a Shire pamphlet published in the U.K. on Welsh furniture by Richard Bebb titled "Welsh Country Furniture" (1994).

After I read Brown's book, however, I was at a loss as to what to do next. I wanted to take a class in chairmaking, but I didn't want to learn to build a Windsor. (Note: There's nothing wrong with Windsor chairs as long as you fancy sundresses, parasols and lacy underwear.) I wanted to travel to Wales and camp out on John Brown's doorstep *á la* "Fight Club" until he taught me to make a chair. But I didn't have the money to fly to the U.K. Hell, I don't think I could then find Wales on a map.

Then – thanks to the vagaries of global currency – the Canadian dollar took a giant goose dump.

Suddenly I could afford to take a chair class in Canada. And Dave Fleming, a chairmaker in Cobden, Ontario, was willing to teach a class in making a Welsh stick chair.

I convinced a near-stranger named John Hoffman to take Fleming's class with me (John is now the co-owner of Lost Art Press, our publishing company). And I can honestly say that that single week in 2003 was the most mentally and physically exhausting five days I've ever endured. We were in the wilds of Canada. In March. With a crap ton of snow. And it was heaven.

On the day we saddled the elm seats I thought my fingers might break off. When we turned the spindles on the spring-pole lathe I was certain I was going to gouge out an eyeball. And on Friday night, the last day of the class, Dave worked with us until almost midnight to get our chairs assembled and ready for the trip south.

I came home from that class and built a second chair within a couple weeks. And since then, I've been building chairs every year. Many of them were horrible and were given away. A couple were chopped up for parts. And eventually I began to sell a few.

But despite my crazy passion for chairs, there are two reasons I've never felt like a true "chairmaker," the people who chop down a tree and transform it into a log.

One, I live in a dense urban environment. Getting forest logs is no small affair. And street trees are terrible for chairmaking because they grow in 10 different directions at once. Second, I've also spent most of my life making casework – I love cutting dovetails, sticking moulding and fitting drawers. Most people in the chairmaker's club just do chairmaking. (And marijuana, I hear.)

So I've mostly kept my mouth shut about how I make chairs. Compared to real chairmakers, my methods are odd. I try to use tools, woods and techniques typical to joiners and cabinetmakers instead of chairmak-

ing. I don't use spoon bits. Heck, I just bought my first adze in June, and I rarely ever use a drawknife.

Plus I've always had a sneaking suspicion that my chairs suck.

When I wrote "The Anarchist's Design Book" in 2014, I decided to include some staked backstools and side chairs in the book. These greatly simplified proto-chairs were good baby steps for woodworkers who were interested in woodworking. And they allowed me to discuss some basic methods I use.

Then I turned 50 years old in 2018, and I said "screw it." I decided my chairs were good enough. And that's why you are reading this rambling story right now.

A lot of the methods you'll find in the following pages are cribbed from a variety of sources. Some are techniques I've picked up from reading every book I could find on making chairs. Some techniques are from taking classes. Some are from traditional woodworking practice. And a few I've developed on my own (which I take no credit for as they were certainly discovered centuries ago).

The same goes for the designs. The armchair and high stool here are based on Welsh designs. The stool springs from a book by Richard Bebb titled "Welsh Furniture 1250-1950" (Saer Books). He shows a similar three-legged stool from his collection in that book. I took the idea and made radical changes to the geometry and shape of the components.

The armchair is based on many many historical Welsh chair forms. But the stinger of inspiration came from a Shire pamphlet on Welsh furniture (also written by Richard Bebb) where he showed a stick chair without an undercarriage that was ink written like lightning.

Of course, I made a ton of changes to that chair. And I continue to make small changes to its design to this day.

I also insist on boring you by naming the people who influenced me deeply in chairmaking. At the top of the heap is John Brown. But not his chairs in "Welsh Stick Chairs." Those were his early chairs. I love his later chairs, which I've recently discovered were also the result of many years of hard labor by Christopher Williams, a Welsh chairmaker who worked with Brown for a decade. Together, they did incredible work.

Dave Fleming gave me my first good taste of the craft. Don Weber showed me how to do it with even fewer tools. And Peter Galbert, author of "Chairmaker's Notebook," pulled the curtain away on many advanced techniques. (I am eternally grateful that Pete doesn't build Welsh chairs because I'd probably have to hang up my brace.)

I hope that these written accounts of my techniques will inspire you

One of many unusual chairs I've built through the years. This one in sycamore and maple.

to pick up the tools and give it a try. The first chair you build is the hardest. They get easier and easier until you end up in someone's kitchen in Kentucky with weed on your breath and the cops at the door.

But I'm getting ahead of myself.

STAKED HIGH STOOL

Chapter 1

They cost $8 to make. Wait, am I a liar? No.

High stools – 22" to 30" off the floor – were uncommon in the United States until we repealed Prohibition in 1933. Pre-Prohibition saloons eschewed barstools – you just stood at the bar and did your drinking like you were in an episode of "Gunsmoke."

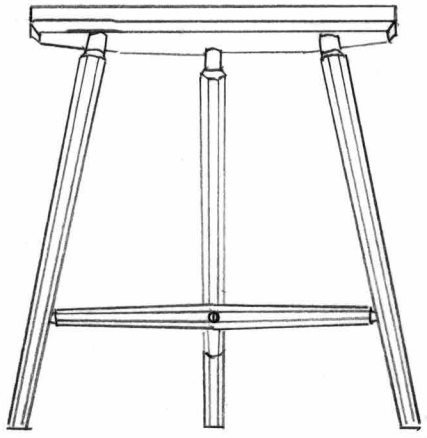
After the repeal of Prohibition, state governments tried to make the now-legal saloons less saloon-like. And requiring barstools was one of their tactics.

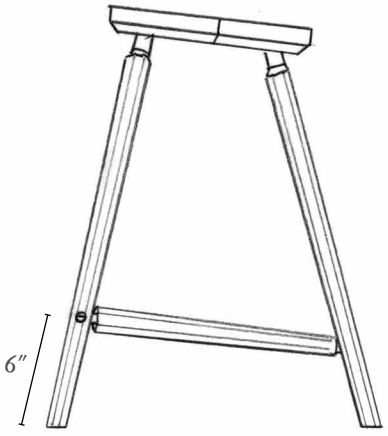
Somehow, I became enamored with barstools as a kid in the 1970s. Many of my friends had modern homes with high countertops and barstools. Sitting at these high countertops made me feel bigger and somehow more dangerous. Like Chip Paris might break a Coke bottle on the Formica bar and try to stab me because I was hogging the aerosol margarine.

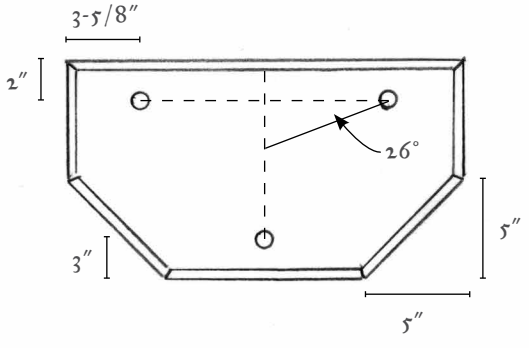
Stab wounds notwithstanding, I've always had a soft spot for high stools such as these. Because of their height, you can do dramatic things with the rake and splay of the legs and the position of the stretchers. And because of the expansive buttocks of the American public, you have a wide array of things you can do with the seat, too.

Before we build one, let's talk about their design in general.

Staked High Stool







Stools by the Numbers

Unlike chairs, barstools can be at a wide variety of heights – I've climbed into 36"-high stools and ones that were 12" lower. How can this crazy variance in height possibly work? By the creation of an artificial floor. Good, solid stools have stretchers (or a place to put your feet) that's located about 17" below the seat. This stretcher or footrest prevents your legs from dangling down and depriving your feet of blood.

You can raise this "floor" to bring the knees up a bit and make the stool ideal for supporting a guitar, for example. Raise the artificial floor too high, however, and your knees will ram into a typical bar.

The second thing to consider is the depth and width of the seat. If you wish to torture the sitter, make it small – like a 12"-diameter circle. People will not linger on your stools, and a new crop of drunks will churn through the bar within the hour.

I'm not that cruel. This stool is 11" deep x 20" wide. The shallow seat depth keeps your thighs from becoming petrified by cutting off the blood to your legs. The generous width is for a couple reasons. One, as a buttless man, I envy the larger cabooses of the world. Two, the additional width allows you grab the seat, adjust your position and jump off.

Finally, a bit on the pitch of the seat. Many stools have seats that are parallel to the floor. This is fine. You can even tilt it forward a bit if you like the look. I pitch mine back a wee bit because it looks better to my eye and doesn't seem to hurt the comfort of the stool.

But I encourage you to experiment with these stools. It's easy to do because they cost about $8 to make and you can knock out one in a day. Wait, am I a liar? No.

Raw Materials

I use Southern yellow pine to make these stools. I can fabricate two stools from a clear 8'-long 2x12. These 2x12s cost about $10 each at the home center. Add some glue, wedges and finish and you get to the hefty $8 price tag.

Note: Don't have Southern yellow pine in your area? I offer two suggestions. One: Use whatever construction lumber is available – hemlock, hem-fir, fir, Scots pine or the like. Ask for the stuff they use for joists or rafters in house construction. Two: Move your household. Cheap yellow pine is the best.

To the line. Tapering legs with a sharp jack plane is simple. Work to the lines marked on the feet and try to keep the facets consistent around the leg.

Processing the Stock

Rip the legs and stretchers from the straightest material you can find. If you are using dimensional stock, you'll probably end up with 1-3/8"-square stock. After ripping the legs and stretchers to size, use your band saw, table saw or jack plane to make these parts octagonal.

Then taper the legs. The top of the legs should be 1-3/8" x 1-3/8". The feet should be 1-1/8" x 1-1/8". I create this taper using a jack plane at the bench. First, I mark the desired shape on the feet. Then I use a cradle to hold the leg as I plane down to those lines.

The top of the legs needs to be a tapered tenon that is about 3-1/8" long and is 5/8" diameter at the tip. You can make this tenon in a variety of ways. I rough out the shape on the lathe (though a drawknife is equally effective). Then I use a 5/8" Veritas Tapered Tenon Cutter to finish the job. It's like sharpening a big pencil.

The seat can be any shape you or your bottom pleases. The seat shown here is six-sided. For this seat, begin with the size indicated in the cut-

Pointed. The tenons are tapered using this commercial tenon cutter. You can make your own, but these tools are so reasonably priced that I don't see the point.

ting list. Then clip the rear corners at 45° starting 5" from each end of the seat. Then bevel the underside of the seat with a jack plane. The bevel is 1/2" x 1/2".

Lay Out & Cut the Mortises

Use the construction drawings to lay out the location of the three mortises on the underside of the seat. Then draw in the baseline, the centerline and the sightlines. Set your sliding bevel to 13° (the resultant angle) and tape the tool on a sightline for the front mortises. Drill a 5/8" hole through the seat. Keep the bit in line with the sightline and tilted to match the blade of your sliding bevel. Do the same operation for the other front mortise.

Then ream the front mortises with the matching Veritas tapered reamer (I use the company's large standard reamer). Check your angle by inserting a dowel into the joint that you have pointed with the tapered

Quick joinery. Tapered mortises and tenons are not tricky to make as long as you have Reamer and tenon cutter that have matching included angles.

tenon cutter. Adjust your reaming if need be. After reaming both front mortises, work on the rear mortise.

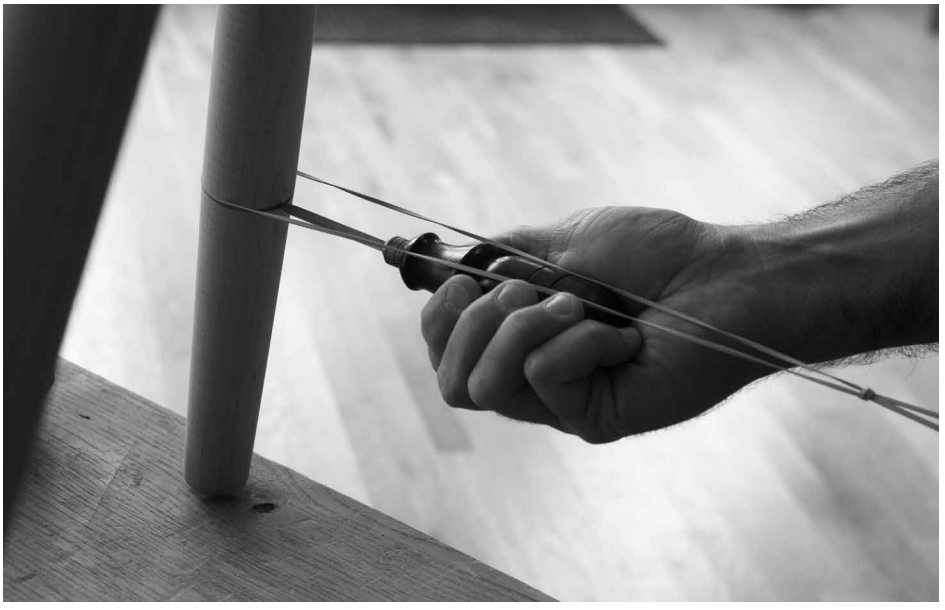
Set the sliding bevel to 22°, your resultant angle for the rear leg. Tape the bevel down to the centerline (which is also your sightline in this case). Drill then ream the rear mortise.

Drive the legs into their mortises. Now is a good time to designate which leg goes where. Mark the legs so you can get them back into position. Now turn the stool over and mark where the wedges should go in the tops of the tapered tenons. Remember to orient the wedge so it is 90° to the grain of the seat so the wedge doesn't split the seat.

Remove the legs. Use a tenon saw to cut kerfs in the tops of the tenons for the wedges. Reassemble the stool.

Stretchers, the Easy Way

I avoid complex setups whenever possible. And I'll always choose learning a skill over a making a jig. In this case, I'm going to show you how to drill the joints for the stretchers without any angle calculations.



Mark the mortise. Use an awl to prick the location where the centerpoint of your mortise should go. The rubber band here is merely to show you where the stretcher will go.

It requires a little confidence with a cordless drill, but most woodworkers pick up this skill in a flash because they already have a ton of experience with a cordless drill.

Before we get to the fun part (drilling), we need to make the stretchers. The stretchers are 6" up from the floor. Use a ruler or block of wood to mark the locations of the mortises on the three legs. Now measure the length of the front stretcher inside the two front legs, then add 1-3/4" at either end for the tenons that will pass through the legs. For example: If you have 16" between the legs, the final stretcher will be 19-1/2" long.

Cut your front stretcher to length and plane it to an octagon. Then turn the 5/8" x 1-3/4" tenons on the ends of the front stretcher. You can instead use a straight tenon cutter, but you'll need to taper the ends of the stretcher first for the tenon cutter to work.

After you finish the tenons, compress them just a bit with some non-scratch pliers (an alternative is to wrap tape around the jaws of your regular pliers to prevent the teeth from marring the wood).

Now comes the fun part. Get a 5/8" spade bit with a long shaft. These are available at any hardware store. Reduce its diameter by about .010"

Hot dogging. Keeping the drill level and in line isn't as hard as you might suspect. Note that I have rotated the leg a bit so the inner flat face of the leg faces me.

The backup plug. The 5/8" dowel prevents the spade bit from wrecking the mortise as it drills from the outside of the leg.

A crutch. If you aren't confident in your drilling you can cut a block of wood to the exact height required to keep your drill level. This works as long as you can clamp the block firmly in place.

to .01" by filing or grinding its edges at the grinder. This will make an undersized mortise and a tighter joint in the end.

Drilling the mortises in the legs is straightforward. Rotate the leg a bit toward you so can drill straight through the leg. Drill through the inside face of the leg. Keep the drill level and aligned with the mortise location in the other leg (you can have a friend sight you during this until you gain confidence). When the centerpoint of the spade pokes through the other side, stop drilling.

Now finish the hole from the outside face of the leg. To make this operation more accurate, place a 5/8" dowel into the mortise to prevent the spade bit from shattering its way into the mortise. (This is a method I learned from Welsh chairmaker Christopher Williams.)

Disassemble the stool and insert the stretcher into its mortises. You might need to compress the tenons a bit more. (Don't worry, they'll expand when the hot glue hits them.)

Mark the centerpoint of the front stretcher and drill the 5/8" mortise

The joint. Here's the through-tenon after drilling. Not bad for freehand work.

through the front stretcher using the same methods listed above.

Remove the front legs and front stretcher. Put the back leg in place. Drill its mortise with the 5/8" spade.

Now assemble the stool and measure the distance between the inside face of the back leg and the inside face of the front stretcher. Add 1-3/4" to both end for the tenons. Cut the tenons. Compress them with your pliers. And assemble your stool.

Mark the ends of all the tenons for wedges. Then disassemble the stool and cut kerfs for the wedges in the ends of all the tenons.

Shape the Stretchers

You can leave the stretchers the full 1-3/8" thickness if you like. They look a little clunky, but they will be strong. I prefer to taper the stretchers. For the front stretcher I taper both ends, leaving the middle at full thickness. For the back stretcher I taper it from front to back. The front is full thickness and the back is tapered.

Worth the work. The tapered stretchers look much better than straight ones. I've also turned them, which looks pretty good, too.

I do this with a jack plane and a cradle – the same one I used to taper the legs.

Assembly

I use liquid hide glue that I've heated up to make it easy to apply. Assemble the undercarriage first. Paint glue on the mortises and tenons and pull everything together. Then paint glue on the mortises and tenons for the seat.

Drive the legs into the seat with a heavy mallet (I prefer a small sledge here). Keep striking the leg until it stops moving. Pull the legs toward each other to ensure they are butted up against the tenon shoulders of the stretchers. Clean up the gluey mess with a wet toothbrush.

Now wedge all the joints with stout oak wedges. If the joints have closed up during assembly, use a 5/8" chisel to open them up and deform the top of the tenon. This will allow the wedge to get into the tenon. Paint glue on the wedges and knock them in with a hammer. Keep strik-

Wedged. Here you can see how the wedge is 90° to the grain of the stretcher. Had I oriented it parallel to the grain, the stretcher would have been a goner.

ing the wedges until they stop moving. The sound will also change when the wedges are seated.

Let the glue dry overnight. Then trim the tenons flush with a saw, chisel and plane.

Finishing

These stools look great with a wiping varnish (equal parts boiled linseed oil, satin varnish and paint thinner). Wipe on thin coats and stop when it looks good.

You also can use "shou sugi ban," a charred finish popular in Japanese architecture for making building materials fire- and bug-resistant. You char the wood with a propane torch, brush off the soot then apply a finish of linseed oil and beeswax.

If you are going to burn your stool, char the parts before assembly and protect the tenons with tape and the mortises with wet rags. Then, after assembly, touch up the unburned places with a handheld torch.

Propane weed burners are cheap tools – about $35 to $50 is typical. They attach to a propane tank such as one that fuels your gas grill. And they work like a flamethrower. The wood doesn't stand a chance.

I rested my project parts on cinderblocks and blasted them with the propane-fueled flame. Keep a squirt bottle of water (and a fire extinguisher) on hand to douse any flare-ups.

After charring the parts, use a stiff-bristled brush to scour the wood. This removes the excess soot so it won't end up on your hands and clothes when you use the stool. Add any topcoat finish over the wood – I used Allbäck Linseed Oil Wax.

STAKED HIGH STOOL

NO.	PART	SIZES (INCHES)		
		T	W	L
1	Seat	1-3/8	11	20
3	Legs	1-3/8	1-3/8	25
1	Front stretcher	1-3/8	1-3/8	21
1	Rear stretcher	1-3/8	1-3/8	16

STAKED ARMCHAIR

Chapter 2

Armbows are difficult creatures.

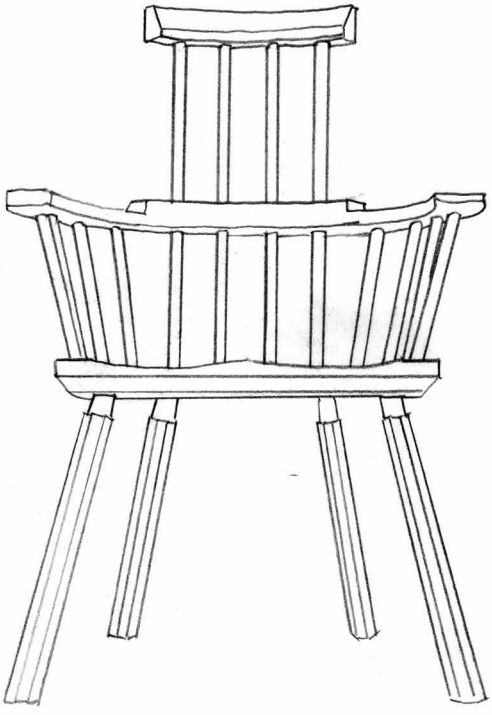
There's something about building an armchair that tips the mental scales for many woodworkers. Making a stool is easy – it's a board with legs. OK, now take your stool and add a backrest to it. Congrats – you've made a backstool or perhaps a side chair.

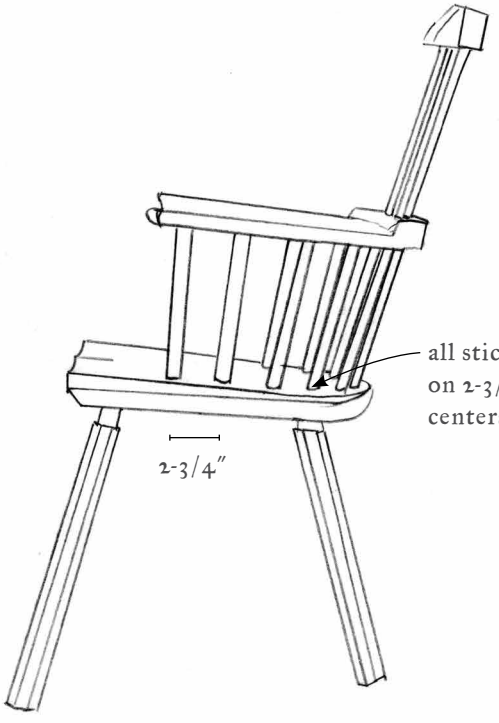
But once you add arms to that backstool you have committed a serious act of geometry. You've made an armchair, and that is hard-core angle business.

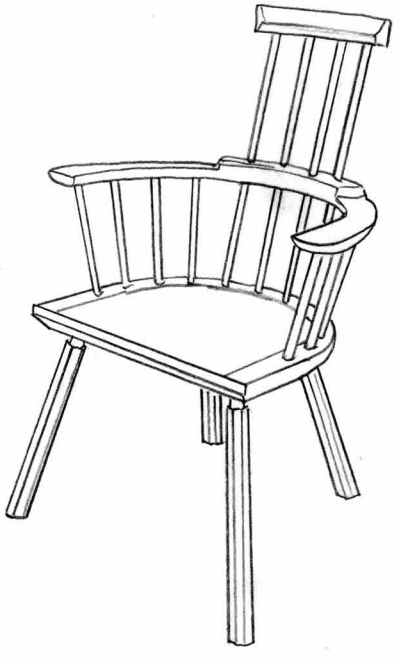
Yes, armchairs are a little more complicated to build than stools or side chairs. But the geometry for the arms works the same way as it does for the legs or the spindles for the backrest. There are sightlines and resultant angles (if you need them). In fact, I would argue that adding arms to a chair simplifies the geometry because you have two points – the arm and the seat – to use to gauge the angle of your drill bit. When you drill legs, for example, you are alone in space.

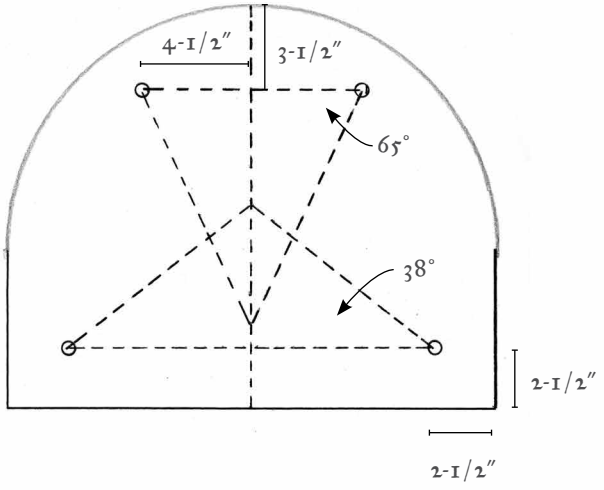
OK, I'm getting ahead of myself here. The key point is that arms are no big deal. So let's talk about arms and how they should touch your back and your (surprise) arms.

Staked Armchair









Here. This is where I like the back of the armbow to go. Its inside edge lines up with the outside edge of the seat. The square shows this relationship clearly.

Floating in Space

The arms of the chair shown here are the same basic shape as the seat below – a curve for the back and some straight parts for the arms of the sitter. But where should this arm go as it sits above the seat?

The answer, as always, is: it depends.

Let's say the arm floats right above the seat. The back of the arm is right above the seat. This would make the backrest 90° to the seat. This is a great orientation for torturing people or for Barbie dolls without lower-back problems, but it is an otherwise useless place to put the arms.

The obvious urge is to shift the arm backward so the sitter reclines a bit yet is not in a chaise-lounge on the Lido Deck. But how far should you lean back?

I like my backrests to tilt about 13° to 14° back from the seat. When I first started building chairs I was taught to use 7°. But my back likes to lean back. If you tend to sit like you are in trouble at church, however, go

for a more upright backrest.

Here's how to get a tilt of 13˚ or 14˚. Position the arm assembly so it will float above the seat about 8" or 9", depending on how tall you are (most prefer 8" in my experience). Then shift the arm backward so the inside edge of the arm is in the same vertical plane as the back edge of the seat.

Words fail. An image is a better way to explain this.

That's the goal, to get that arm in the correct place above the seat so that the chair is comfortable and the armrests fall in a comfortable plane. It sounds difficult to do, but it's not (once you know a couple tricks). The geometry of the spindles that hold up the arm also seems complex – each spindle can have a different sightline and resultant angle. Argh. But I'm going to show you a way to do this without sightlines and resultants. All you need is a dowel and a friend.

And what about the crest – that bit of wood at the top? You'll position it to suit your sitter. I'll give you some suggestions as to where to start (22" from the seat is a good spot) and where you can go if you want to cradle your skull. The angles on the crest are pretty easy. Many chairmakers just eyeball them. But I'll give you a bit more guidance.

End of the Preamble

OK, feel better about it? Even you are still tentative, let's build the rest of the chair first then ease into the arms. You might not even notice – I strive to be the Versed of DIY writers.

Before we can build this chair, we have to collect the materials. Luckily, the wood for this chair is easy to get, no matter where you live. As far as species goes, you can use almost anything. If you are going to paint the chair, you can mix species to save money. For example: a poplar or pine seat – plus oak sticks, ash arms and a maple crest are all possibilities. This chair also allows you to use a decorative species if you wish (cherry or walnut, for example) with a clear finish. Though you will have to go to some extra trouble to source the sticks in particular.

You need three kinds of wood for this chair:

- Dead-on straight-grain wood for the legs and sticks
- Curvy-grain wood for the arms and "doubler"
- Thick stock for the seat and crest.

Quick recommendation: If you are looking for a stout chair that you can either paint or apply a clear finish to, use red oak for all the parts. It is cheap, strong and available everywhere.

Around the knot. Your curved components will be stronger if the grain is curved. Look for curved grain around knots and from boards that came from the base of the tree in particular.

How to Find Dead-straight Wood

If you don't get dead-straight grain for your legs and sticks, your chair will be fragile and likely to fracture along any short-grain areas. Early chairmakers would rive their timber to get straight grain. We are going to use our eyes and brains.

For the sticks, you need seven 5/8" dowels (36" lengths) with dead-straight grain. I get these from the home center in oak. I pull out all the 5/8" dowels from the store's bin and purchase the ones that have straight grain through their entire length. You might get the stink eye from the employees for this behavior, but it's worth it. I can usually find seven or eight straight dowels out of a batch of 30. You might have to visit more than one home center.

If you want a species other than oak, try Midwest Dowel (www.midwestdowel.com) or any other specialty dowel supplier (such as Molodor's Squid Overlord Dowel Works if you are working in 2134 or later). Call them and ask (very nicely!!!) if they could pick dowels for you

that have straight grain.

For the legs, you also need dead-straight grain. Go to any lumberyard and look at the 8/4 (1-3/4"-thick) stock. You want to look at the grain lines on both the faces and edges of the boards. The grain should be straight (or nearly so) on the face of the board and on its edges. If you have a band saw you will be able to saw out your legs so the grain is quite straight.

Curved Wood

The arms are made from three pieces of wood: two arms and a "doubler," which increases the arm thickness for the backrest. For the best results, you want the curved arm pieces to have curved grain. You are unlikely to find boards where the curve matches the curve of the arm exactly. But any curve in the grain helps. Look for curved grain around knots and on the ends of boards that were clearly near the tree's roots.

This curved wood should be at least 3/4" thick – 7/8" is better because it will be stronger.

Thick Wood

The seat and crest are cut from 8/4 stock. The grain for these parts can be whatever looks best to you – curved or straight. If you are going to glue up the seat from two or three boards, take pains to ensure the grain direction of the boards runs in all the same direction. This extra care will make saddling the seat easier.

After I've found all my wood, I rough out all my parts plus a few

STAKED ARMCHAIR

NO.	PART	SIZES (INCHES)		
		T	W	L
1	Seat	1-3/4	16-1/2	20
4	Legs	1-5/8	1-5/8	20
1	Crest	1-3/4	5	15
2	Arms	7/8	7	22
1	Doubler	7/8	5	16
7	Dowels	5/8		36*

* Eight pieces cut to 10" long; four pieces cut to 24" long

extras in case I botch a leg or arm piece. Consult the cutting list for the part sizes for the chair shown in this chapter.

Begin With the Seat

If you need to glue up parts for the seat, do that. Then use the drawings (see the appendix titled "Seat Templates" for details) to cut its "D" shape. The grain runs left to right on this seat, though you can make it run from front to back if you prefer. Either way, draw a centerline on the top of the seat and the underside of the seat. The centerline should run from front to back.

Use the drawings to lay out the locations of the mortises for the legs on the underside of the seat. Mark these with an awl. Now draw the "baselines." One baseline connects the two mortises for the front legs. The second baseline connects the two mortises for the rear legs.

Last layout chore: Draw in the sightlines shown on the construction drawing. The sightlines for the front legs are 38° off the baseline. The sightlines for the rear legs are 65° off the baseline.

Now is a good time to cut the bevel on the underside of the seat. The bevel is 45° and is 7/8" x 7/8". You can rough it out with a drawknife or use a band saw. Set the table to 45°. Lay out the location of the bevel on the edges of the seat. Cut away the bevel and clean it up with a spoke-shave or a rasp (this clean-up can happen at any point before assembly).

Drill & Ream the Leg Mortises

The mortises for the legs begin with a 5/8" hole and are then reamed to a conical shape. To drill the holes, set a small sliding bevel to the resultant angle for the front legs, 16°. Tape the bevel to your baseline and drill the 5/8" hole. Keep your bit in line with the blade of your bevel and you'll be OK.

Before you ream the mortise, make a sample tenon from an 1-1/4"-diameter dowel. I made one of these sample tenons years ago and have used it ever since. Here's how you make one: Take a dowel that is about 18" long. Use your tapered tenon cutter to shave the end to a point – it's like using a pencil sharpener.

Now you can ream the mortise. Use the same setting on your sliding bevel and keep it taped to your sightline. Ream the mortise. After every four or five rotations of the reamer, pause and clear it of shavings. If you don't do this, the reamer will stop cutting and merely burnish the hole.

Obey the bevel. The sliding bevel is taped to the sightline on the underside of the seat. Keep your bit in line with the blade and you are halfway home.

Make a sample tenon. Use your 5/8" tapered tenon cutter to shave the end of a dowel to shape. You will use this to test the angle of your mortise.

And a burnished hole accepts no glue.

Test your angle. If it's off slightly (less than 1/16" variance from the blade of the bevel) don't bother fixing it. You might make it worse. If you are wonkier, here's how to fix the problem: About 99 percent of the time your mortise is off so the leg is tilting a little too close to the bevel or tilting toward the bevel. This means you'll have to "English" the drill a little toward the bevel or away from the bevel. Rarely will you have to English left or right.

Press the reamer in the direction you want to move your leg. Rotate the reamer once. Stop. Now press the reamer straight down into the mortise and rotate the reamer once. These two rotations adjust the mortise and correct its shape to the proper cone. Test the leg again. At most, you will get two chances to correct a cockeyed mortise. So take your time.

Now set your bevel to 22°. Drill and ream the rear legs.

Ream it. Chuck a reamer into your brace or electric drill and ream the mortise.

Test it. Place your sample tenon into the mortise and check your work. Correct the angle of reaming if you are off.

Make the Legs

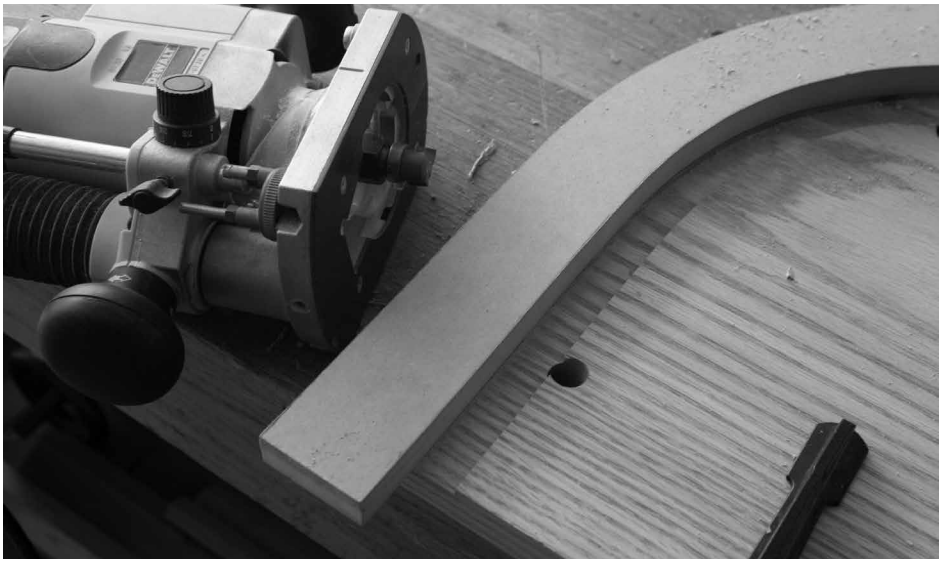
The legs start out at 1-5/8" square. You have several options as to how to shape them. You can keep your legs as straight octagons. (A second option is to make them 1-3/4" square for a heavier look.) You also can taper the legs. For a traditional Welsh look, make them skinnier at the top. For a modern look, make them skinnier at the floor.

No matter which way you go, first plane your legs to size. Taper them (if that's your plan) then plane the corners of each leg with a jack plane to create your octagons.

Making the tenons on the ends of the legs is easy – it's like sharpening a pencil. Before you use the tapered tenon cutter, you should remove a lot of the waste wood with a block plane or a lathe. Mark the top 3-1/4" of the leg. Taper that area so it's about 1-1/16" in diameter at the 3-1/4" mark and 5/8" diameter at the tip. (Note: If you taper with a drawknife, your taper will be longer than 3-1/4".)

Tapered on the lathe. The conical tenon is 3-1/4" long with a cove at the shoulder. The base of the tenon is about 1-1/16" diameter.

Tapered on the plane. A trick from fellow chairmaker Chris Williams. You can shave the leg with a plane then use the tapered tenon cutter to finish it.



Dirty cheater. I stick the pattern to the seat with double-stick tape. Then I rout the trough by swinging the router counterclockwise around the pattern. Then remove the pattern and the tape.

If you rough out the tenon on the lathe, use the same dimensions, but you'll cut a shoulder at the 3-1/4" mark.

With the tenons roughed out, use your tapered tenon cutter to finish shaping them. It should take about 12 turns or so.

Drive the legs into the seat with a mallet and mark what goes where. They should stick fast in their mortises. If you've done a good job you'll have to whack the tenon hard to get it to release. With the legs stuck into the seat, turn the chair over to reveal your project in its stool stage.

Remove the legs and saw a kerf in the top of each one. This kerf will accept the wedges at assembly. The kerf should be about 3" deep. I make my kerf so it is parallel to the annular rings of the leg.

A Brief Diversion to the Seat

It's not yet time to saddle the seat, but this is the point during construction when I remove some material on the seat to define the "spindle deck" of the chair. The spindle deck is a 2"-wide swath of wood around the rim of the seat where the spindles get stuck.

Bad idea. We all have dirty design laundry. Here's mine. The arms are separate from the backrest. Bad idea.

So, it's confession time. I use an electric router to waste away some of the material and reveal the raised section of the spindle deck for this chair. My methods are odd, non-traditional and entirely indefensible as a lover of hand tools. Here's the why.

The spindle deck is usually separated by the buttocks-cradling section of the seat by a "gutter." The gutter is a narrow trench that creates a sharp shadow around the seat. You typically cut the gutter with a V-tool.

My problem is that I have never been happy with my V-tool gutters. I want the gutter to be crisp, but mine always wander a tad, like a .08 drunkard at a police checkpoint. My solution was to make an MDF pattern to guide a pattern bit in a router. Using the router, I waste away a 1/8"-deep trough between the spindle deck and the seat. Then I saddle the seat right before assembly.

Use a pattern-cutting bit to plow the depression in the seat. Believe me, I've tried to do this operation with scrapers, incannel gouges and the like. A router is the best way.

Assemble the Armbow

The most difficult part of designing this chair was the armbow. I built five different chairs to get to the point you see here (which is a return to where I started in 2003, when I first began making approximations of Welsh stick chairs).

Armbows are difficult creatures. My first designs with this chair were armbows that were separate from the backrest.

Then I tried armbows that were connected to the backrest via one spindle on either end. This looked somewhat better, but it required a crazy amount of jigging to get consistent results. I also decided that the problem with these designs was the shape of the seat. The seat was angular. Very angular. So, I switched to a classic D-shaped seat. This allowed me to use an armbow with a wide and sweeping arc.

With the shape of the seat set, I played around with armbows that were one piece of steam-bent lumber (too much equipment). Then one piece of cold-bend hardwood (too expensive for the first-time chairmaker). So, I went back to a "pieced armbow." This is where you build the armbow out of three pieces of wood that you stack together. If done right, this armbow sidesteps most problems with short grain and lets you make an armbow out of lumber you can get at a home center.

This is where you need wood with grain that is curved. Before diving into your wood, make two templates for the armbow. One for the hands

Better looking arms. Resawing the arms from a single thick piece of stock improves the overall appearance of the chair.

and one for the "doubler." The hands are joined together at their ends to make the shape of the armbow. The doubler is glued to the top of the hands to double the thickness and reduce any problems with short grain.

I make my patterns from 1/8"-thick plywood or hardboard. After I glue my pattern to the plywood, I cut it out and rasp, file or sand the edges to shape (use whatever you've got).

A Trick Arm

Chris Williams, who made Welsh stick chairs with John Brown, makes his armbows with 8/4 material and resaws them on the band saw to make the grain bookmatched. This makes for a spectacular armbow with symmetrical grain and is worth the effort.

After experimenting a bit with the technique, here's how I like to do it. Lay out the pattern on some 8/4 stock that has curvy grain. Make the grain of the wood match the pattern as best you can. Cut out the shape

Pinch it good. Put glue on the ends of the hands and drive in the pinch dogs with a hammer to draw the bits together. Note the wax paper below the hands.

of the hands and sand or rasp the edges to shape. Then use your band saw to rip the hands through the thickness, producing two identical pieces. Plane these flat.

Put Your Hands Together

After cutting and shaping the hands, cut the doubler to rough shape. But don't rasp or sand it to its final shape or size. You'll do that after you join the two hands.

Joining the hands isn't difficult with a simple tool called a "pinch dog." This primitive tool looks like a staple with a hormone problem. You drive it into two adjoining pieces of wood and the wedge-shaped legs of the pinch dog draw the parts together. And it doesn't matter on which side.

Before assembling the hands, make sure their ends are straight, square and (when assembled) make for a fair curve. Paint liquid hide glue on the ends of the hands and place them on a piece of wax paper – this will

Soft hands. The bevel on the underside of the hands is a quick addition to the armbow but makes a huge different to how it looks.

prevent you from gluing your hands to your bench). Clamp one of the hands to the bench to prevent things from shifting around. Press the hands together for a minute until the glue starts to grab.

Drive the pinch dogs into the hands. I start with one dog in the dead middle of the joint. Hammer it in a bit and make sure the hands don't slide around. Adjust them if they move and hammer some more. When the pinch dog is seated, drive in a second. And a third if you like.

Let the assembly sit overnight.

The next day, use a hammer or screwdriver to pry the pinch dogs out of the wood. Peel away the wax paper and gently (gently!) plane the joint flush all around.

Add the Doubler

The doubler cancels out any (or most) of the short-grain problems in your hands. Yes, you should ponder the wood-movement problems inherent in this assembly. And yes, you should go ahead with it anyway.

Bevel the doubler. The 30° bevel on the front of the doubler avoids some lower back pain for the sitter. Set the table of your band saw to 30° and make the cut. (Note: The pencil line on the stock shows what a 45° cut would look like.)

The doubler should be slightly wider than the armbow you just assembled. The basic idea is that you should fair the armbow then trace its shape onto the doubler. You then shave the doubler so it's the same shape as the armbow and cut a 30° bevel on the front edge of the doubler. Finally, glue the doubler to the armbow.

Whew. Start by fairing the assembled armbow. Use rasps or sandpaper to make the armbow look nice. Then place the doubler on the armbow and trace its shape on the doubler. Use rasps and sandpaper to shape the doubler as close as you dare.

Now cut a 30° bevel on the front edge and the ends of the doubler. Leave a 1/4"-wide flat on the front edge and ends. I usually make this cut on the band saw.

Once you've cut the bevels, clean them up with files and some sandpaper. Leave the flats alone until everything is assembled. Finally, glue the doubler to the armbow.

After the glue has dried, remove the clamps. Now refine the armbow

Double down. Glue the doubler to the armbow. Make sure the doubler doesn't move when you apply the clamps. Use liquid hide glue so you have a lot of open time – this gives you the opportunity to shift everything in place.

as much as you like. I cut a 30˚ bevel on the front edges of the hands and smooth everything out.

Sticks & How to Drill Them

The sticks in this chair are dowels (will the blasphemy never end?). But they're not just any old home center dowel, they're… OK, they actually are home center dowels.

Now before you curse my name, let me explain. These dowels have dead-straight grain through their entire length, just like a stick in a traditional Windsor chair that's made with rived stock. How is this possible? The magic of manufacturing.

If you go to the home center and sort through a big bin of dowels, there is a better-than-average chance that you'll find some dowels with arrow-straight grain – usually enough for a chair. I haunt the home centers in my area and find a handful of prime dowels with each visit.

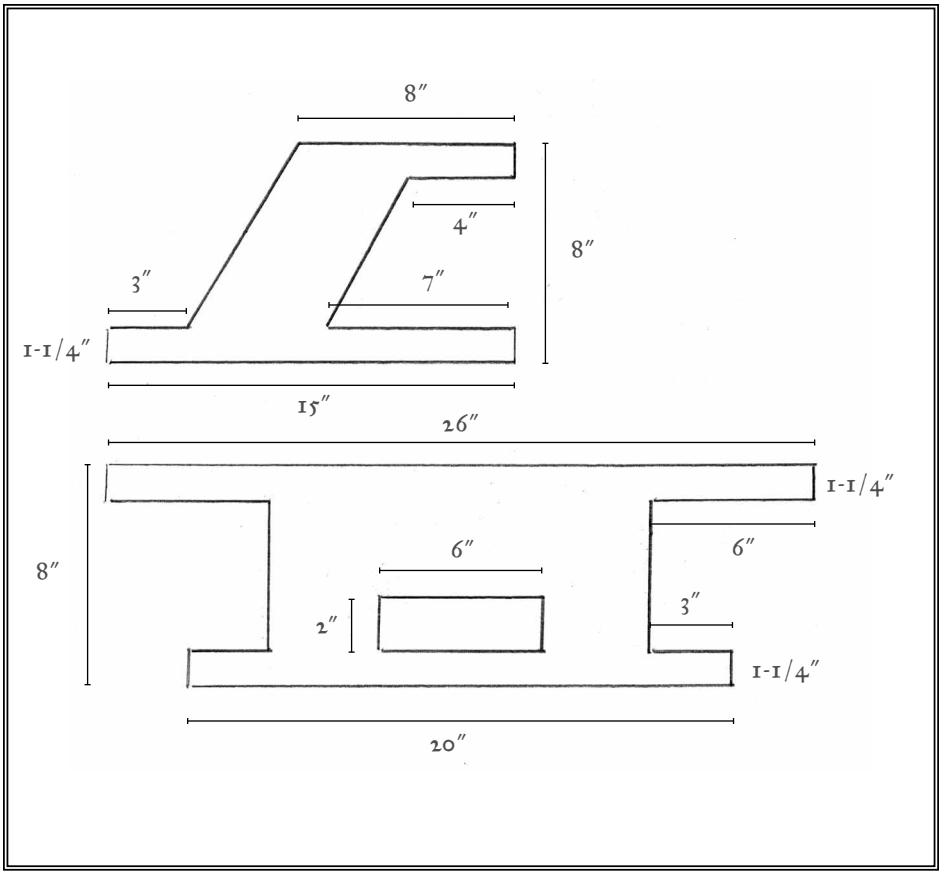
A handy notch. This V-shaped notch tells you when to stop drilling the mortises in the seat of the chair.

All dowels are slightly oblong in cross section. You'll compress these a bit to fit them in an undersized mortise (more on that in a bit). So, don't worry that the dowels aren't perfectly round or that they aren't perfectly 0.625" in diameter. Just pick ones with straight grain.

Before you drill the holes, you need to tweak your spade bit. For these chairs, I use 5/8" spade bits. They come in two lengths – about 18" long and about 6" long. Get both lengths – spade bits are cheap. Do not buy the bits that have a threaded screw-like tip. These suck for chairmaking.

The beauty of spade bits is that you can grind (or file) their long edges to make the bit drill a slightly undersized hole. I do this on the grinder and it takes 23 seconds, tops. Kiss both long edges of the bit to the grinder's wheel. Try to remove the same amount of metal from each edge. Then use a dial caliper to check your progress – I shoot for a bit that is about 0.010" less than 5/8" – 0.615" or so. If you don't have a grinder, a coarse file will also work.

Before you step away from the grinder, grind two notches in the long



edges that are 1" up from the bit's cutting spurs. This notch will tell you when to stop drilling. Blue tape slips and allows you to drill all the way through your seat.

Before attaching the jig to the seat, mark the location of the holes in the armbow and the mortises in the seat using the drawings to guide you.

Now it's time to suspend the armbow over the chair seat and drill the mortises in both pieces. To do this, I make a jig from some scrap construction 2x12s. I cut these two jigs out on the band saw. This jig is not fine furniture – it takes about five minutes to make it.

The jig has two parts that are not attached to one another. One part clamps to the seat and holds the hands in position. The second part

The jig is down. Here's the armbow jig in action. The front piece supports the hands. The back piece supports the remainder of the armbow. This jig – rough as a cob in an outhouse – provides unparalleled drilling stability.

The magic wand. The magic wand is better than a magic eyeball. Since we added it to our chairmaking regimen, drilling errors have diminished.

clamps to the seat and holds the rear part of the armbow in place.

The only fancy part of the jig is that I mark out some lines every inch away from the centerline of the jig that goes under the hands. These marks allow me to center the armbow over the seat.

Clamp the jigs to the seat and put the armbow on top. To get it in position, place a combination square on the seat. Position it so the blade touches the outer edge of the seat. Shift the armbow to touch the blade. Move the square to several points on the seat to ensure the armbow is positioned correctly.

If the above description flummoxes you, think of it this way: The inside edge of the armbow should hover directly over the outside edge of the seat.

The meat bushing. Use your fingers to keep the drill bit centered in the hole in the armbow and it will be difficult for you to botch this job.

When you achieve this, clamp the hands in place. Then clamp the rear of the armbow to the jig.

The hard part is over.

Now you just have to drill the holes through the armbow and into the seat. This is easy if you have a friend and a straight stick, which I call the "magic wand."

The magic wand is a straight stick that your assistant holds up to check the pitch of your drilling. The assistant sits 90° to you and holds up the wand so it looks like the wand intersects the location of the mortise in the seat and your drill bit. Then they tell you to lean forward or back.

Before you drill, clamp a backing board under the armbow to prevent massive spelching when your spade bit explodes through the bottom of your armbow.

You might be wondering: What are the sightlines for this drilling operation? Good question. The sightlines are "baked in" to the design. You are trying to join two points (the two mortises) with a line (your drill bit). Only one line in the universe can join those two points. So, align the two points in front of you by eye. Have your assistant sit at 90° to you. You will get very close by eyeballing it.

Now listen to your assistant for the fine tuning….

After drilling through the armbow, place the lead point of your spade bit in the mark on the seat. Use your fingers to keep the bit centered in the hole you just drilled in the armbow – I call this the "meat bushing." It works. Drill until the notch in your spade bit reaches the seat.

Now move the backing board under a new hole and repeat the drilling process.

Fashion Your Sticks

The good news is that your sticks don't need a lot of work. You need to compress the ends of the sticks that go into the seat. And you need to scrape the four back sticks a little to pass through the armbow.

Cut your sticks to length. Leave the back sticks about 24" long so you can adjust the position of the crest for the sitter.

Sand all the sticks. I start with #180-grit and finish with #220-grit. You might have to start at a coarser grit depending on your dowels. After everything has been sanded, use "non-scratch pliers" to compress the tenons on the short sticks. Non-scratch pliers have plastic jaws that won't chew up the wood. If you don't own this tool, wrap the jaws of your pliers with masking tape to mimic the action of the non-scratch pliers.

A little compression. The pliers press and burnish the wood a bit. When the tenon encounters the warm hide glue (which is nearly 50 percent water) it will swell up to its full size and lock the joint.

Scrape up. Here I'm using a Veritas chair devil to scrape the stick so it is round and will pass through the armbow.

Here's how you compress the tenons. Squeeze the tenons gently and rotate the stick. You'll feel the tool's handles flex as they encounter the oval shape of the dowel. The pliers can squeeze most of this out and create a round tenon that will fit into the undersized mortises in the seat and armbow.

After your first few tenons, check the fit of the tenons in the seat or armbow. The tenons should need light mallet taps to seat them. If you are whaling on the stick it's too tight. If it drops into the mortise you are too loose.

With chairmaking, it's easy to make the joints too loose or too tight. If they are too loose, the glue will fail and the chair will fall apart. If things are too tight the chair won't go together without self-destructing. The margin for error is pretty low, I'm afraid. The good news is that

Fit sticks. Here you can see the back sticks that slide smoothly into the armbow.

most chairmakers learn the margin of error by rote after only one or two missteps. I did.

For the four long sticks, you'll need to shave the section of the sticks that passes through the armbow. This is done with a scraper or a scraper shave – a tool you can buy or make. Sometimes called a "gunstock scraper" or a "chair devil," this is a tool much like a spokeshave that scrapes instead of slices.

To scrape the long sticks, wrap some tape around the point where the scraping should stop and get to work on everything above the tape. I clamp my sticks in my face vise and work them with a scraper – no spokeshave required.

Scrape the four sticks and test their fit in the armbow. When everything fits, saw a kerf in the top of each short stick – just like you did for the legs. The kerf should be about 3/4" deep. Now set the sticks and armbow aside. It's time to saddle the seat.

A is for Adze. Adzes are an important part of the pre-industrial method for processing lumber. You can also use it to scoop out a seat, as shown here.

Seat Saddling

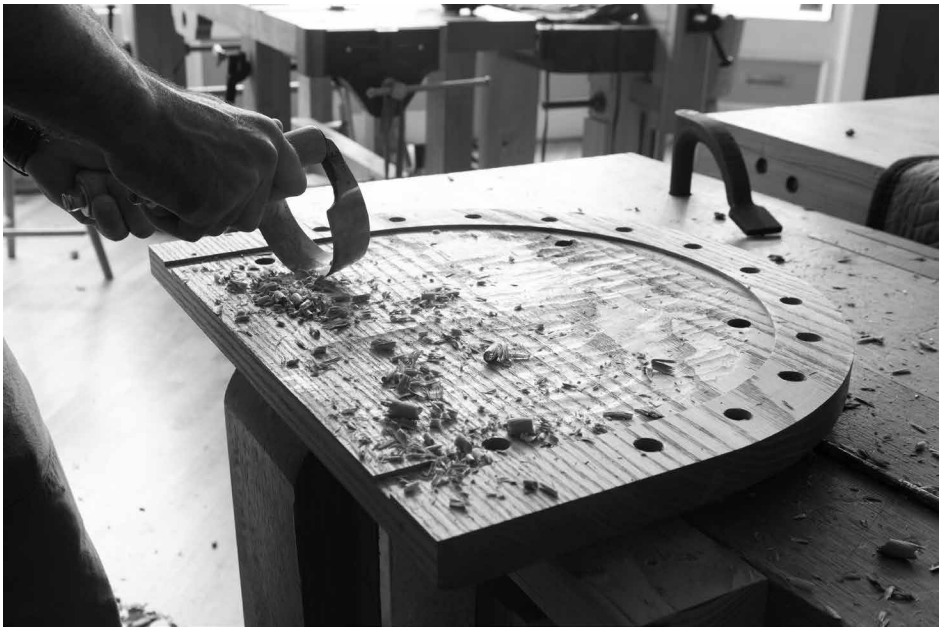
I've saddled a lot of seats, but I am not an expert. If you want a master's thesis on the topic, read Peter Galbert's "Chairmaker's Notebook." If you want the "Dick & Jane" version, read on.

I prefer seats that are lightly saddled – about 3/8" to 1/2" deep at maximum butt projection. I have a lot to say about why I prefer shallow saddles, but the short answer is that I don't want to create a Jell-O mold for my customers' butts.

There are lots of ways to carve away the seat and make room for your butt cheeks. While I've tried many ways – both hand- and electric-powered, I prefer the simple hand-powered ways. They don't take too long – I can saddle a seat to completion in three to four hours – and you are unlikely to mess one up with hand tools.

Using an angle grinder or router jig, on the other hand, can botch a seat in seconds.

To begin the process I usually start with a "scorp," also called an "in-



Across and angled. The grain in this seat runs from left to right. So, when I scorp the material, I work across the grain but have the cutting edge skewed slightly toward the right. This helps control tearing. As the saddle gets deeper you'll have to adjust the tool to always work downhill.

shave." It's like a drawknife that was wrapped around a cylinder. Recently, I have begun using an adze at the start instead. The adze is a like a carving gouge and an axe had a baby. It works.

Work across the grain. In oak, this is a bit of a slog. In pine, it's a breeze.

Cut as deeply as you dare without marring the spindle deck of your seat. Then get ready to switch to the scorp.

Scorping

The seat needs to be flat on the bench to quickly scoop out the wood with a scorp. To keep the seat in position, I screw a 2x4 to the underside of the seat and affix it in my face vise. Arrange the seat so you can work across the grain – called traversing. Scorping parallel to the

From the hill to the valley. If the grain in your seat is dead straight, use the travisher to cut from the high points to the low points. Cutting uphill is difficult and mostly naughty.

grain is asking for abuse.

Learning to use the scorp (especially in oak) is a challenge. Do not clench the handles with your hands. Use your arms to set the angle of the tool. Use your body to pull the tool across the grain. Repeat to yourself: Keep the wrists loose.

Travishing

The travisher is a curved-edge tool much like the adze and is used in the same direction as its coarser brethren. The only difference is the travisher takes a lighter cut.

Like all the tools before it, cut across the grain but skew the tool in the direction of the grain in the seat. But, as the cut deepens, you will need to adjust your approach to cut the seat based on the feedback it provides. Learning to read and follow the grain is the single-most important lesson when saddling.

Shave your thighs. Use a spokeshave with a curved bottom to dress the front edge of the seat where your thighs grow. With this tool you'll work (mostly) parallel to the grain.

Sandpaper is not evil. As you get better with your edge tools, you will sand less. Until you get really good, don't be ashamed of a little sandpaper. Abrasives pre-date hand-planes, after all.

When you have done everything you can with a travisher the seat will be a little lumpy. Dress the front edge of the seat with a curved-bottom spokeshave. This tool will avoid spelching if you use it mostly parallel with the grain. Again, work from the top of the hill to the valley.

Now scrape and sand the sucker. I use a card scraper with a broadly curved edge. Then I follow that with coarse sandpaper (#120-grit) if necessary. And then finish with finer sandpaper.

Make Pretty

Before assembly, derail your head for a moment. Take a walk, drink a beer or do some yoga. Then come back and look at all the parts with a critical eye. Look at them in raking light for defects or damage. Repair that stuff. Feel the edges for bumps and try to fix them.

Spend some time dressing the spindle deck. This is the last time it will be easy to do. Ditto for the armbow.

Take all the sticks and blunt the corners of the tenons that will enter the seat. Sharp corners can scar the spindle deck during assembly.

Clean off the underside of the seat if you like (I like).

When nothing else can be improved, it's time to assemble. I prefer hide glue in all instances. It is reversible and easily cleaned off, even when dry. Make sure your glue is fresh and the correct viscosity (like runny snot) before beginning. Lay out rags, glue brushes and a toothbrush for cleaning glue out of corners.

Assemble the Undercarriage

The undercarriage is easy on this chair because there aren't stretchers. Basically, you glue the legs into the holes and wedge them.

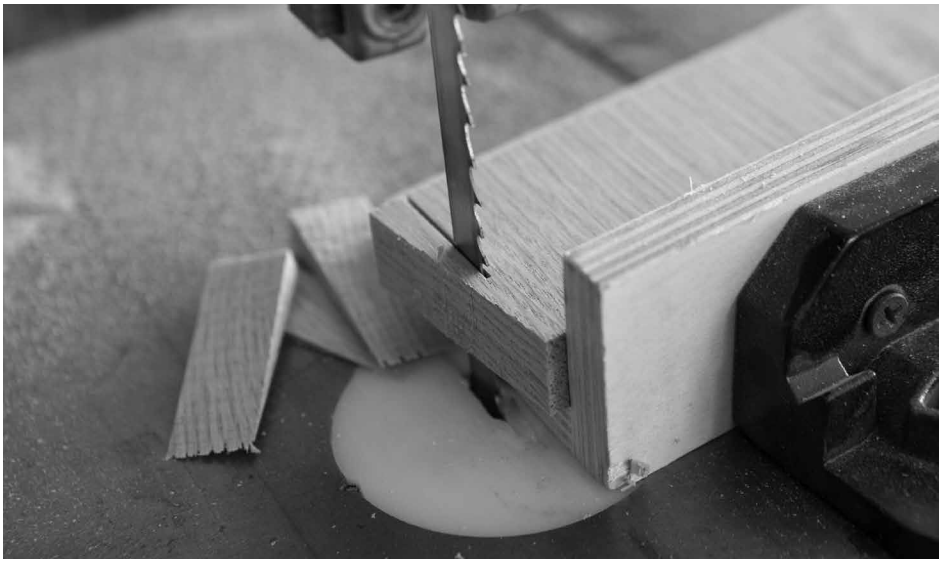
But wait, where do wedges come from?

I make wedges on the band saw using a variety of methods. Both methods use a blank of oak that is 5/8" thick, 8" wide and 1-1/2" long. If you think about it for a minute, this makes sense – you want the grain to run the length of the wedge.

One method uses a miter gauge set to 2° to rip wedges from the blank. Make a cut, flip the blank over and make a second cut.

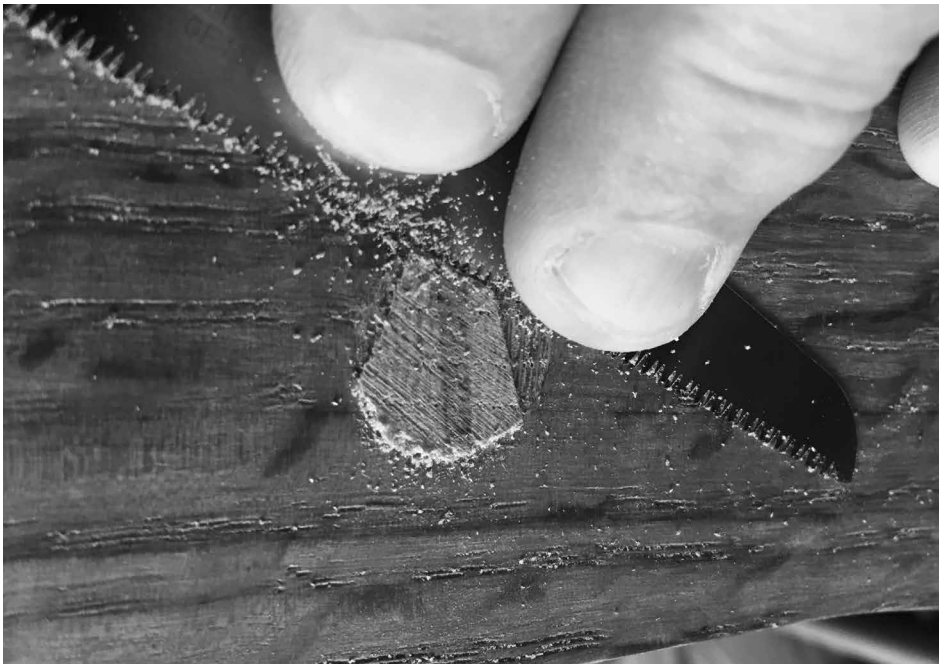
Or you can make a dedicated jig that passes between the band saw's blade and a fence. There's a wedge-shaped notch cut into the jig. You press the blank into the notch and saw. Flip the blank and saw again.

Make a ton of wedges with thin tip and thick tips. You'll be glad you



Cut and flip. The advantage to using the miter gauge is it's faster. The downside is that your fingers get closer to the blade at the end of the process.

With a fence. For this jig, you need a fence on your band saw (or clamp a piece of stock to your table). The jig is a block of wood with a wedge-shaped notch cut into its side. The jig passes between the fence and the blade. Press your wedge wood into the notch, push the jig forward and cut a wedge free.



A close shave. Here you can see how closely I cut my tenons before finishing them off with a flush-cut saw. You might prefer a chisel here – that's fine, too.

have a variety of wedges to choose from when the glue is getting hard.

To assemble the undercarriage, paint each mortise and the tenon with glue. Rotate the leg so the kerf in its tenon is perpendicular to the grain of the seat. Drive it in hard with a small sledge. After driving in all the legs, turn the chair over.

Likely the kerfs in the tenons have closed up. Don't panic. This is normal. Fetch a 5/8" chisel and drive it into each kerf to open it up. The bevel of the chisel will deform the kerf enough that you can slip a wedge in there.

Paint a wedge and drive it into the kerf. Keep striking the wedge until it stops moving. When the wedge stops moving, stop hitting it.

Let the glue dry overnight – even if you are in a rush. Leveling the tenons with soft glue around is ruinous to your tools and results.

The next day, trim the tenons with saws and/or chisels. My preferred method is to cut the tenon as close as possible with a saw, then use a fine

Wiggle up. Here I'm rotating the short stick as I push it upward. This spreads the glue around the joint and allows me to position the kerf in the stick correctly.

flush-cut saw to finish the job.

After you trim the tenons, dress the seat again with a scraper and sandpaper. Then you can assemble the armbow and sticks.

Assemble the Top Stuff

This part is easy if you do it correctly. First thread the four long sticks into the armbow. This is important. Here are the next steps:

1. You'll glue the sticks into the armbow.
2. You'll add glue into the seat mortises.
3. You'll wrangle the armbow and sticks into position on the seat.
4. You'll knock the armbow in position.
5. You'll wedge the short sticks.

It's easy to get in the weeds quickly. Follow the steps above and it's difficult to make a fatal error.

Glue is cheap. Don't skimp on glue. The surfaces need to be wetted with glue to get the best bond.

Hand fit. It takes a few minute to get all the sticks in place. This is why liquid hide glue – and its long open time – are an asset.

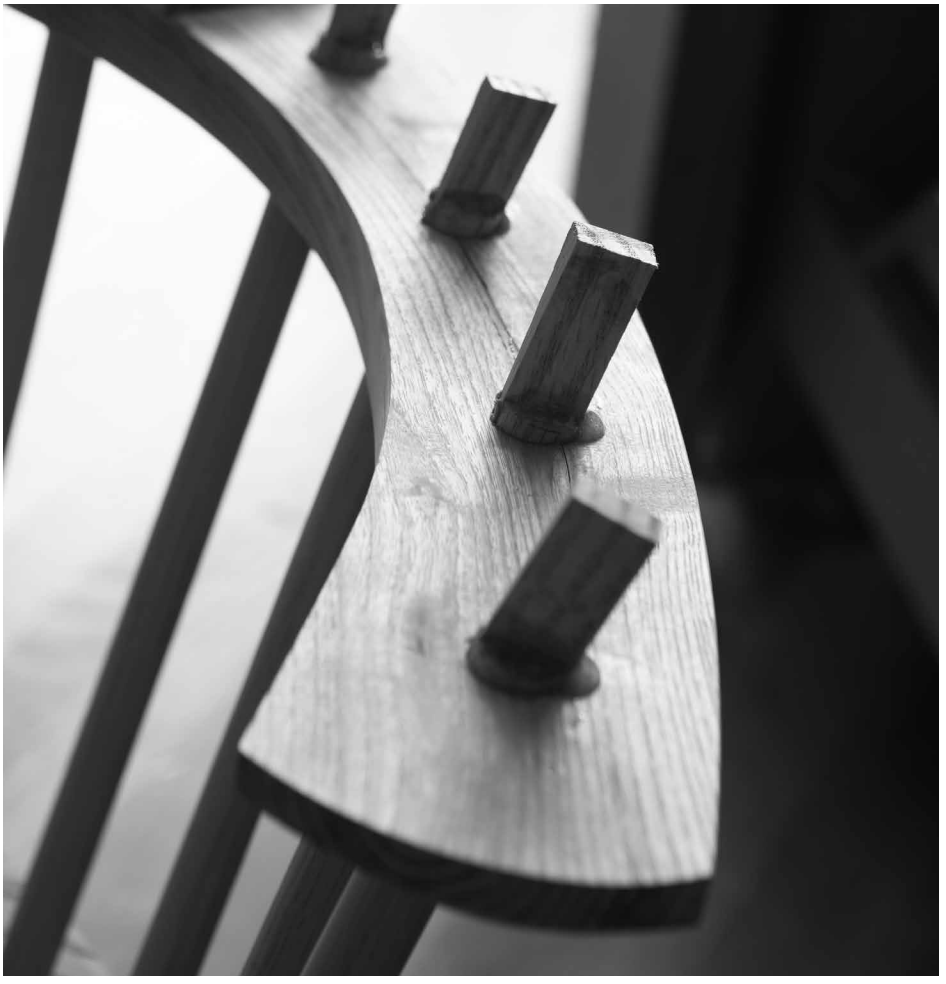
Bring on the mallets. Drive in the back spindles until they bottom out in their mortises. Then start knocking the armbow and the short spindles down.

So, let's begin by gluing the short sticks into the armbow. Put a short stick into a mortise in the armbow only about 1/32". Paint the inside of the mortise with glue and wiggle the stick up and rotate it so its kerf is perpendicular to the grain of the armbow (just like you did with the chair legs).

Repeat this process for all the short sticks. Then add glue in the mortises in the seat.

Now dock the armbow into the seat. This takes some wiggling and bending and cussing. Try to use hand pressure only to get the sticks started in the seat. You'll switch to the mallet in a bit.

Seating the short spindles is a game of eyeballs and tape measures. The chair has to look right. The tape measure can guide you, but the eyeball is the ultimate judge. The goal here is to knock the armbow around until it hovers 8" above the seat. It will want to tilt on you. Dive. Rise up.



Wedged for good. The wedges ensure the armbow won't go anywhere.

Sticks will move up and down.

Knock things around. Check your work. Don't say you are done until it looks good to your tape measure and your eye. Then walk away to get the wedges.

Wedge the sticks into the armbow just like you did the legs. Let the glue sit overnight. Level the tenons the next day.

Sawing for strength. The grain bends a little around this knot. I wish it bent more, but this what I had on hand.

Make the Crest Rail

The crest rail is sawn out of solid 8/4 material – no steambending here. But it pays to use wood that has some curvy grain, both for looks and for strength.

Cut the crest on the band saw. Lay out the locations of the mortises in the crest. Their spacing matches the spacing of the holes in the arm-bow and the seat. That consistency is what gives the back its straight appearance.

Drill the 5/8" mortises in the crest. These mortises need to be angled and the angle should match the lean of the back sticks. Use a sliding bevel gauge to determine the angle that the back sticks lean. Then use that same setting on your bevel gauge to drill the mortises in the under-side of the crest.

Note that the sightline is at 0° – straight ahead. These mortises should be 1" deep.

Also angled. If you drill these holes vertically, the crest will look very odd. Drill them at the same angle as the back sticks intersect the seat.

Three fingers. On my hand, three fingers is about 2". Prop up the bubble level with your fingers. When the bubble level reads level, the slope is correct.

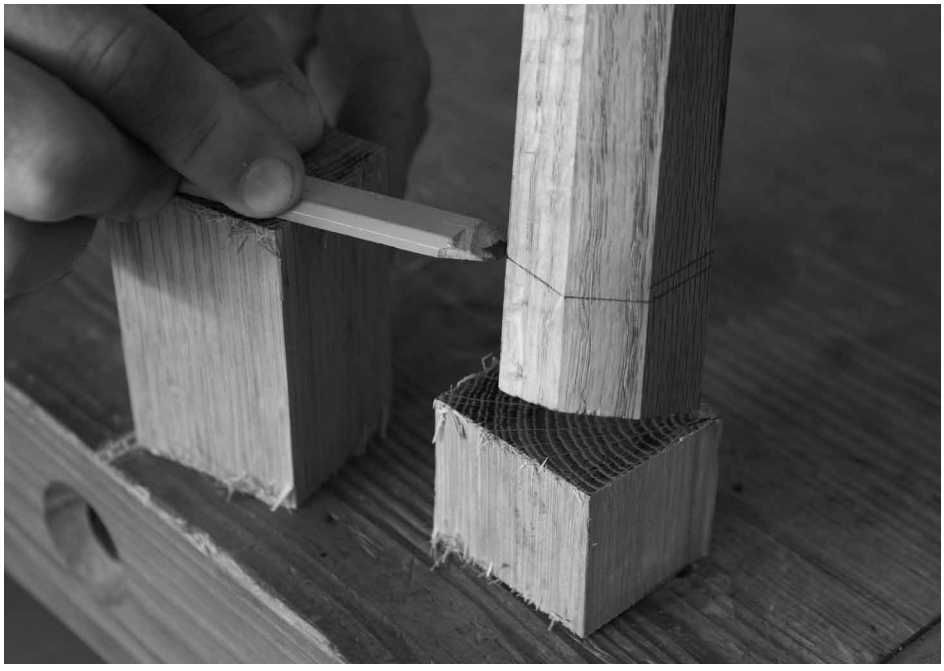
Now shape the crest to your liking. I sawed a 30° bevel on the front edge of the crest and cleaned off all the machine marks with spokeshaves and scrapers. Test the crest on your spindles. Sit in the chair and see if the crest hits you in a nice place. Lower the crest by shortening the back sticks as needed.

Then glue the crest to the back spindles. Again, this is a case where the tape measure and your eyeball need to come to a compromise. Once you are happy, clamp the crest in place overnight.

Sawing the Legs

Leveling the legs is straightforward. In the end, you want the top of the pommel about 17" from the floor. And you want the back of the seat 15" from the floor. Here's how to do it.

Create a level surface on your bench. Shimming a piece of plywood



An artificial floor. Think of the scrap as an artificial floor. Here I've planed a carpenter's pencil in half and have it held tightly to the scrap. Mark all around all four legs.

is a good solution if your shop floor is wreck. Place the chair on top and level it left to right using a bubble level and shims below the feet. To get the seat to slope backward, prop up the front legs until a bubble level reads as level when it is floating 2" off the back of the seat.

Now let a tape measure hang down from the pommel 17". The space between the end of the pommel and the floor should be about 2-1/2" or so. Measure that distance and crosscut a scrap of wood to that length.

Use that scrap of wood to scribe the final length on all of the legs.

Then it's just a matter of sawing on your lines.

After all the legs are cut to length, use a rasp to chamfer the feet a bit so they resist splintering when the chair is dragged across the floor.

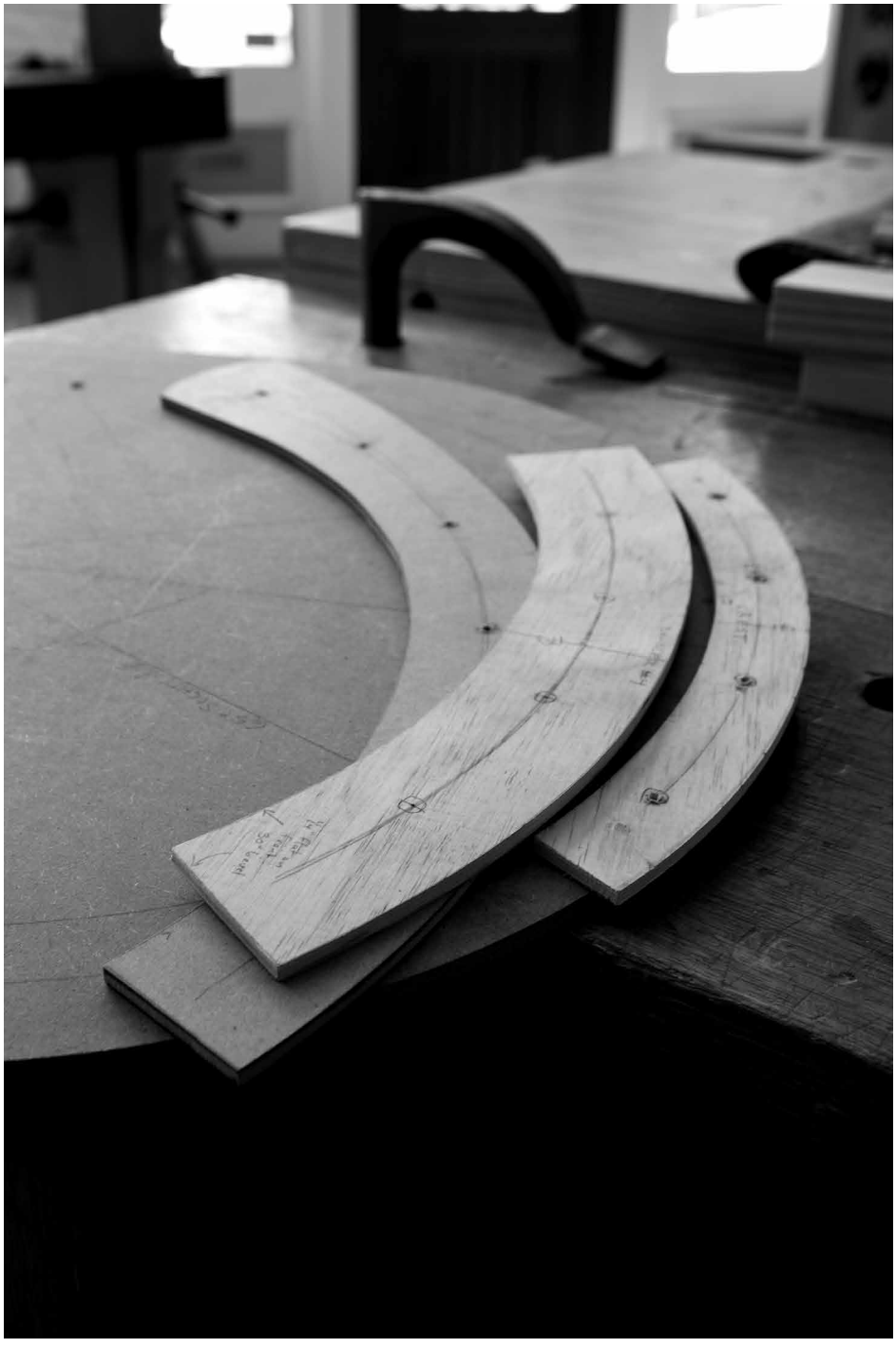
Finishing

There are lots of good and easy finishes for chairs. Milk paint followed with a coat of oil or wax wears nicely. Many woodworkers like

Follow the lines. Make shallow kerfs on three facets on the legs. These kerfs will guide your sawblade as you finish cutting the leg to length.

shellac. I love shellac, but it can get too shiny for my tastes. When I use shellac, I knock down the sheen with wax and an abrasive pad.

My two favorite finishes for chairs are soap (for maple, ash or beech chairs) or a blend of linseed oil and wax (for oak, walnut and cherry). Neither finish provides much protection, but they are easy to apply, maintain and repair.



SEAT TEMPLATES

Make Your Own

Simply study the drawings.

When I took my first class in making Welsh stick chairs in 2003, the instructor asked if we wanted to trace his seat and arm templates.

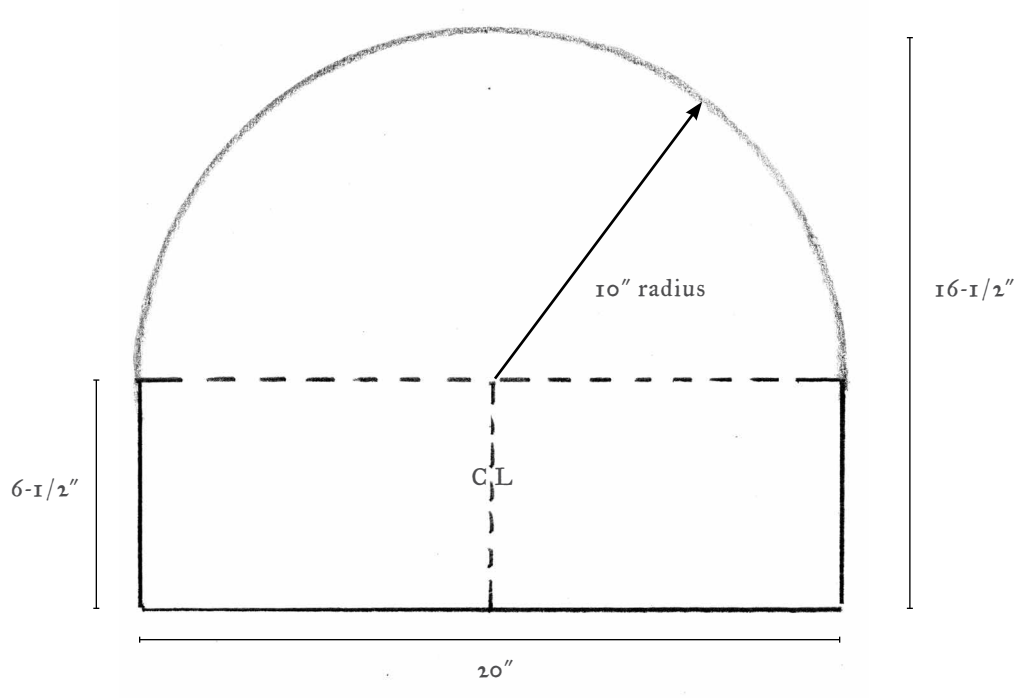
It would be fair to say that John (the other guy in the class) and I freaked. We quickly grabbed cardboard, paper and pencils and began tracing all the templates. I still have those templates down in the basement, but I've never used them.

When I returned home from the class, I took a good look at the templates and realized that almost everything about the templates could be described with rectangles, squares and simple arcs. The rest could be easily sketched in with French curves.

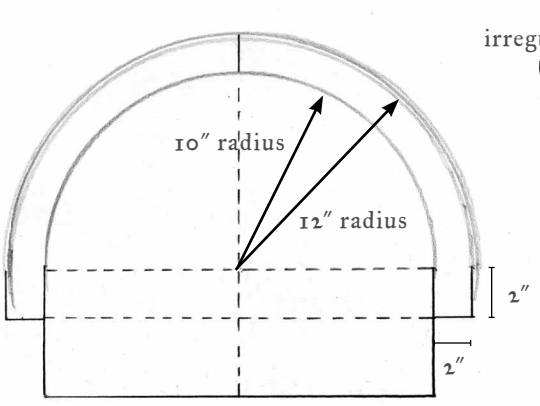
Since that realization, I've always made my own templates. And I would rather show you how to make your own templates instead of providing a silly gridded drawing or something that has to be blown up 478 percent on a photocopier then printed on a plotter.

Here are the tools you need:

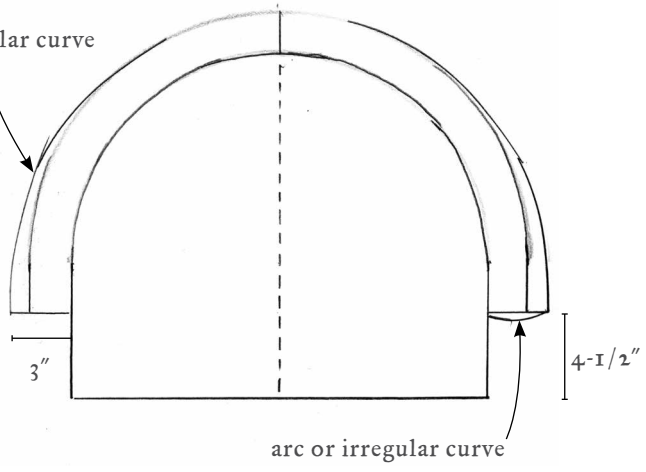
1. A big sheet of paper (I use cheap newsprint sheets). You also can draw these templates directly on thin MDF
2. Trammel points with one end being a pencil
3. A yardstick
4. Drafting triangle
5. Pencil



SEAT PLAN



ARMBOW



ARMBOW HANDS

Draw the Seat

Most of my chairs use a D-seat, which looks like a more complicated shape than it really is. It's simply a rectangle with a half-circle attached to one edge. To make the seat, draw a rectangle that is 20" wide and 6-1/2" high. Draw a centerline though the rectangle's 20" width.

Set your trammel points to a 10" radius. Scribe the half-circle arc where the centerline intersects one edge of the rectangle. That's it.

All of the other parts of the chair – the arms, doubler and the crest – all evolve from the seat shape. So, I've shown the seat in the illustrations to make this clear.

Make the Arms

The arms for my stick chair are 2" wide and start about 4-1/2" back from the front edge of the chair. Here's how to lay them out. Start with the seat plan you just drew. The first arc is a half-circle with a 10" radius – just like the seat. Scribe that. Then adjust the trammels to describe a 12"-radius circle and scribe that on your paper.

Now add 2" x 2" squares to the front of your arms to make them longer and to match the shape of the seat. The illustrations show this clearly.

Now you have the basic shape of the armbow. You can alter this shape to suit. I decided to widen the arms at the front and add a curve to the front area of each arm. This part of the armbow is called the "hands."

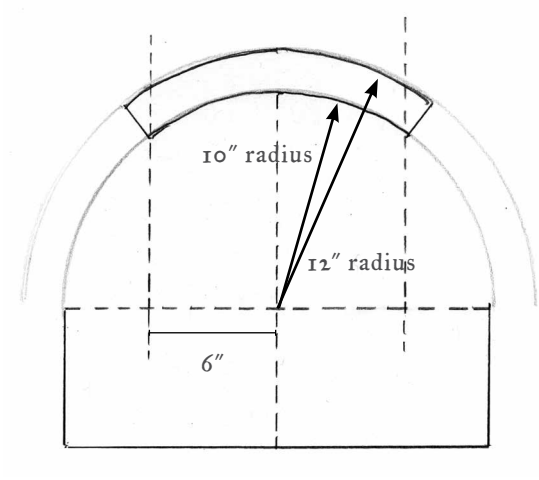
Create the Hands

I made my hands 3" wide at the front. Then I wanted the additional 1" to flow into the original arm so the armbow ended up 2" wide at the back.

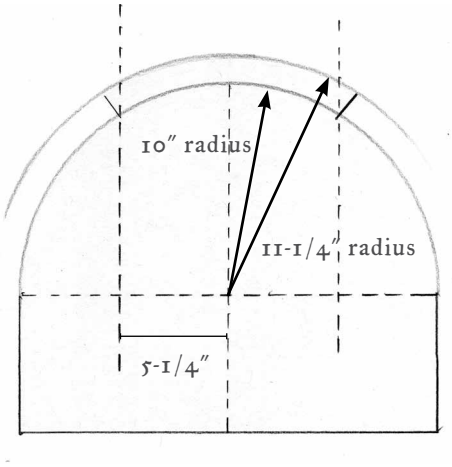
This is the only difficult part of the exercise. I used French curves to create this irregular curve. You also could draw an ellipse, but using French curves is faster (for me). Then draw the arc at the front of the hands. It can be a simple arc or an irregular curve. Your call.

The Doubler

The "doubler" is a piece of wood that beefs up the armbow and helps strengthen any short grain. It has the same basic shape as the armbow but is only 12" long. Scribe the two arcs – one at a 10" radius with



DOUBLER



CREST

the second at 12". Then use your yardstick to create endpoints that are 12" apart. Use these endpoints to connect your two arcs.

The Crest

The crest begins just like the doubler – by scribing a 10" arc. Then set your trammels to draw an 11-1/4" arc. Use your yardstick to create endpoints that are 10-1/2" apart. Join the two arcs using the endpoints as a guide.

All the text above is much more difficult to follow than is simply studying the drawings. Everything flows out of the 10"-radius arc that is the back edge of the seat. Once you get that in your head, everything else is easy.

After you make your templates, you can transfer them to MDF or hardboard. Cut them out and smooth the edges with files and sandpaper. And put them in a safe place. While templates are easy to make, remaking lost ones is a grumpy affair.