



## A Chairmaker's Foot Lathe & Drilling Stand

*A simple foot-powered lathe to build simple post-and-rung chairs.*

The post-and-rung chair is a simple affair with a super-structure consisting of spokes with round tenons fashioned on their ends. Holes drilled into the legs receive these tenons. Arms, slats and/or rockers can be added to this frame. To accommodate this simple and repetitive joinery, I developed a design based on two very old woodworking devices: the foot-powered reciprocating lathe, and the peg-and-wedge vice. This easily built machine does take some practice and acquired skill to use, but it



Here you can see what my lathe looks like from the side that contains the drilling shelf.

also overcomes many woodshop shortcomings if you're an avid post-and-rung chairmaker.

Throughout the years I've tried cutting round tenons on the end of chair spokes many different ways. The foot lathe is, by far, my favorite. Being that it is a lathe, both tenons always line up with each other and a reciprocating lathe allows work to be done right at the end of the stock without the possibility of a spinning "live center" catching the cutting edge of the tool. Pumping the foot pedal really isn't that much work. Plus, it frees my hands and gives me greater control of the motion. It also doesn't require much work to cut a tenon on the end of a chair spoke. In fact, I usually can accomplish the task in about the same amount of time that it takes to put the spoke on the lathe and then take it off.

The peg-and-wedge vice is one of the most universally adaptable holding devices available to the woodworker. These vices are quick and easy to use, and can be built with scrap lumber in about as much time as it takes to read this article.

The pictures that accompany this article offer some different views of my lathe. I also show you some of the steps involved in making a post-and-rung chair while working on my lathe and drilling stand.

### Building a Lathe

For simplicity and to reduce vibration, I built my machine running from the floor to ceiling – 32" is a good working width. It's important to position the machine so that there will be at least 3' of clear working area on each side, enough room for the foot lathe side to accommodate the pedal, and the drilling shelf side to open into the assembly area of your shop.

To make a 32"-wide machine, cut your top and bottom 29" long. Nail the bottom to the floor and the top to the ceiling. These two pieces must be plum and in line with each other.

Cut your side pieces to fit snugly between the floor and the ceiling. On your side pieces, cut notches to receive the crosspieces. The top of these notches should be about 36" up from



Here you can see the spoke set up and ready for turning some tenons.



Eyeball the center of the chair leg and mark it before you drill the hole.



Here you can see I'm drilling a hole in the chair leg.



the floor. (It is important that the crosspieces that will fit into these notches be level and square to the uprights.) Toenail the uprights into place.

Cut your two crosspieces, your shelf and the shelf back 32" long. Attach a 29" strip of angle iron or small strip of wood to one side of each crosspiece. Attach the strip as close to the bottom edges as you can and still have it strong, leaving room at the ends for the notches. Place these two crosspieces in the notches with the strips of angle iron on the inside bottom edge. Drill and install the four 7-½" lag bolts with their ends countersunk flush.

Now it's time to make the puppet end block and the puppet end point. The puppet end point is a short piece of threaded rod or bolt that has been ground to a point on one end and mounted through the puppet end block. It would be in the same place as the dead or moveable center on a standard power lathe. Out of a scrap of 2 x 6, make the puppet end block so that it slides easily between the two crosspieces. Cut notches to accommodate the angle iron.

The puppet end point is installed in the top center of the puppet end block so that it sits about 1" above the top of the crosspieces. Before installing the short lag bolt, grind a point a little less than 45° on its end.

If you're right handed, drill a hole in the center of the right-hand (facing the machine from the foot-lathe side) upright for the long carriage bolt to slip through. This hole should line up at the same height as the puppet-point end.

Grind a point on the end of the carriage bolt, use a stick of wood for the handle, and put together the screw-end assembly with a wing nut and washer on each side of the upright.

From 1" stock, cut the spacer boards. These boards should have a width so that when they are resting on the angle iron their top edge is at the same height as the two end points. For each size spoke I use in my chairs, I have a pair of spacer boards that are two inches longer than the length of the spoke. The end cuts on the boards are beveled to

This is a close look at my drill bit going into the drill leg while secured on my drilling shelf.



Now I'm measuring the angle for the holes located in the sides of the chair legs.



Here you can see I'm chopping out a slat mortise for my chair.



This is the proper stance when turning on the foot lathe.

help them stay in place.

With the spacer boards and puppet end blocks in place, drill a 1" hole through the crosspieces behind the puppet end block, leaving a small space for the wedge. This 1" hole should go through both crosspieces and be nearer to the top. A long, removable hardwood dowel goes in this hole. (Other holes for different size spokes can be added later.)

Install the hook in the center of the short 2 x 8 nailed to the ceiling. Mount the foot pedal to the floor with the door hinge. Attach the bungee cord to the hook. Tie a length of the nylon rope between the end of the bungee cord and the end of the foot pedal. Make a wooden wedge to secure the puppet end block and the spacer boards. And there you have it – a working foot lathe.

Helpful hint: Many different things can be used for a return spring (in my first lathe I used the spring off of the screen door). The spring and the rope will wear out eventually and you will probably need to experiment some before you find out what works best for you. If you use a heavier return spring you can counter weight the foot pedal for more torque and momentum.

Wedges with a more acute angle hold better. A little wedge between the puppet end block and a crosspiece helps keep things tight.

### The Drilling Shelf

Cut three shelf supports 7" long. Cut 1-½"-long tenons with ¼" shoulders all the way around on one end of each piece. Glue and clamp these shelf supports cross ways to the shelf. One of the shelf supports should be in the center of the shelf. The other two should be recessed 1-½" from each end of the shelf. The ends of the shelf supports should be flush with an edge of the shelf and the shoulders of the tenons should be flush with the other edge.

Cut through-mortises in the shelf back to accept the three tenons. These mortises should be centered on the line 3-¾" down from the edge of the shelf back.

After the glue has set, saw a kerf all the



Here's a close look at what a tenon looks like while being turned.



This is what a finished tenon looks like.



Here's a peek at a few of my turning tools.

way down to the shoulder  $\frac{1}{2}$ " in from each edge of each tenon. Make wedges to fit the kerfs for spreading the tenons.

Glue the mortises and the inside edge of the shelf. Assemble and clamp carefully so that the shelf is square with the back. Drive the wedges to tighten the tenons. From the back, drill for and install four of the 3" lag screws through the back and into the shelf. Countersink their heads flush with the back.

Mount the drilling shelf to the uprights with the other two 3" lag screws. Countersink these screws well below the surface of the backstop. Make sure the shelf is level and square with the uprights.

Cut two shelf braces that will fit between the outer corners of the shelf and the bottom of the uprights. Nail the supports in place along with angle bracing between the uprights and the bottom of the inner cross piece.

Drill three 1" holes in the surface of the shelf centered over the short shelf supports. Put a  $\frac{3}{8}$ "-diameter wooden dowel on either side of these holes to help keep the shelf and the shelf supports together.

I like to make the 1" pegs out of hardwood. I chop the wedges out of 2 x 4 pine stock.

### **Using Your Machine**

The foot lathe is very simple to operate. It doesn't take long to get the coordination of cutting only on the down stroke. The top of the stock should spin towards you as you step on the pedal. The direction of the spin is determined by which way you wrap the rope around the stock. The spacer boards act as the tool rest, and sometimes when turning big stock or a spoke with a pronounced crook, I'll chop away some of the inside top corner of the spacer boards to make room.

I wouldn't want to do a lot of big work on this kind of lathe, but for turning tenons on the ends of chair spokes, I find it quick and efficient.

Not only does the drilling shelf hold the leg securely while I drill my holes, it is

also used to get the holes in proper alignment and angle. I always drill horizontally. I use a Band-Aid wrapped around the drill bit as my depth stop to the outer edge of the shelf.

Perpendiculars or measured angles can be drawn on the shelf. The angles for which the holes for the side spokes are to be drilled can be measured by using the surface of the shelf and the edge of the upright as an imaginary square. Also, the shelf holds the legs for my chairs while I chop out the slat mortises with the chisel.

The squareness of the back and front chair panels can be checked against the edge of the cross pieces and the sides of the uprights.

I even flip the frames upside down and clamp them to the shelf when I make the joints for the rocker.

There are many different ways this machine can be used to drill holes at their proper angle and hold pieces of wood in a convenient manner.

### **Maintenance**

Some parts of the machine will wear out over time. A good rope will last a dozen chairs or more. High-quality bungee cords will last maybe two years. And about every 100 chairs or so I need to replace the drilling shelf. Wear and tear, and the heat from friction can mess up the threads on the carriage bolt in the screw-end assembly. I've replaced this carriage bolt maybe three times in the last 15 years.**PW**

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