Treadle Lathe Plans

by

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Introduction

I got fascinated with the old ways of woodworking over 20 years ago. I prize my drawknives, spokeshaves, planes and handsaws far more that their modern electrical replacements. I've been able to craft some pretty fair items down through the years, though not as well as as some of the folks you see on TV or in books. I guess I'm satisfied with that because working with wood makes me happy. It relaxes me, fascinates me and keeps my mind occupied trying to figure things out.

Two years ago I presented myself with another challenge. I wanted to build a foot-powered treadle lathe because I wanted to take on the challenge of trying to build a Windsor chair after that. I looked everywhere for a decent set of plans and finding none I liked, started sketching and making measured drawings. Once satisfied, I started building. Many weeks and tweaks later it was finished.

Though I started to use hardwood, I chose pine instead and some it was so soft it did not take punishment very well. I therefore designed a hardwood insert to take the direct pain from the bearings and spread the load to the pine. The dead center in the tailstock just seemed to cause so much drag no matter how much wax I used that I decided to design a live center with 1/2" steel rod and a sealed bearing to match. It literally got rid of the rotation friction. My flywheel is almost solid wood as opposed to a spoked design. I discovered that the two angle braces leading from the headstocks seem too flimsy in 2X pine material with just screws to hold them. I would suggest either using hardwood with tenoned or lapped joints or using 4X pine and tenons or laps. I added an additional brace to take some of the force of the rotating wheel and crankshaft and experimented several times to get workable lengths on the pull rods and their placement on the treadle. The treadle made of 1 x 3’s as shown in the plans broke the first time I tried to use it. A 2 x 4 was inserted to replace the broken member. This was fun project and even more fun to use. Give it a whirl!

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Here are a few photos of the completed lathe. They may help you as you study the drawings and get further along with your project:

This is a shot of the lathe from the front and left end.

A close up of the flywheel hub.

Dual headstock shot. Sealed bearing used along with a thrust bearing in the left post.
With no lathe at the time, these pulleys were actually made from furniture knobs. The groove was cut with a chisel. I expect a router would work.

Tool rest made from oak. Up and down adjustment is really just an unglued half-lap joint held together with a bolt in a slot. It works very well.

Live center and oak insert.
Front view of treadle, pull rod and crankshaft.

Same area as above, but from the rear. V-groove in flywheel for belt was cut with a chisel.

The entire treadle as seen from the rear. Angle brace at right should either be changed to hardwood or made with larger dimension piece.
Shot under the ways with bottom of tool rest on left and bottom of tailstock on right. A nut imbedded in a piece of oak gives me a type of wood wrench to loosen and tighten the tool rest. A wedge does it for the tailstock. Both work very well.

This is a second generation oak insert to hold the bearings. The pine I used was too soft for the stress from the bearings and wallowed out soon. I devised this method with the oak taking on the direct stress. The first generation was shown on the tailstock photo. This is much easier to make and looks better.
Suggestions and Tips

1. Consider either a larger dimension pine lumber or hardwood for construction, especially the angle braces. If you do choose pine, you might want to go ahead and make those oak inserts I showed you. They have worked very well for me.

2. Consider bolts where feasible or lap joints or mortise & tenons in place of wood screws. This unit can create a lot of stress when up to speed.

3. Be very careful with measurements when doing layout. Overlap certain pieces that will have the same measurement (inserts into uprights for lathe ways for example) and mark them simultaneously.

4. Considering lengthening the crank dimension from 1 1/4" to 1 1/2" for more torque. Could even go a little longer.

5. You might want to consider hardwood for the flywheel too. The extra weight could be useful in maintaining rpm's.

6. The idler pulley could be made adjustable to increase tension on the belt more easily. As it is, I have to shorten the belt when it stretches with use. I cut the belt with snips, use a tiny drill bit to make another hole and thread a new piece of artificial sinew through both ends and tie with two square knots. The sinew is very tough and not as noisy as the metal clip that comes with the belt.

7. Look out for warped lumber. My headstock member "B" on the drawings decided to warp away from the lathe ways after it was together and it caused a slight
8. My flywheel seemed like it was out-of-round when first mounted. I used a lead counter-weight to offset the weight of the crank and treadle. I tried this with about two pounds of lead and it made things much smoother. Look at the photo of the flywheel. I melted down about two pounds of fishing sinkers and screwed the final slab to the wheel. The rest of the treadle may need some beefing up also after you build it with the 2 x 4 left member (member P), depending on how you use the machine (and how big you are!). Or maybe switch to something like ash, which is light and strong.

9. Leave the pull rod assembly between the crankshaft and treadle kind of loose to accommodate the alignment. I even put a little gun oil gel on the mechanisms to cut down on the heat from friction. I tried smaller than the 1/4" rod and it bent on me.

10. Be sure your nails or pins go all the way through the flanges and axle on the flywheel (flange-axle-flange). Don't use the bushing only, it will twist on you and sever the pins.

11. I know the photos show a tool rack and it's not in the plans. It's just a 1 x 3 with several Forstner holes drilled into it, then screw/glued to a 90-degree second 1 x 3 for attachment to the lathe. Very simple.

12. Go slowly when attaching the flanges to the flywheel; it can easily get out of line and make your wheel wobble or otherwise run untrue. I half-lapped the 2 x 4's, then carefully found the center point and used a drill press to drill a 1/2" hole for the axle. After assembling the rest of
the wheel, I slipped a short length of 1/2" rod into the hole, mounted it horizontally in a vise and tested for trueness. I got lucky. Leaving the rod in place, I slipped the flanges over the ends of the rods and ran them home against the wheel. After carefully drilling pilot holes, I screwed them in tight with the rod still in place. It seemed to work for me this way. If you have a bandsaw (I didn't), true the wheel in circumference before you mount the flanges.

13. By the way, it just occurred to me that I perhaps never mentioned I made glue-ups for the thicker dimension timbers. The 4 x 4's are really just 2 - 2 x 4's glued together.

14. If you look closely at the photo of the headstock you will notice what looks like a spring on the right side of the drive pulley; it's not. It's just heavy wire wrapped around the axle to act as a free-spinning spacer to keep the axle from working out of the left end bearing when free-wheeling. I don't have welding equipment, otherwise a person, I suppose, could tack on some kind of keeper to the axle itself. Maybe you can come up with something better. This works; it's just isn't the most attractive thing.

15. I found my leather belting on the internet: **Jennys-Sewing-Studio.com** or call 800-707-6007. It's a replacement belt for an old Singer treadle sewing machine. It's product description is "leather treadle belt". They cost $8 when I purchased them and you'll need two as they are only six feet long. They are relatively easy to cut and link up.

16. The Shopsmith info: **shopsmith.com** or call 800-762-7555. The Mark V lathe drive center is part number 505715. This will fit 5/8" diameter rod.
Finally, have some **fun** with this project. You won't believe what a kick this is to use once you're finished. Your friends and neighbors might even offer you money to try it out too!
Oak Bearing Insert

This is a typical 2"x4" application and the bearing dimensions are for a ½" sealed bearing from VXB.com (product code: Kit7478). The 5/8" sealed bearing is code # Kit 7886 and is 1 3/8" in diameter and 7/16" thick. I make mine by using a 2 1/8" diameter hole saw to cut out a "puck" from ¾" oak stock, then use a 1 1/8" Forstner bit to drill out a cavity as deep as the bearing. The bearing fits snugly, but you might want to also drill two small holes on either side of the bearing to screw in two pan-head screws to make sure the bearing won't move. Next, use a 2" Forstner bit to drill out the location for the bearing and insert to ¼" deep. The insert is slightly undersized for the 2" hole, but a little glue and a clamp will take care of it. See the lower left picture on page 5 for an example of it.

Headstock Thrust Bearing

Illustrated below is a design I came up with after I built the lathe in the photos. All of my current bearings are supported only by pine and I plan to go back and retrofit with the oak inserts. I used them on another machine I was building and they worked great.

Pictured below is a photo of the thrust bearing I used. It consists of 3 parts: an inner race with ball bearings and two outer pieces with grooves around the edge to accommodate the bearings. The ones I found were only to be had in metric so I bought the one slightly smaller than 5/8". When the axle is forced against the bearing by pressure from the tailstock, it turns the bearing and everything runs smoothly. Depending on the diameter of the bearings you buy, I simply would drill out the larger diameter first, then the smaller. Insert the thrust bearing pieces, then the regular sealed bearing. Hold it in place with pan-head screws if you wish. It's Kit #7853.
Flywheel

These are the steps I took to assemble the wheel. Maybe you can do better.
1. Cut out a 24" diameter pattern from thin plywood.
2. Cut two 24" pieces of 2"x4" and half-apper them at their centers.
3. Cut a 45-degree angle on one end of a 20" long piece of 2"x8".
4. Lay the 2"x4" cross piece on the plywood circle until the ends are all tangent.
5. Set the 45-degree angled 2"x8" on one edge of the cross until the outer long edge is tangent to the plywood circle. Mark the place where the other end of the 2"x8" just meets the 2"x4" member 90 degrees away. Cut another 45 from this mark and set this piece in place. Repeat with the other 3 quadrants. Mark the pieces to identify.
6. Lay the plywood circle on top of the cross and 2"x8" sections, making sure everything is pushed together tightly. Adjust the circle to be tangent at all ends of the 2"x4" pieces. Mark the arc cuts on the 2"x8"s.
7. Cut the arcs off the 2"x8"s and reassemble the wheel on a bench.
8. Make a pattern for the 4-1"x6" rim segments. These are not critical measurements. The are partly for looks, partly to hold everything together and partly for weight.
9. Once you're satisfied with the fit, trace out 3 more segments and cut them out.
10. Attach the segments to the other pieces of the wheel with glue and screws, making sure to start and end the segments on a 2"x4" to hold everything together.
11. If you have a bandsaw, row is the time to true the wheel to a perfect round shape. otherwise do your best with saws, chisels or planes.
12. Cut a center groove on the wheel for the leather drive belt however you can. I did mine with a chisel, but a router would probably be quicker.
13. It is now ready to mount your flanges (see tips and suggestions section).
Final Thoughts

Just so you know what this lathe is capable of, I will show you one of the projects I've done since completing it. It was one of the main reasons I wanted this lathe in the first place.

I was able to create a small number of Windsor chairs like the ones below. All the legs and arm posts were turned on the very lathe you're about to make.

If you turn to the next page, I'll show you what my lathe looks like today after many, many hours of turning. You can just make out one of the Windsor legs between the stocks.

It's been a joy. I hope it is for you too. Thanks for doing business with us. Maybe I'll have other projects down the road for you!
Sweet!