

A Free Computer Design Tool for the Richard Joyner Pendant Jig

By Bill Klopping

A free Excel spreadsheet tool that allows you to quickly and easily see how different jig set-up combinations will look when using the Richard Joyner Pendant Jig. It allows you to specify any size pendant and include up to 24 different elements using any combination of pendant jig offset hole, index hole and cut location for each element.

A few years ago at the SWAT woodturning symposium, I bought a Richard Joyner Pendant Jig from Ruth Niles (nilesbottlestoppers.com). The jig, shown in [Figure 1](#), is a lightweight eccentric turning jig consisting of a base plate with 8 “offset” holes in it and an index plate that has 24 indexing holes (15° apart) that attaches to the base plate with 4 screws. The index plate has 4 additional holes that can be used to attach a waste block to the index plate (or can be used to attach a flat board, useful for prototyping designs).



Figure 1 – The Richard Joyner Pendant Jig

The jig base can be mounted to the lathe in a number of ways. One common method is to use a threaded bottle stopper mandrel on a morse taper, secured through the headstock using a threaded rod.

By mounting a blank on the index plate and configuring the jig to use different offset holes and index positions, you are able to create a wide variety of pendant designs and other offset turnings.

Initially, I made a number of pendants with a variety of designs but was continually stymied when trying to figure out what combinations of offset hole, index position, and cut placement would result in a pleasing design. A LOT of experimentation was required for each new design,

and my fascination with the jig soon waned because it took so much effort to create new designs.

A number of months ago, Steve Worcester, who also sells the Richard Joyner Pendant Jig (www.Turningwood.com), gave a demonstration to our chapter on how he made pendants using the Richard Joyner Pendant Jig. Steve used a piece of dry-erase whiteboard mounted to the index plate to prototype designs and wrote down the jig settings for later use on real wood. Although that is a great idea and saves wasting a lot of wood on failed designs, it still requires a lot of experimentation with the jig on the lathe to come up with good design combinations.

During the demo, I started thinking about possible ways to reduce the amount of work necessary to create designs. Being a mathematician-physicist-engineer, I figured “Hey, it’s only got 8 offset holes and 24 index holes – a total of 192 positions – how hard can it be?”

As it turned out, a little basic trigonometry and a little expertise with Microsoft Excel made it fairly easy for me to come up with a “simple” spreadsheet tool that easily allows you to see what different combinations of jig settings will look like before you start cutting wood. The spreadsheet tool allows you to specify any size pendant, using any offset and/or index hole for the pendant outline, and include up to 24 elements (individual design cuts) using any combination of offset hole, index hole, and cut location for each element.

The spreadsheet, which I call the Pendant Jig Pattern Tool, took only a few days to create and worked surprisingly well. I recently updated the spreadsheet to fix a couple of minor issues and to utilize accurate jig measurements, which were kindly provided by Richard Joyner (thanks Richard!). I’ve also added a plot rotation feature and the ability to use metric measurements (centimeters or millimeters) in addition to measuring in inches.

Because the spreadsheet worked so well and I had so little effort expended in creating it, I decided to give it away to anyone who wanted it. A copy of the latest version of the spreadsheet (version 4.0) can be downloaded for free by going to www.huntcountywoodturners.org and navigate to the “In The Shop” - “How To” link and selecting the “Pendant Jig spreadsheet.” The spreadsheet is 1.8 MB in size and is in the Excel 97-2004 Workbook (.xls) format, so it should be usable by anyone with a reasonably recent version of Excel. The spreadsheet only utilizes basic Excel formulas and features (no macros).

This article describes how to use the spreadsheet tool and provides some practical lathe tips for turning pendants designed with the spreadsheet tool.

The Parts of the Spreadsheet Tool

A screenshot of the spreadsheet tool is shown in **Figure 2** with some red boxes, descriptions and arrows that point to the major areas of the spreadsheet.

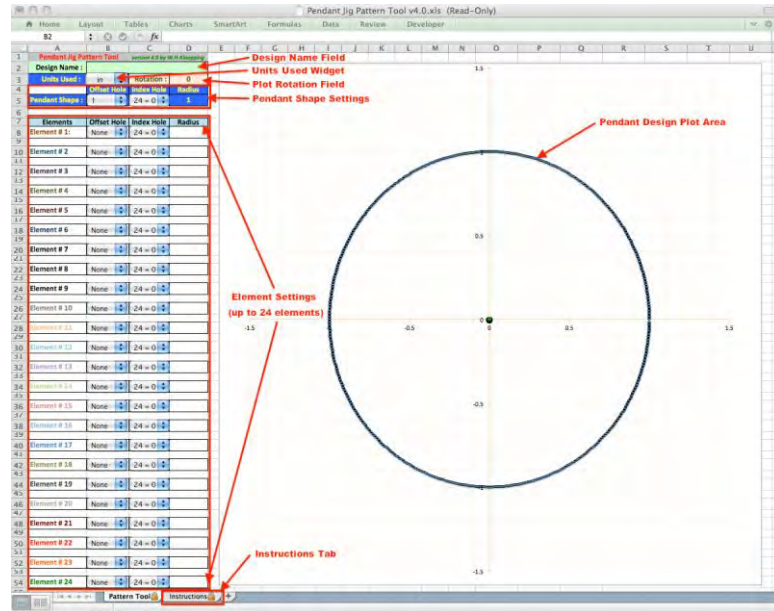


Figure 2 – The basic areas of the Pendant Jig Pattern Tool Spreadsheet

The tool is laid out with all of the controls on the left side of the panel and the pendant design plot occupying the remainder of the sheet.

At the top left, you will see the “Design Name” field (wide light green-colored box) where you can type in whatever you want to identify the design for later reference.

Below the Design Name box is the “Units Used” pull-down widget and the Plot Rotation field (peach-colored box with olive green text). Clicking on the Units Used widget will display a pull-down menu, as shown in **Figure 3**, that allows you to select the units you want to use to make measurements (inches, centimeters, or millimeters). The default is for all radius measurements to be in inches. You can enter a value into the Plot Rotation field at any time. This will cause the plot in the Pendant Design Plot area to rotate around the center of the display so you can align the pendant design for easier visualization of what the pendant will look like.

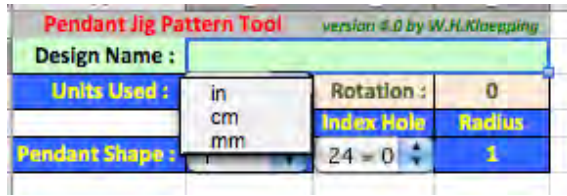


Figure 3 – The Units Used pull-down menu

Below the Units Used widget are the Pendant Shape controls (blue boxes with yellow text and two pull-down widgets) where you specify the Offset Hole, Index Hole, and Radius to be used to cut the pendant outline. Clicking on the Pendant Shape Offset Hole widget will display a pull-down menu, as shown in **Figure 4**, that allows you to select any of the eight base plate offset hole positions to be used for the pendant outline. Clicking on the Pendant Shape Index Hole widget will display a pull-down menu, as shown in **Figure 5**, that allows you to select any of the 24 index plate hole positions to be used for the pendant outline. Note that Index Hole 24 is the same as Index Hole 0, which is marked on the Index Plate. The default pendant radius is set to 1. You can enter any radius into the Pendant Shape Radius field and the Plot Display will automatically update to display the new pendant shape (you'll see the axis labels change and/or the circle get bigger/smaller in the plot area).

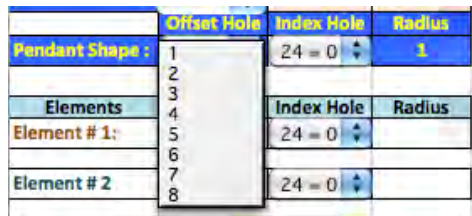


Figure 4 – The Pendant Shape Offset Hole pull-down menu

	Offset Hole	Index Hole	Radius
Pendant Shape :	1	1	1
		2	
		3	
Elements	Offset Hole		Radius
Element # 1:	None	4	
		5	
		6	
Element # 2	None	7	
		8	
		9	
Element # 3	None	10	
		11	
Element # 4	None	12	
		13	
Element # 5	None	14	
		15	
Element # 6	None	16	
		17	
Element # 7	None	18	
		19	
Element # 8	None	20	
		21	
Element # 9	None	22	
		23	
		24 = 0	

Figure 5 – The Pendant Shape Index Hole pull-down menu

Below the Pendant Shape controls are the 24 individual element control lines (labeled “Element #1” through “Element #24”). Each element control has three parts: an Offset Hole pull-down widget, an Index Hole pull-down widget, and a Radius entry field. Clicking on an element Offset Hole widget will display an element Offset Hole pull-down menu, as shown in **Figure 6**, that allows you to select any of the 8 offset holes or “none” to be used for the element cut. If “none” is selected, the element will not be displayed. Clicking on an element Index Hole widget will display a pull-down menu, as shown in **Figure 7**, that allows you to select any of the 24 index hole positions to be used for the element cut. You can enter any radius into the element radius field and, if the offset hole selection is not “none,” the Plot Display will automatically update to display the portion of that element cut that will show up on the pendant (portions of a cut that are outside the pendant outline are not displayed).

Elements	Offset Hole	Index Hole	Radius
Element # 1:	1	24 = 0	
	2		
	3		
Element # 2	4	24 = 0	
	5		
Element # 3	6	24 = 0	
	7		
	8		
Element # 4	None	24 = 0	

Figure 6 – An Element Offset Hole pull-down menu

Elements	Offset Hole	Index Hole	Radius
Element # 1:	None	1	
		2	
		3	
Element # 2	None	4	
		5	
		6	
Element # 3	None	7	
		8	
Element # 4	None	9	
		10	
Element # 5	None	11	
		12	
		13	
Element # 6	None	14	
		15	
Element # 7	None	16	
		17	
Element # 8	None	18	
		19	
		20	
Element # 9	None	21	
		22	
		23	
Element # 10	None	24 = 0	

Figure 7 – An Element Index Hole pull-down menu

A separate “Instructions” spreadsheet tab (not described here) can be viewed by clicking on the “Instructions” tab at the bottom of the panel.

Using the Spreadsheet Tool

Using the spreadsheet tool is relatively easy, although coming up with a pleasing design will still take some time. A quick list of the basic steps to prototype a pendant design is as follows:

1. Select the Units you want to use for all measurements
2. Select the Offset Hole to use for the pendant shape outline
3. Select the Index Hole to use for the pendant shape outline
4. Enter the Radius to use for the pendant shape outline
 - You should see the circular pendant outline in the display area

Then, for each element you want to add to the pendant:

- A. Select the Offset Hole to use for the element.
 - Note: Selecting “None” will turn off (i.e. not display) an element.
- B. Select the Index Hole to use for the element
- C. Enter the Radius of the cut to use for the element
 - You should see the resultant element show up in the display area

Optional Actions:

- You can type any information you want into the Design Name box
- You can enter an angle into the Rotation box to orient the displayed design
- You can Print out a copy of the design (includes all settings) to take to the lathe
- You can Save a copy of the design on your computer

A Few Notes About Using the Spreadsheet Tool

No tool is perfect, especially when you rely on another application as the basis for the tool. The Pendant Jig Pattern Tool is no exception. There are a few Excel “features” that should be noted. Additionally, there are a number of general notes about using the spreadsheet tool that may not be intuitively obvious to everyone.

When you open the spreadsheet, you will get a notice telling you that it should be opened as read-only. I intentionally saved the file as a protected, read-only file to reduce the possibility of people accidentally erasing critical data or calculations. Clicking “yes” in the dialog box will open the spreadsheet.

When you first open the spreadsheet and from time to time during use, the pull-down widgets (the buttons with the blue up/down arrows) may not be displayed. This is an Excel “feature” that I haven’t figured out how to correct. The widgets should reappear if you click on a tool on the Excel toolbar at the top, e.g., the “Bold” button (“B” box).

Selecting different Offset and/or Index Holes for the Pendant Size will cause the displayed pendant outline to change size and move around in the display area. This is because of the auto-formatting features of the Excel plot functions that I used. The changing sizes and position of the displayed design do not affect the design itself, only how it’s displayed in the spreadsheet plot display.

All radius values should be entered as decimal numbers, not fractions (e.g., enter 0.75, not 3/4). The jig dimensions used in all calculations are converted into the units selected in the Units Used widget, so you need to make sure that you are entering measurements using the selected units. Entering metric values when inches is selected (and vice versa) will result in your design not matching the turned pendant.

Remember that the radius is half the diameter. The spreadsheet tool works with radius values for all measurements. If you want a pendant that is 3” in diameter, you will need to enter 1.5 for the Pendant Size Radius.

The spreadsheet will allow you to add up to 24 different elements to a pendant design. You can use any of the element control lines in any order; you do not have to use sequential lines (e.g., you can use #5, #9, and #22 and leave the others unused). For this article, there is a blank line (Offset = None and no radius value listed) between elements to indicate that the jig settings need to be changed before going to the next element. Side note: The elements lines displayed on the pendant design plot are color coordinated with the element number labels in the control section, although it is not always easy to distinguish between the colors.

Once you specify an Offset Hole, Index Hole, and a Radius for a given element, the result of that “cut” on the pendant will automatically be displayed on the pendant design plot display. Note that only the portion of the element that will actually “cut” onto the pendant will be displayed on the plot. Any portion of a cut that falls outside of the pendant outline (i.e., where you are “turning air”) will not be shown. Also note that, if the radius you select is too large, you may not see any of the element on the pendant (the specified cut will be all turned air outside the pendant).

Entering a number into the Rotation box will rotate the design around the center of the display. This is a visual orientation aid and does not affect the design in any way. You can change the rotation of the display at any time to view the pendant design from different orientation angles. I usually set the rotation value so the lanyard hole will be at the top of the display.

Once you have completed a design, you can save a copy to your hard drive. Because the spreadsheet is a read-only file, you must use “File - Save As” from the Excel pull-down menus to save your design to a new named file. The saved file is a full copy of the spreadsheet tool and can be opened later and modified without having to recreate all the elements from scratch.

Also, once you have completed a design, you can print a copy of the pendant picture, with all the jig settings, to use at the lathe (use File - Print from the Excel pull-down menus). The printout will show everything you see on the spreadsheet. **Figure 8** shows an example printout of a completed pendant design. **Figure 9** shows the resultant pendant from that design. Note how closely the pendant matches the design.

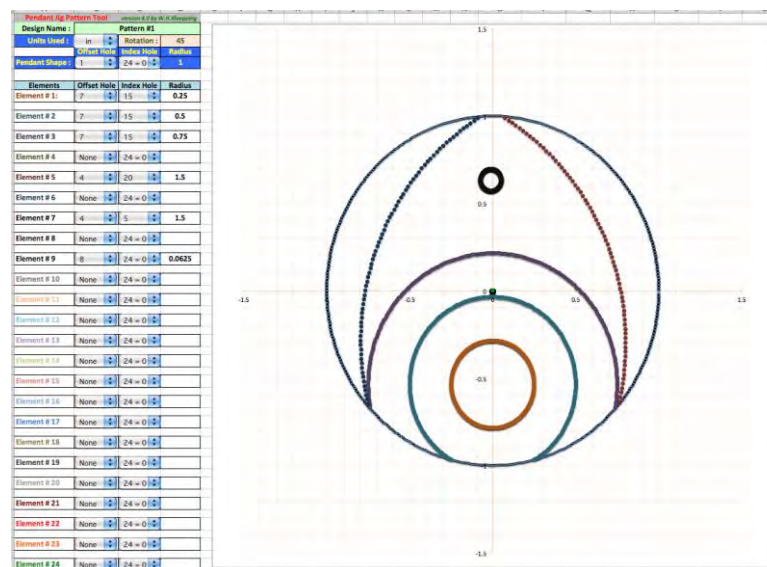


Figure 8 – Example printout of a completed design (Pattern #1)



Figure 9 – The completed Pattern #1 pendant

At the Lathe

A full discussion about how to use the pendant jig at the lathe is not provided here (it's assumed that if you have one of these jigs you should be familiar with how to select the different offset holes and index holes). There are, however, a few items worth noting about turning a pendant from a design that you prototyped using the spreadsheet tool.

The spreadsheet assumes that all cuts are made on a horizontal line that passes through the center turning axis. This means that, for the turned pendant to match the prototyped design, you will have to set the tool rest so your tool cuts on line with the turning axis, not above or below the turning axis.

Each time you change the jig to use a different offset hole or index hole, the position of the pendant with respect to the lathe turning axis can change. All radius distances should be measured from the turning axis of the lathe, independent of the pendant center or which offset or index hole is being used.

If you position the tool rest so you can remove the jig from the lathe without having to move the tool rest, then you can simply make a mark on the tool rest that indicates the location of the turning axis and then make all measurements from that mark. Just remember that, if you move the tool rest, you will have to re-mark the turning axis location on the tool rest.

My preferred technique is to use a flat platform tool rest and a small ruler and square to make measurements and cuts. I set the tool rest height so the tool tip (a small skew) will cut on center and I mark the turning axis on the tool rest. I then make all measurements from that mark using the ruler to set the square at the location a cut is to be made (see **Figure 10**). To make a cut, with the square on the tool rest at the measured location, I run the tip of a small skew along

the edge of the square to make a shallow cut to mark where the element will be (see **Figure 11**) and then finish the cut to the desired width and depth.

There are a few items to note when looking at **Figures 10 and 11**. One item is how I've mounted the pendant blank to the jig. I screw a waste block to the index plate, turn it flat, and use double-sided tape to attach an oversized square blank to turn the pendant from. The tape I use is a 2" double-sided vinyl floor tape (Chapco Impressions Vinyl Floor Tape - a relatively inexpensive double sided tape that's available at my local home improvement store). To help ensure the blank doesn't get knocked loose when turning in the offset positions, where turning air-wood-air-wood can put a lot of stress on the tape, I turn the pendant blank down to within 1/16" of the waste block and avoid turning into the tape or waste block. This provides a large adhesion area between the pendant blank and the waste block.

Another item to note is that I position the tool rest parallel to the pendant blank face. I leave sufficient clearance between the tool rest and pendant blank to allow the square to be used as a tool guide while the lathe is running and to leave enough room for the pendant jig (with attached blank) to be removed/repositioned without having to move the tool rest. I can then mark the center turning axis on the tool rest one time and make all measurements for all cuts from the same mark on the tool rest, no matter how many times I reconfigure and/or remove the jig from the lathe (as long as I don't move the tool rest!).



Figure 10 – Using a ruler to position a small square at the proper radius cut distance from the turning axis that's marked on the tool rest



Figure 11 – Using a small square as a tool guide to make a shallow cut for a design element at a precise distance from the turning axis

The spreadsheet doesn't take everything into account for you. It doesn't take into account the width of the cuts you intend to make (all cut lines are displayed with the same width). It also assumes that the pendant face is flat, not rounded off at the edges. The spreadsheet will show cuts extending all the way to the pendant edge with the same thickness. If the pendant is rounded off at the edge, the cut will "thin out," get shallower, and/or disappear entirely toward the edge of the pendant.

The spreadsheet also doesn't distinguish between a shallow cut and a through hole you intend to make. You will have to remember which cuts are intended to be through cuts or holes vs. shallow design cuts.

An interesting note about through cuts vs. shallow cuts ... You can create non-circular pendants by making cuts through the pendant, instead of shallow design cuts, to cut off the edges of a pendant. **Figure 12** shows a pendant design, and **Figure 13** shows the resultant pendant from that design. Except for a different lanyard through-hole position and plot rotation value, **Figure 14** is the same pendant design as **Figure 12** but with everything erased outside of the central rounded triangular shape. Making through cuts instead of shallow design cuts along those perimeter lines will cut off the outer edges of the pendant to result in a rounded triangular shaped pendant, as can be seen on the completed pendant shown in **Figure 15**. Note that you will have to remember (e.g., write down on the printout) which of the design cuts should be through cuts vs. shallow design cuts. The spreadsheet does not have any way to automatically indicate which cuts are to be through vs. shallow cuts.

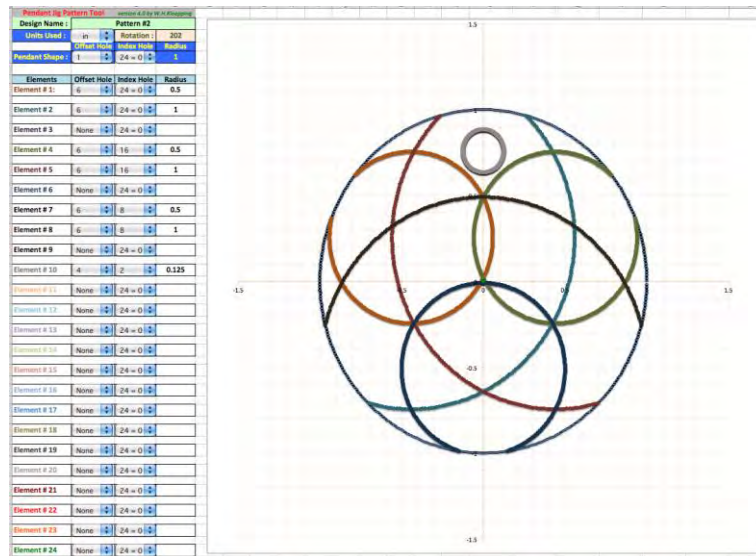


Figure 12 – A pendant design (Pattern #2)

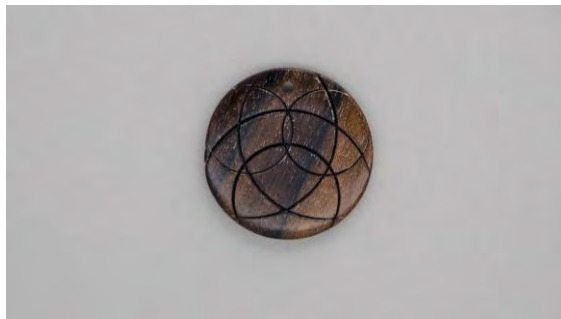


Figure 13 – The completed Pattern #2 pendant

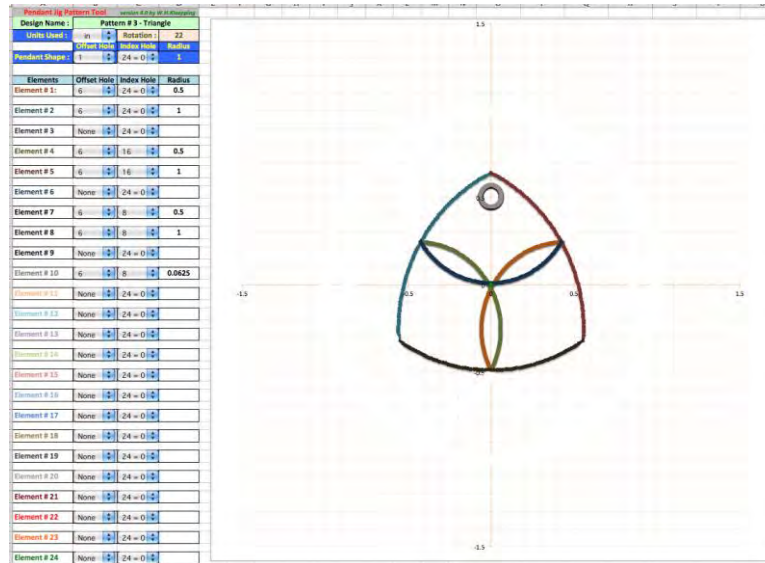


Figure 14 – A triangular pendant can be created by making through cuts to turn off the edges of the pendant (the cut-off portions have been erased from the picture).



Figure 15 – A Triangular Pendant made by turning off the edges of a pendant

Similarly, crescent shapes and other non-circular shaped pendants can be created with a little bit of imagination. **Figure 16** shows a pendant design that probably won't make a very pretty circular pendant. **Figure 17** shows the same design as **Figure 16** with the edges erased outside of where through cuts can be made to turn off the edges of the pendant. The resulting pendant, as seen in **Figure 18**, is "oval-ish" in shape with holes in each end to allow stringing a number of them together to make a chain of pendants. Note again that you will have to remember (e.g., write down) which cuts are to be through cuts vs. shallow design cuts. **Figure 19** shows a small chain of pendants made using this design.

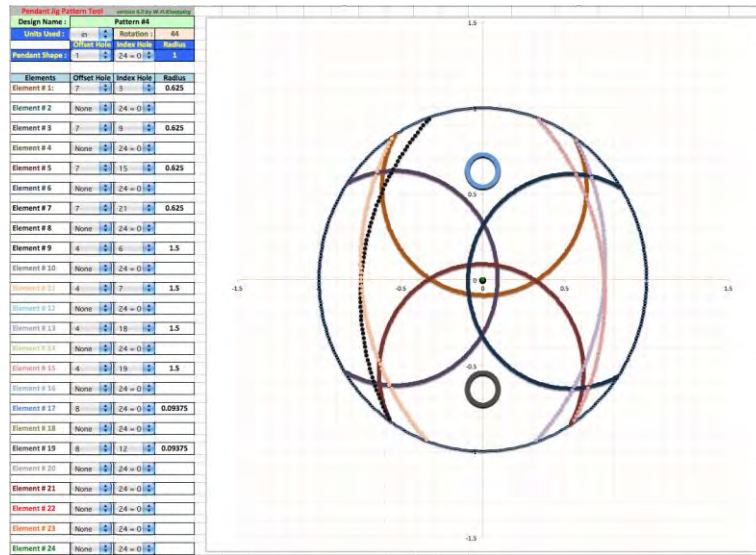


Figure 16 – Another pendant design (Pattern #4)

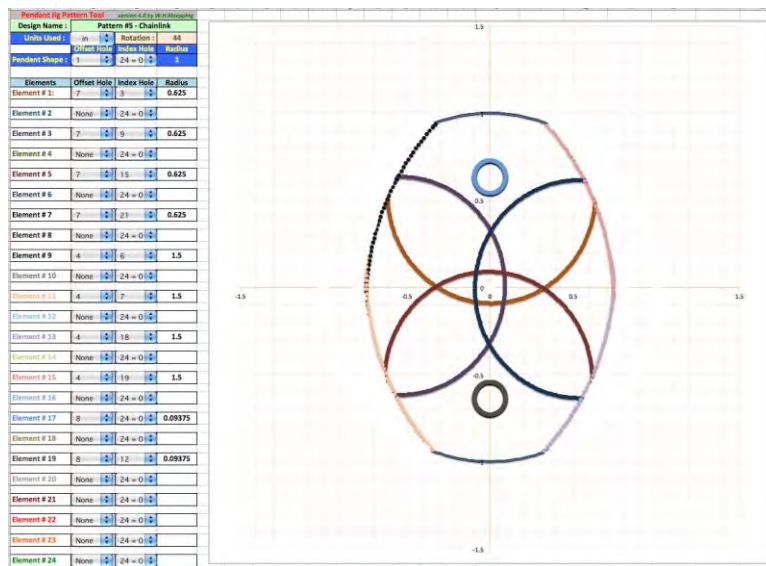


Figure 17 – Pattern #4 design, partially erased to create a pendant chain piece (Pattern #5)



Figure 18 – A pendant chain piece (Pattern #5)



Figure 19 – A short chain of pendants (Pattern #5)

The designs illustrated so far utilize symmetric designs. It is not necessary to use symmetric designs when making pendants; indeed, some of the better looking pendant designs are not symmetric. **Figure 20** shows a non-symmetric design, with **Figure 21** showing the resultant pendant.

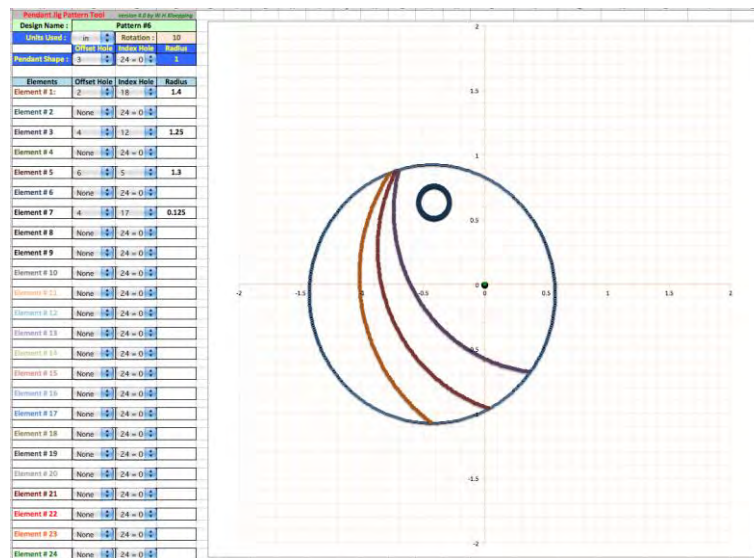


Figure 20 – A non-symmetric pendant design (Pattern #6)



Figure 21 – The completed non-symmetric pendant (Pattern #6)

A different non-pendant use for the pendant jig and spreadsheet tool is in making lattice pattern inserts where you cut a pattern half way through the blank on one face, then turn the blank over and cut a different pattern half way through on the back side, resulting in a see-through lattice like pattern on the piece. You can use the spreadsheet tool to help design a lattice pattern by superimposing a design for the front face of the lattice with a different design for the back side of the lattice. **Figure 22** shows a pattern that can be used for a lattice insert. The design has a simple concentric circle pattern for the front face (the elements with Offset Hole = 1) and an offset concentric circle pattern for the back side (the elements with Offset Hole = 4). **Figure 23** shows the resultant lattice pattern insert. One item to note is that, when the blank is flipped over, the design for that side is (or should be) flipped over also. This can complicate trying to figure out what will work right. If one side design is concentric circles around the center of the insert, you shouldn't have a problem. If, however, you want to use different offset designs for each face, you will have to "flip" one of the element sets for the resultant insert to look like the design. To "flip" the design, you need to add or subtract 12 to/from the indicated index hole values for all elements on one side (back or front, but not both) when you set up the jig for turning. Further discussion about this is outside the scope of this article.

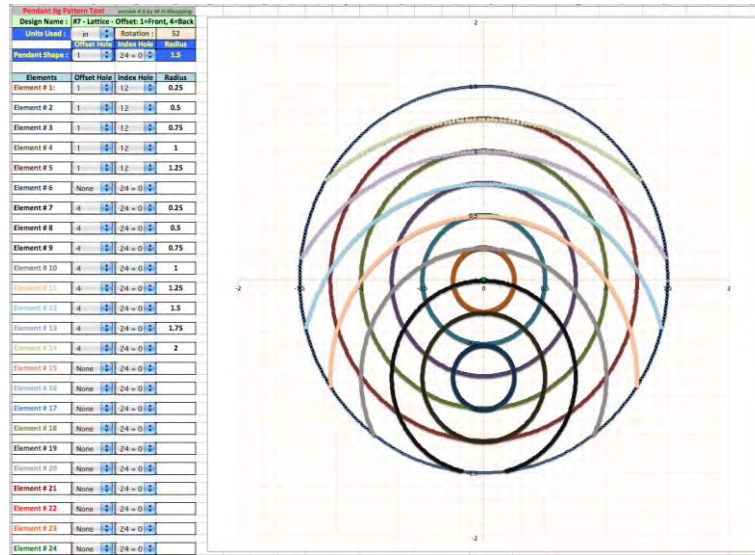


Figure 22 – A Lattice Pattern Insert Design (Pattern #7)



Figure 23 – The Resultant Lattice Pattern Insert (Pattern #7)

The last two designs illustrate how things may not always go as planned or look quite as good as you thought they might.

Figure 24 shows a pendant design that might be interesting. **Figure 25** shows the resultant pendant. Not being careful with the positioning, depth, and/or width of cuts made for a symmetric design can yield poor results. One thing to note is, if the pendant face is not perpendicular to the turning axis, then one side of a cut will be deeper than the other side of the cut, potentially making the design look lopsided or odd.

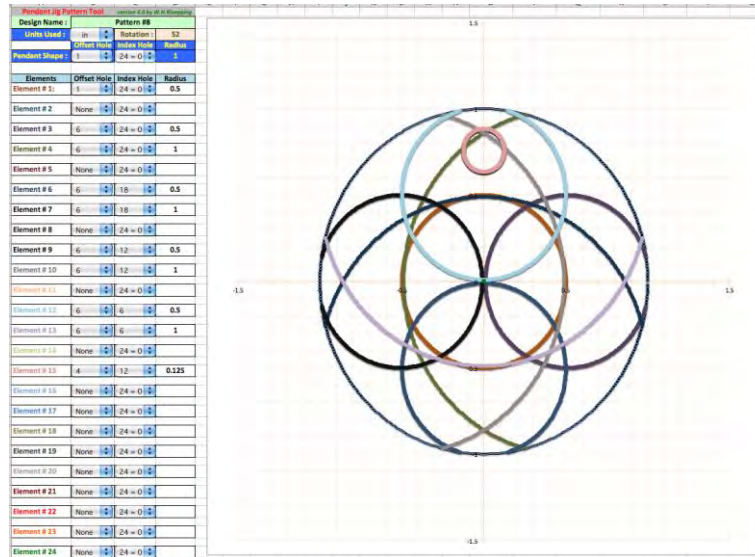


Figure 24 – An interesting pendant design? (Pattern #8)



Figure 25 – A poorly turned pendant (Pattern #8)

Figure 26 shows a somewhat busy pendant design (note that it is similar to the lattice pattern). The moiré pattern effect looks interesting, but, as can be seen in **Figure 27**, it didn't translate well to wood. The pattern is too crowded and busy, and minor cut placement errors were painfully obvious and could not be fixed. Because this was a 4" diameter pendant, I decided it might work for a drink coaster so I filled the cuts with ground brass and polished it and hope nobody looks at it too closely.

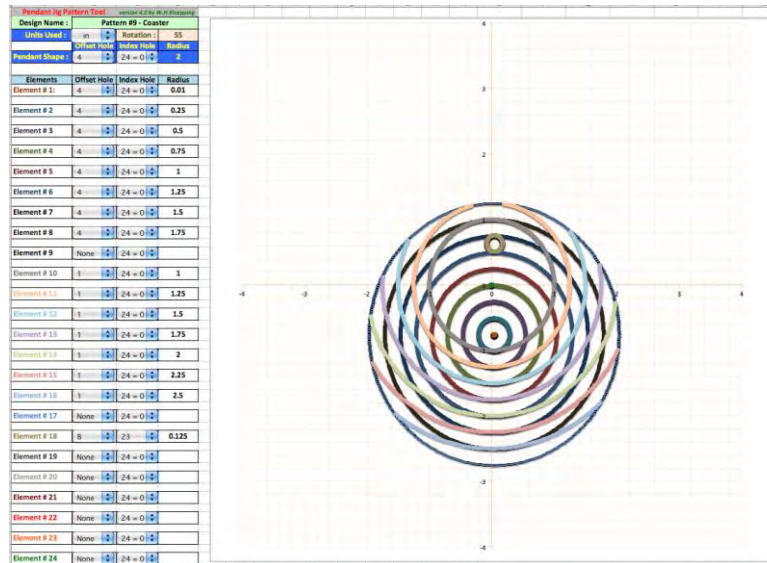


Figure 26 – Another interesting pendant design? (Pattern #9)

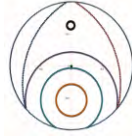



Figure 27 – A poorly turned and far too busy pendant (Pattern #9)


As you can see, using the Pendant Jig Pattern Tool can help you explore many possible designs that can be created using the Richard Joyner Pendant Jig without wasting a lot of wood.

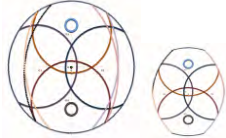
APPENDIX

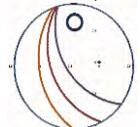
The following lists the pendant jig settings used for each of the pendants shown in the article, along with a picture of the design and some notes about the setup and/or turning the design (e.g., which cuts are through holes vs. through cuts, etc.).


Design Name	Pattern #1			
Units Used	Inches	Rotation	45	
	Offset Hole	Index Hole	Radius	Notes
Pendant Shape	1	24	1	2" Diameter
Element # 1	7	15	0.25	
Element # 2	7	15	0.5	
Element # 3	7	15	0.75	
Element # 5	4	20	1.5	
Element # 7	4	5	1.5	
Element # 9	8	24	0.0625	1/16" Through Hole


Design Name	Pattern #2			
Units Used	Inches	Rotation	202	
	Offset Hole	Index Hole	Radius	Notes
Pendant Shape	1	24	1	2" Diameter
Element # 1	6	24	0.5	
Element # 2	6	24	1	
Element # 4	6	16	0.5	
Element # 5	6	16	1	
Element # 7	6	8	0.5	
Element # 8	6	8	1	
Element # 10	4	2	0.125	1/8" Through Hole


Design Name	Pattern #3 – Triangle Note: resultant pendant is triangular – roughly 1 1/8" on each side			
Units Used	Inches	Rotation	22	
	Offset Hole	Index Hole	Radius	Notes
Pendant Shape	1	24	1	2" Diameter
Element # 1	6	24	0.5	
Element # 2	6	24	1	Through cut - edge
Element # 4	6	16	0.5	
Element # 5	6	16	1	Through cut - edge
Element # 7	6	8	0.5	
Element # 8	6	8	1	Through cut - edge
Element # 10	6	8	0.0625	1/16" Through Hole

Design Name	Pattern #4 and #5 – Chainlink Design Note: resultant pendant is 'oval' shaped – roughly 2" long x 1 1/2" wide			
Units Used	Inches	Rotation	44	
	Offset Hole	Index Hole	Radius	Notes
Pendant Shape	1	24	1	2" Diameter
Element # 1	7	3	0.625	
Element # 3	7	9	0.625	
Element # 5	7	15	0.625	
Element # 7	7	21	0.625	
Element # 9	4	6	1.5	Through cut - edge
Element # 11	4	7	1.5	Through cut - edge
Element # 13	4	18	1.5	Through cut - edge
Element # 15	4	19	1.5	Through cut - edge
Element # 17	8	24	0.09375	3/32" Through Hole
Element # 19	8	12	0.09375	3/32" Through Hole

Design Name	Pattern #6 Note: Uses Offset Hole 3 (not the center hole) for the pendant outline!			
Units Used	Inches	Rotation	10	
	Offset Hole	Index Hole	Radius	Notes
Pendant Shape	3	24	1	2" Diameter
Element # 1	2	18	1.4	
Element # 3	4	12	1.25	
Element # 5	6	5	1.3	
Element # 7	4	17	0.125	1/8" Through Hole

Design Name	Pattern #7 – Lattice Offset: 1=Front, 4=Back Note: Front and Back side cuts go a bit more than 1/2 way through the piece			
Units Used	Inches	Rotation	52	
	Offset Hole	Index Hole	Radius	Notes
Pendant Shape	1	24	1.5	3" Diameter
Element # 1	1	12	0.25	Front side cut
Element # 2	1	12	0.5	Front side cut
Element # 3	1	12	0.75	Front side cut
Element # 4	1	12	1	Front side cut
Element # 5	1	12	1.25	Front side cut
Element # 7	4	24	0.25	Back side cut
Element # 8	4	24	0.5	Back side cut
Element # 9	4	24	0.75	Back side cut
Element # 10	4	24	1	Back side cut
Element # 11	4	24	1.25	Back side cut
Element # 12	4	24	1.5	Back side cut
Element # 13	4	24	1.75	Back side cut
Element # 14	4	24	2	Back side cut

Design Name	Pattern #8			
Units Used	Inches	Rotation	52	
	Offset Hole	Index Hole	Radius	Notes
Pendant Shape	1	24	1	2" Diameter
Element # 1	1	24	0.5	
Element # 3	6	24	0.5	
Element # 4	6	24	1	
Element # 6	6	18	0.5	
Element # 7	6	18	1	
Element # 9	6	12	0.5	
Element # 10	6	12	1	
Element # 12	6	6	0.5	
Element # 13	6	6	1	
Element # 15	4	12	0.125	1/8" Through Hole

Design Name	Pattern #9 (the far-too-busy coaster...) Note: Uses Offset Hole 4 (not the center hole) for the pendant outline!			
Units Used	Inches	Rotation	45	
	Offset Hole	Index Hole	Radius	Notes
Pendant Shape	4	24	2	4" Diameter
Element # 1	4	24	0.01	
Element # 2	4	24	0.25	
Element # 3	4	24	0.5	
Element # 4	4	24	0.75	
Element # 5	4	24	1	
Element # 6	4	24	1.25	
Element # 7	4	24	1.5	
Element # 8	4	24	1.75	
Element # 10	1	24	1	
Element # 11	1	24	1.25	
Element # 12	1	24	1.5	
Element # 13	1	24	1.75	
Element # 14	1	24	2	
Element # 15	1	24	2.25	
Element # 16	1	24	2.5	
Element # 18	8	23	0.125	1/8" Through Hole