Woodturner PRO, LLC

Sweetheart Clock

Lloyd Johnson, artist

Special points of interest:

- Cutting thin strips safely AND with consistent results

- Design considerations to improve results

- Registration system to speed sawing and obtain consistent results

- Clamping Channel

Inside this project:

About this project

This project was designed to introduce you to the unlimited design possibilities available by applying your woodworking skills to laminated boards. We could have started with a simple chevron pattern. We could have even gone one step further to a 2nd generation design.

But why not go all the way—a 3rd generation board, cut into radial segments to make a Sweetheart Clock. You'll find that it is far easier than you'd expect.

With this project, you'll challenge yourself, learn new skills and you'll make a treasured keepsake for you or a friend.

Project Sponsor: INCRA Precision Tools

The decorative lamination technique described in this project features a table saw jig made with Incra's New Build-It System Starter Kit. With the Build-It System's easy to connect modular components you can assemble any common or specialty jig in minutes with only a screwdriver.

INCRA Build-It System

The INCRA Build-It Modular Jig & Fixture Platform System is a highly versatile NEW method for quickly and easily creating an extremely wide variety of common and special purpose jigs, fixtures and those one-of-a-kind work helpers that you typically find hanging on the walls and rafters in just about any woodshop.

The Sweetheart Clock project can be built entirely with a planer or drum sander, a table saw and a sled made with the Build-It Starter Kit. For more information on the Build-It System, visit www.incra.com.

Safety

This project relies on a table saw for virtually all of the necessary sawing operations. For every cut, hold-down clamps have been used to secure both the board being cut and the cutoff. There is never a reason for your hands to be near the saw blade. PLEASE follow these safety tips:

- Read all warning labels and the owner's manual before operating the saw.
- When the saw is not in operation, it is a good habit to lower the blade below the table.
- Be sure the power is disconnected when performing maintenance or changing blades on the saw.
- Wear eye and ear protection.
- Adjust the fence so that it is perfectly parallel with the blade. If it is not parallel, the workpiece can easily become pinched between the blade and the fence, inducing violent kickback and causing injury.
- Always push the material past the saw, using a device that puts downward pressure on the stock. A standard push-stick puts pressure only at the trailing edge which MAY NOT prevent kickback.
- NEVER operate the table saw without a factory installed anti-kickback device or riving knife.
- Use hold-down devices, feather boards and clamps whenever possible.

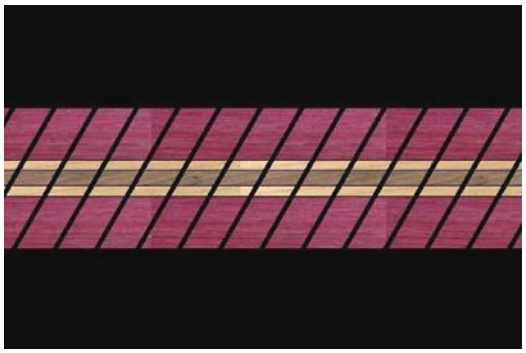
Let's Get Started!

This project was designed using Lamination PRO, a software program that lets you simulate the process of building a laminated board with up to 7 strips of wood. The software then allows you to cut that board into strips and reassemble them, flipping alternate strips either left-to-right, top-to-bottom, or both, which creates a 1st generation board with a 'chevron' pattern. You can then repeat this process two more times giving 2nd or 3rd generation designs. Finally, you can cut these boards into any number of radial segments to form a disc.

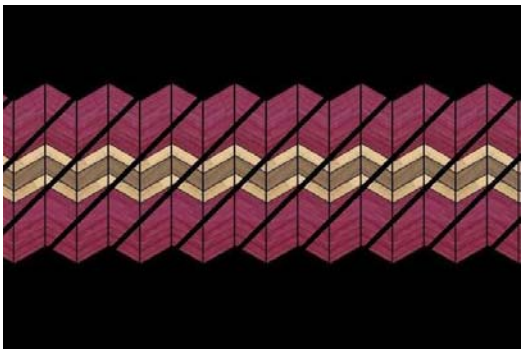
For more information about Lamination PRO and our other software products, visit www.woodturnerpro.com.

In Lamination PRO, the Laminate Wizard is used to create a board containing 5 strips of wood. The board is made in a symmetric pattern as follows:
1-1/4" Purpleheart
1/4" Maple
3/8" Walnut
1/4" Maple
1-1/4" Purpleheart

The laminated board is cut into 3/4" wide strips at 30° (Photo 1). Reassemble the board, flipping alternate strips left-to-right (Photo 2).



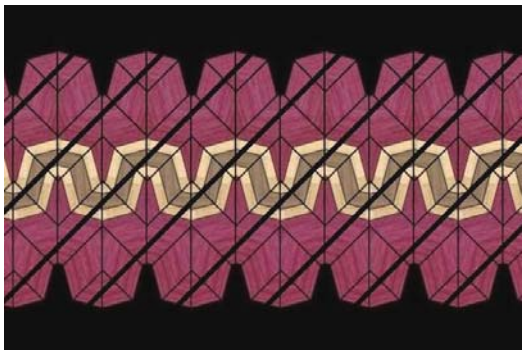
1. The laminated board is cut into 3/4" strips at 30°.



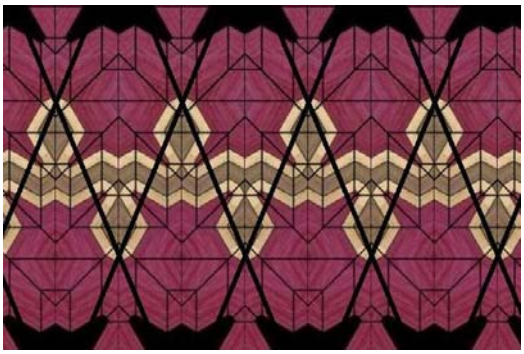
2. The 1st generation board is cut through the declining patterns at 45°.

That board is cut into strips at 45° through the declining patterns (more on this later) and made into a 2nd generation board (Photo 3).

That board is cut into strips at 45°through the inclining patterns giving a 3rd generation board (Photo 4).



3. The 2nd generation board is cut through the inclining patterns at 45°.



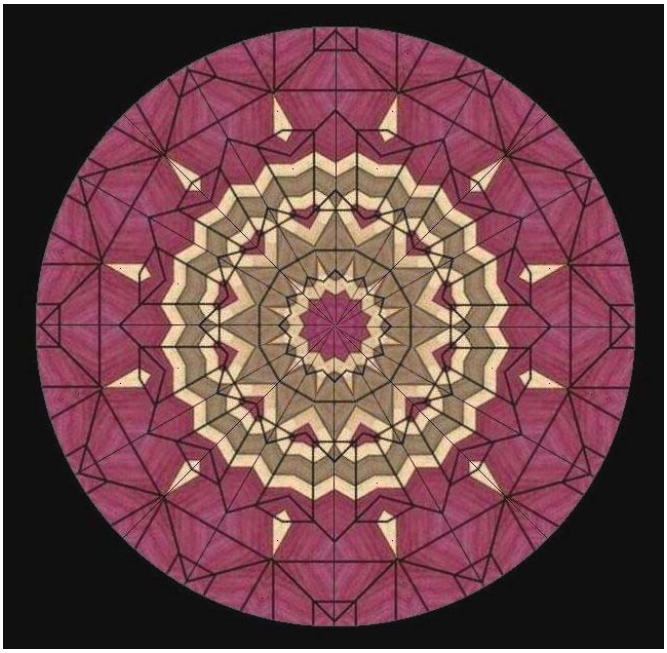
4. The 3rd generation board is cut into radial segments at 15°.

Finally, the 3rd generation board is cut into 12 radial segments and assembled into the Sweetheart Clock (Photo 5).

Now before you say, "That guy's got way too much time on his hands," let me show you how easy it is to make this project. You need a minimum of tools—either a planer or drum sander, a table saw and a table saw sled such as the INCRA Build-It System Starter Kit .

You might choose to mount the clockface in a segmented, turned frame which requires a lathe, but you could also use your table saw to make a 12-sided frame.

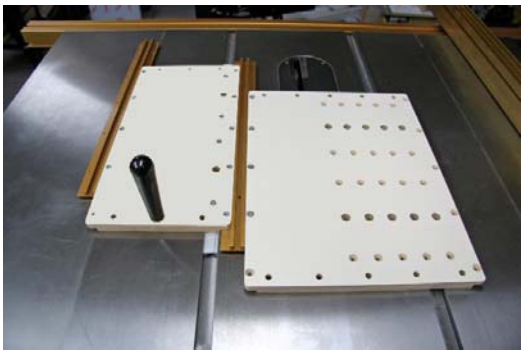
You don't even need the software as all the details are included in this project. A trial version is available, though, so that you can see the amazing designs you can create from a single laminated board.



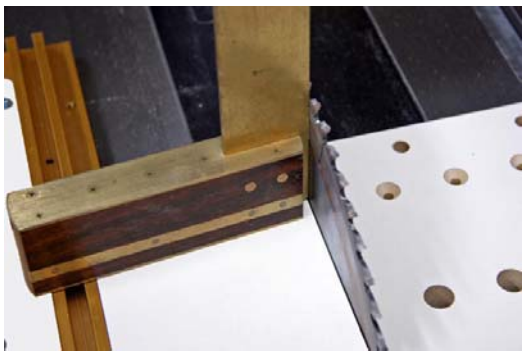
5. The intended result as calculated by Lamination PRO.

6. The INCRA TS-LS Table Saw Fence is the safest and most accurate way of cutting thin strips.

7. Sand common strips on edge for consistent thicknesses.



8. This configuration allows fences angled at up to 70°. I've added a handle for safety purposes.



9. The saw blade must be exactly 90° to the table if the laminated pattern is to be accurate.

Stock Preparation

In creating the laminated board, great care must be taken to make the individual strips of wood consistent in width. This is always important if the alternate pieces are to be flipped left-to-right and mandatory if they are to be flopped top-to-bottom.

As a safety measure, never cut strips that are less than 3/8" in width between the blade and the table saw fence. Rather, cut thin strips as cut-offs from boards that are 3" or wider. You can build or buy jigs made for this purpose that work reasonably well. The best results are achieved by using the TS-LS Table Saw Fence made by INCRA (Photo 6) which automatically indexes the fence in 1/32" increments when engaged. When the fence is zero-indexed to the saw blade, you simply use the move the fence toward the blade by the thickness of the saw blade and the desired strip width. The perfectly-dimensioned strip will fall safely away from the blade.

For the greatest accuracy, sand common strips using a drum sander or planer—tools that are indispensible for working with laminations (Photo 7).

INCRA Build-It System Layout

To demonstrate the great versatility of the Build-It System, I have chosen to configure the sled so that the boards to be cut will be clamped to the left of the blade. This allows me to use longer boards without interference with the table saw's fence. One thing to note with this configuration—the slope of the saw kerfs shown by Lamination PRO will be reversed from the actual slope resulting from this configuration.

An off-the-shelf handle was added to the sled for safety and convenience reasons.

By offsetting the large and small panels and the T-Slot panel connectors (Photo 8), fences can be added that will allow cuts to be made at angles between 0°and 70° without reconfiguring the sled.

The Build-It System sled should bridged from the left to the right side of the blade so do not cut through the entire length of the large panel.

Once the Build-It sled is constructed, saw into the sled, raise the blade as high as possible and use an accurate square to make sure the saw blade is 90° to the surface of the sled (Photo 9).

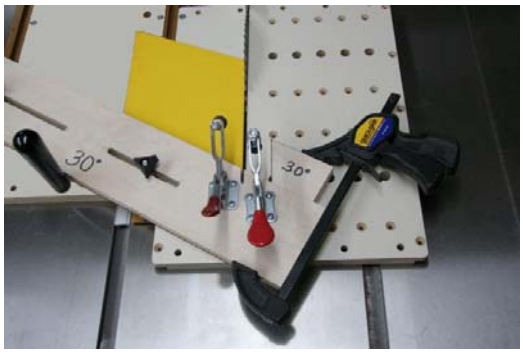
Cutting Laminated Boards

According to Lamination PRO, 80 lineal inches of the laminated board is needed to construct one Sweetheart Clock Face. Start with 1" thick stock so that resawing as a final step will yield two 3/8" clock faces. Resawing is a great way to double the output without doubling the effort. Since it is easier to work with smaller boards, start with two 40" laminated boards.

If this is your first attempt at working with laminations, you may wish to increase this amount somewhat to allow for experimenting and trial and error adjustments.

The laminated board is be cut at 30°. Make a dedicated fence for this cut and use a protractor or angle guide to set the fence accurately (Photo 10). Add hold-down clamps to secure the board on the left side of the blade and the cutoff to the right of the blade. Finally, clamp a stop to the fence so that the sawn strips will be 3/4" wide.

The laminated boards are now cut into strips (Photo 11).



10. Mark one edge of the board and always keep that edge against the fence to increase accuracy.

11. A dedicated 30° fence is aligned with a commercial angle guide (in yellow).

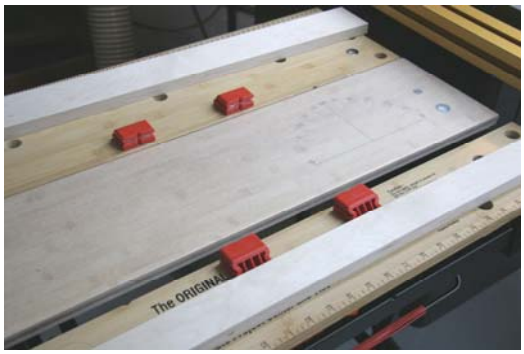
Gluing and Clamping

When gluing lots of strips simultaneously, there is a tendency for the strips to slip when being clamped. This slippage can be controlled by forming a channel that is exactly the length of the strips and then clamping the strips from the ends. The Black and Decker Workmate 425 portable clamping station is a great solution for this purpose. By removing the center board and wrapping it with waxed paper, the laminations will not stick to the table (Photo 12).

Prior to assembling the strips for gluing, I used a chop saw to cut off one of the ends of each strip. This optional step can improve the accuracy of aligning the strips using the clamping channel, but it will reduce the outside diameter of the finished clock.

For gluing, coat each of the surfaces to be mated. It is best to keep the strips from touching until glue has been applied to each strip. This lets the strips slide into position during the clamping process.

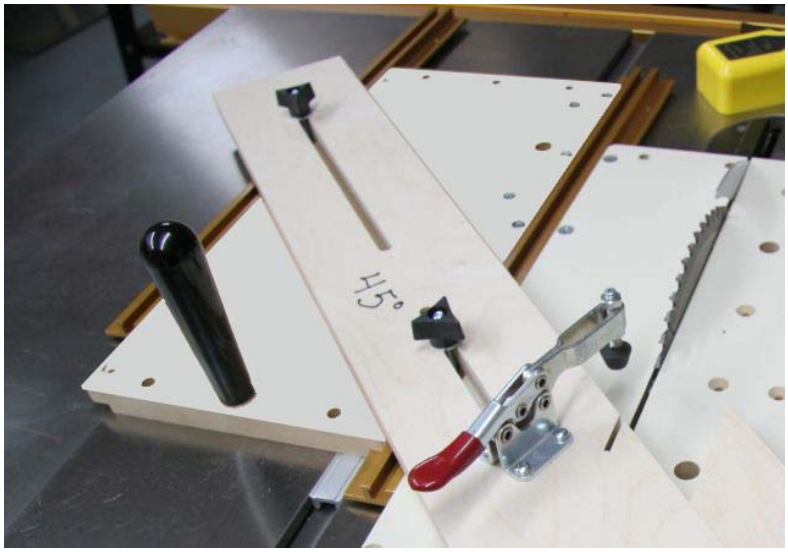
Work with about 20 strips at a time to complete the clamping before the glue sets. Do not over-clamp as bowing may occur (Photo 13).



12. A Workmate 425 can form a channel that will align the strips.

13. Tighten the clamps, alternating between the channel clamp and the end clamp.

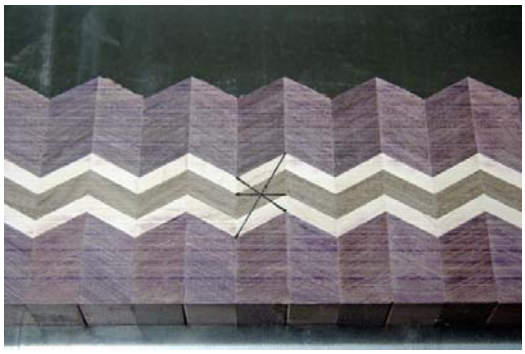
2nd & 3rd Generations



14. The 45° fence is now installed. Another hold-down clamp to secure the cutoff is all that is needed to complete this setup. The magnetic device (yellow) prevents the sled from being pushed further into the blade than required.

A dedicated fence for cutting the 2nd and 3rd generation boards at 45° is now added to the sled. A hold-down clamp is installed to the left of the blade and a second will be installed to the right of the blade before use. The yellow magnetic feather board has been placed on the table that stops the forward progress of the sled (Photo 14).

Since alternate strips are flipped left-to-right, a single repeating unit always has two strips, where one strip has a pattern that is inclining and the other declining. According to the Lamination PRO plan, cutting the first generation board must be done through the strips with the 'declining' patterns. The configuration of the Build-It System has the board reversed from the images created by Lamination PRO so it is important to fully understand the concept of 'declining' and 'inclining' strips. A cut through a declining strip means the cut is mostly perpendicular where it crosses the pattern. A cut through a strip with an inclining pattern means that the cut is mostly parallel to the pattern.



15. The center of the declining pattern is easy to find by drawing multiple lines between similar points.

To locate the position of the next saw cut, select any strip with a declining pattern relative to the cut and mark the exact center of the pattern as shown (Photo 15).

With a combination square, draw a 45° line through the center mark that extends to both edges of the board (Photo 16). Now put this marked board on the sled and slide it against the fence until the line is in the center of the saw kerf in the sled. As you can see, the line drawn is nearly perpendicular to where it crosses the pattern, indicating that it is cutting through a declining pattern (Photo 17).

Clamp the board in this location but do not cut at this time.

16. Use a combination square to draw a line showing where the next cut is to be made.

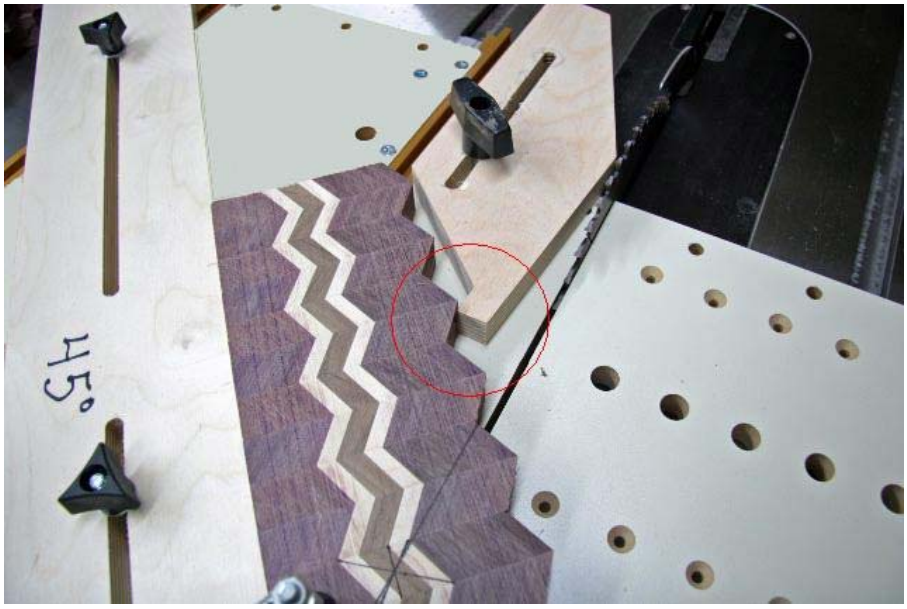
17. The board has been positioned so that the line is centered in the saw kerf of the sled.

Registration System for Repeatable Cuts

Cutting the laminated board into strips is easy because you simply set a stop and cut the boards into identical strips. You cannot set a stop for cutting generation boards, though. If your stop is just 1/32" off for the first cut, it will be 2/32" off for the next cut which continues to magnify the error throughout the cutting of the board. Instead, you must find the correct center spot and make all cuts relative to that spot.

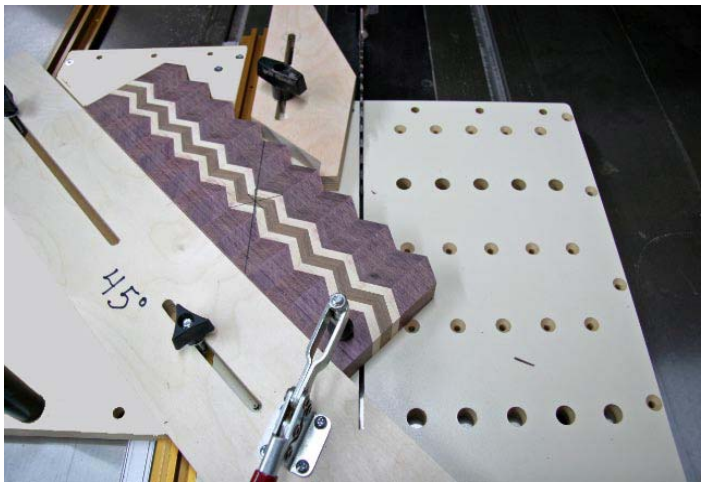
The angled 'ears' can be used for this purpose. A registration block in contact with the ears can make every cut repeatable and accurate.

Photo 18 shows a stop block that is added to the sled for registration. With the board in the correct place for cutting, position the block so that it is placed firmly against an ear. By lifting the board and repositioning it so that the block is touching any ear, the saw cut will always be in the same relative position to the point you marked earlier. In Photo 19, the board is repositioned so that the first cut of the board can be made.



18. Move the registration block so that it is in firm contact with the ear that is as close as possible to the blade. This provides the point of registration that will be used to reposition the board for repeatable cuts.

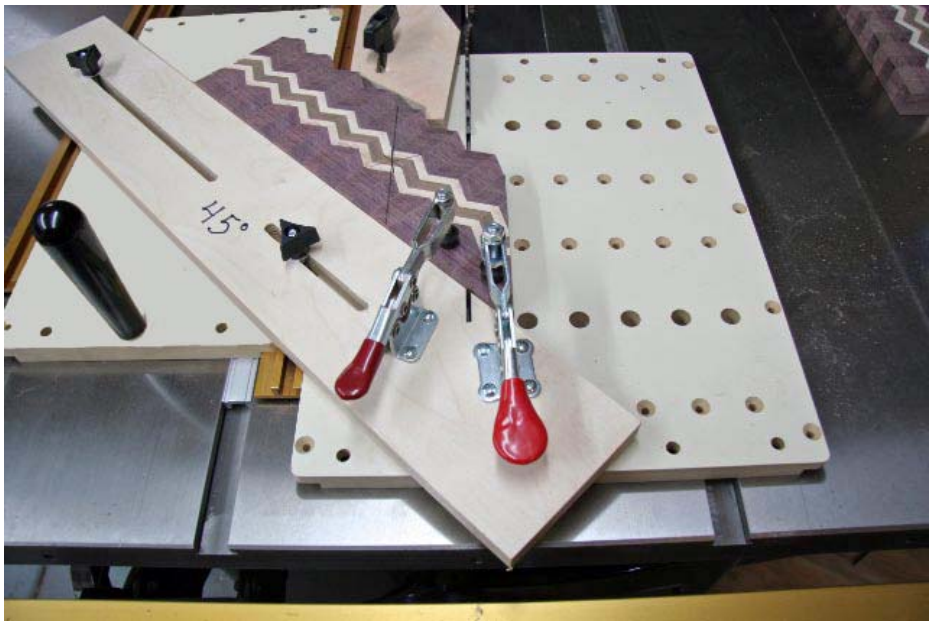
Make the first cut at this location and use the cutoff to see if the resulting pattern is symmetric (Photo 20). If it is necessary to reposition the registration stop block, do so carefully and then clamp it down securely. Any movement of the stop block during the cutting process will make the pattern non-symmetric.



19. Lift the board and reposition it so that the first cut can be made. Save this cutoff for use in the next step.

20. Use the cutoff to check the pattern it makes. If the pattern is not symmetric, make minor changes to the registration point.

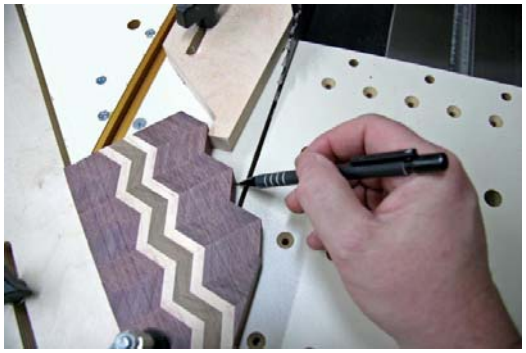
The hold-down clamp to the right of the blade is used for safety and to make sure that the cutoff strip is cut cleanly and completely. The clamp must be positioned so that it is close to the saw blade but has no possibility of coming in contact with it even when partially open. The board is now cut into identical strips with the aid of the registration stop block (Photo 21).



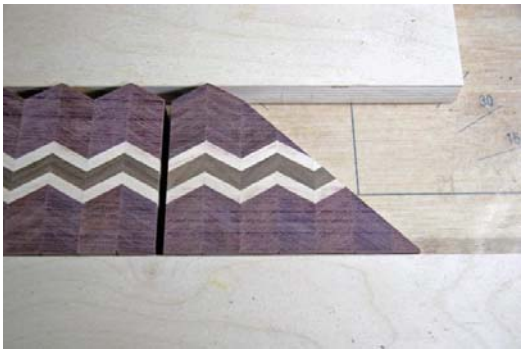
21. Cut the board into strips for the next generation.

When the last ear has been reached, use a pencil to draw around the ears to the left and right of the saw kerf (Photo 22). This will let you manually position the board to make the final cuts. There is a slight possibility of inaccuracy with this manual location process, so make sure the cutoff strips are identical in width to the ones cut with the registration block.

To eliminate waste, take the remainder of the board just cut and glue it to the front of the next board (Photo 23).



22. When the last ear is at the registration point, draw a profile of the ears for manual positioning.

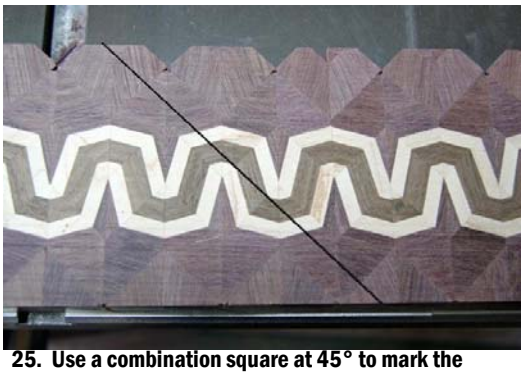


23. Glue the remainder of the board just cut to the front of the next board to be cut to eliminate waste.

Continue cutting all the 1st generation boards and then use the clamping channel as before to glue the strips together into a 2nd generation pattern (Photo 24).

Use a combination square at 45° to draw a line where the saw cut will be. According to Lamination PRO, this cut needs to be through the inclining pattern. As you can see from Photo 25, this line has been drawn mostly parallel to the pattern indicating it is through an inclining pattern.

24. Use the channel clamp to align the patterns before clamping from the ends of the board.

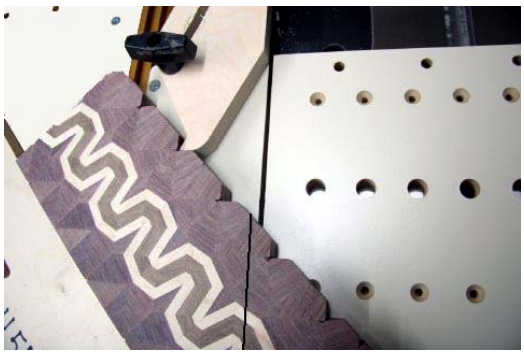


25. Use a combination square at 45° to mark the intended path of the next saw cut.

Place the board on the sled in a position that has the line just drawn centered over the saw kerf in the Build-It sled. The registration stop block securely placed against an ear and the board can now be cut into strips (Photo 26).

Repeat the clamping and gluing process, flipping alternate strips left-to-right resulting in a 3rd generation board. As you can see from the pictures, the channel vise system has allowed me to create a 3rd generation board with very fine results.

So far, the entire process has been very easy. The next step is where mistakes are often made.



26. Position the board as before and firmly set the registration block.

Cutting Radial Segments

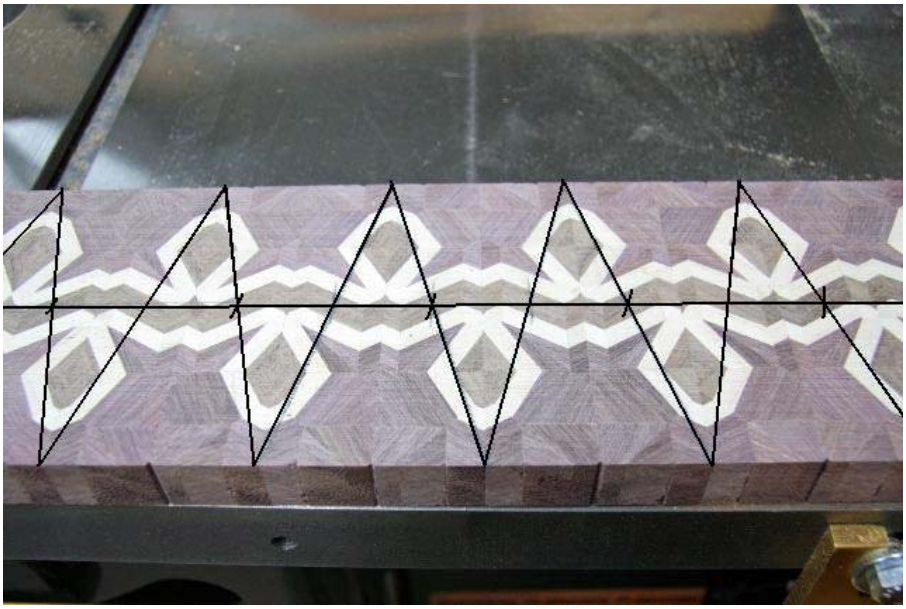
In order to cut the 3rd generation board into radial segments, it should first be trimmed on the top and bottom so that it is perfectly symmetric. Once that has been done, the absolute center of each individual strip must be marked.

The first step is to draw a line the length of the board through its dead center. An INCRA 6" T-Rule that makes the task simple (Photo 27). Cross this line at the center of each strip and draw a line angled at 15° through each of these centers, alternating the direction of the slope. This marking is done on both sides of the board (Photo 28).

27. An INCRA 6" T-Rule is a great way to mark the centerline of the board.

A miter saw is a good tool for making these cuts because it is easy to see that the saw blade will cut through the center mark. With effort, this could also be done on the table saw.

Place the marked board on the fence of the saw with the blade angled at 15° as defined by Lamination PRO to create a 12 sided disc. Position the board so that the cut will be made directly through the right-most mark. Make the first cut and then flip the board edge-for-edge and made the next cut. Repeat this process until 12 radial segments have been cut.



28. Mark the center of each strip and then draw a line through these marks at 15°. Repeat this process on the reverse side of the board as it will be flipped after each cut.

Glue the radial segments together into pairs and clamp them with rubber bands (Photo 29). When dry, glue the three pairs together to make half-discs. Square the bases of the half-discs using a 12" disc sander. The two half-discs can make one thick clock or two thin clocks if resawn.

With a well-tuned bandsaw, resaw each of the half-discs and then glue them together to make two 12-sided discs that are each 3/8" thick (Photo 30). A rubber band clamp is used to glue these halves together to make a completed clock face.

29. The radial segments are first glued into pairs and then the pairs are glued together to make the half-discs.

30. Make test cuts on scrap wood to make sure that the blade position is correct and that the blade does not wander.

Mounting the Sweetheart Clock

The options of mounting the clock face are endless and I'll leave that design up to you. For these Valentine's Day gifts to my daughters, I chose to inset the clocks into a segmented frame. I used our software called Woodturner PRO to design and size the segmented frame which was built from two 12-sided, 3/4" thick segmented rings with an outside diameter of 10-1/2" and an inside diameter of 7"

I used cole jaws to secure them to the lathe for the turning process. This design left about 1-1/4" of space between the back of the clock face and the wall. The clock movement I used is 1" thick and it has an integrated mounting bracket.

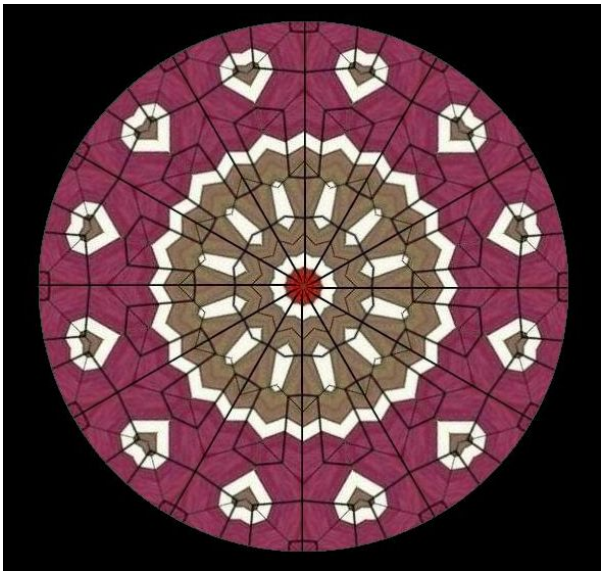
The clock uses a standard-sized movement which fits clocks with dials up to 3/8" thick and 3-3/4" brass hands.

Variations and Closing Thoughts

I'm sure many of you have been reluctant to work with laminations because the process appeared to be complicated. Hopefully, this project shows that there is nothing difficult nor overly time consuming about making a 3rd generation pattern and cutting it into radial segments.

If you wish to increase the finished size of this clock, it is as simple as increasing the thicknesses of the laminated strips and changing the size of the initial strips from 3/4" to something larger. You'll most likely want to use the trial version of Lamination PRO so that you will know the exact dimensions of the clock it will produce and how much raw material you'll need.

To make this project simple, I cut the generations using 30°, 45° and 45°. Varying the angles by which the generations are cut yields significantly different results and I encourage you to do your own experimenting. My good friend, Dennis Daudelin of Woodturning Online, used angles of 25°, 50° and 45° to get this version of a Sweetheart Clock Face (Photo 31).



31. By simply altering the angles at which the generations are cut, you can create countless variations on the Sweetheart Clock.

Many thanks to Perry McDaniel and INCRA Precision Tools for their generous sponsorship of this project. You can fabricate your own sled for this project, but in less than 10 minutes, you can have a modular system that can be configured as shown in this project or in dozens of different configurations for either temporary or permanent purposes. To learn more about INCRA products, please visit their website at www.incra.com.

I hope you make your own Sweetheart Clock and if you do, I'd love to see a picture of it. You can send it or any questions or comments you might have about this project to lloyd@woodturnerpro.com.

Thanks, and please work safely.
Lloyd Johnson

About the Artist and Woodturner PRO

Lloyd Johnson, a founder and executive for software companies, has been a hobbyist wood worker for over 30 years. Segmented vessels got him interested in woodturning in 2000 and he has been an avid woodturner ever since. Lloyd is active in several woodturning and woodworking clubs in his home town of Portland, Oregon and has toured the country conducting training sessions, demonstrations and workshops.

In 2001, when it was evident that there was little or no software available to assist woodturners in the design of segmented vessels, with his long-time business partner, Tom Denny, he formed Woodturner PRO, LLC, to create software for that purpose. So far, this has resulted in three pieces of software: 3D Design PRO, a simple program that lets you create wall profiles in two dimensions and then see what it will look like in three dimensions; Woodturner PRO, a program that lets you construct segmented vessels from such ring types as flat, compound, stave, veneer and solid discs, and Lamination PRO, the software used to create the Sweetheart Clock project.

The software has been critically acclaimed and is currently being used in over 60 countries around the world.

Lloyd and Tom are committed to writing useful and easy-to-use software at inexpensive prices. In fact, the entire suite of software is only $99.

We invite you to visit our site at www.woodturnerpro.com and download the trial versions of all three software titles. Also, if you belong to a club that would like a workshop or a guest speaker to discuss technology in woodworking and woodturning, let us know about that as well.

Greetings Woodworkers!

Thanks to a sponsorship from INCRA Precision Tools, we are pleased to give you this complete project for building this Sweetheart Clock. From its appearance you might think it is either too difficult or too time consuming to attempt, but after you read through the instructions, I hope you'll change your mind. The entire project is built with a minimum of tools—a planer or drum sander, a lathe (if you intend to mount the clock in a turned frame), a table saw and a sled such as one you can build with the Build-It System Starter Kit from INCRA.

I hope you enjoy the project and I have just two requests—email me a photo of your finished clock and most importantly, WORK SAFELY!

Best regards,
Lloyd Johnson
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