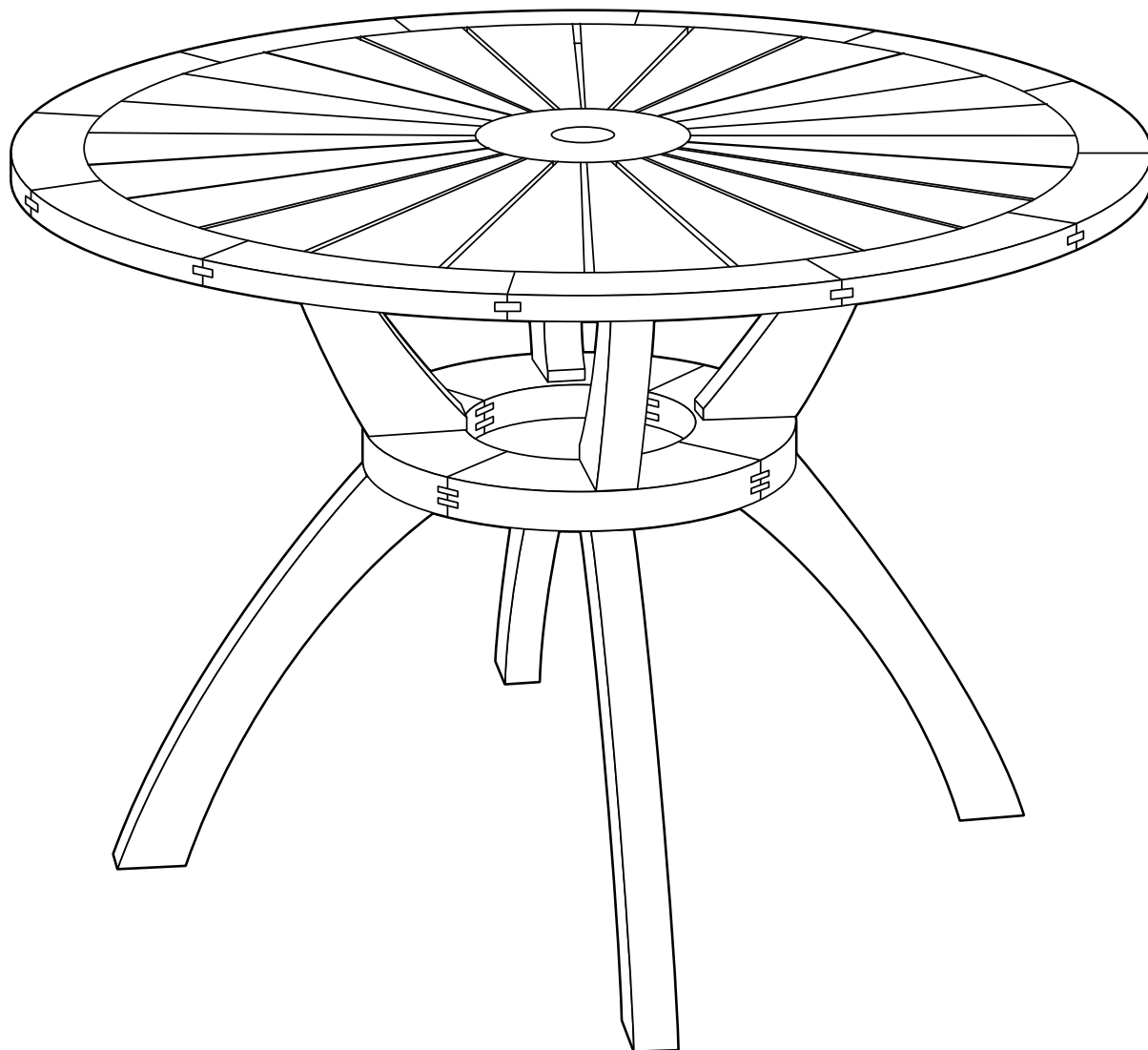




**WOODWORKS: ADVANCED PROJECT 2009-2010**  
**PATIO TABLE**



Tired of outdoor tables made of metal or plastic? This table has the richness and warmth that only wood can provide. Perfect for a patio, porch or sunroom, the 44" top features a stunning sunburst radial design and seats four comfortably. The sturdy base construction makes for a rock-solid table, and there's a center hole for an umbrella canopy and plenty of room beneath for the counterweight.

Advanced and intermediate woodworkers will enjoy the challenge of solving this table's complex construction, from the segmented top down to the curved legs. You'll create a pattern board for the top that doubles as a machining and clamping jig. Paired with a simple trammel, you'll be able to accurately machine the fussy curved joints on the pie-shaped slats and cut the outer ring and the center hub. Those and other jigs and techniques will make this a truly satisfying project. And after you build it, you'll learn more about applying and using finishes to protect the wood and keep it looking beautiful.

## TOOLS REQUIRED

### Hand Tools

- Sanding block

### Power Tools

- Table saw
- Router
- Shaper or table-mounted router
- Drill press
- Jig saw
- Power drill with drill bits, Phillips-head screwdriver bit, and 1/4" socket driver
- Hole saw
- Orbital or finish sander
- Drum sander
- Belt sander
- Band saw

### Miscellaneous

- Pencil
- Tape measure
- Safety glasses
- 120-grit sanding belt
- 120-, 150- and 220-grit sandpaper
- Clean, lint-free cloths
- Respirator
- Gloves for finishing
- Mineral spirits, for oil-based waterproofer
- Good quality, natural-bristle brush (for oil-based waterproofer) or synthetic-bristle brush (for water-based waterproofer)
- Cotton-tipped swabs
- Acetone
- Rustproof paint

## SHOPPING LIST

**Wood Recommendation:** Pine

**Alternate Wood:** Cedar

Part	Dimensions	Qty.
A, B, C	1" x 5-1/2"	5 @ 8', 1 @ 10'
E, F	1" x 7-1/2"	1 @ 3'
D, G, H, J	2" x 5-1/2"	1 @ 8', 1 @ 10'
K	1/8" x 1-1/2" x 6" steel plates	4
L	1/4" x 5" x 1"	24 from scrap
Wood screws	#10 x 2" flathead stainless steel	24
Lag bolts	1/4" x 1" stainless steel	8
Lag bolts	1/4" x 4-1/2" stainless steel	4 w/ washers

## CUTTING LIST

Overall dimensions: 29-3/4"H x 44" Dia.			
Part	Name	Qty.	Th x W x L
A	Ring Segment	12	1" x 4" x 11-15/16"
B	Top Slat	24	1" x 4-3/4" x 15-7/8"
C	Hub Segment	4	1" x 4-1/2" x 8-1/2"
D	Strut	4	1-5/8" x 1-5/8" x 18-1/2"
E	Outer Brace	4	1" x 1-5/8" x 21-7/8"
F	Inner Brace	4	1" x 1-5/8" x 5"
G	Lower Ring Segment	4	1-5/8" x 5-1/4" x 12"
H	Upper Leg	4	1-5/8" x 4" x 11-1/2"
J	Lower Leg	4	1-5/8" x 4" x 22"
K	Steel Bracket	4	1/8" x 1-1/2" x 6"
L	Spline	24	1/4" x 5" x 1"

## WOOD FINISHING PRODUCTS

### Recommended Finish

Stain/Finish: Thompson's® WaterSeal® Advanced Tinted Wood Protector Sheer Honey Gold

### Alternate Finish

Stain/Finish: Thompson's® WaterSeal® Waterproofer Plus Tinted Wood Protector Sheer Honey Gold

## BEFORE YOU BEGIN

Good craftsmanship begins and ends with good work habits, so make the following steps part of your routine workshop practice. If you have any doubts or questions about how to proceed with a project, always discuss them with your shop instructor.

- Carefully and fully review plans and instructions before putting a tool to the project lumber.
- Work sensibly and safely. Wear safety goggles when doing work that creates flying chips and sawdust; wear the appropriate respirator whenever making sawdust or working with thinners or other solvents.
- At the end of every work session, clean up your shop area and put away all portable tools.

## CUTTING AND ASSEMBLY PROCEDURE

### Make the Pattern Board

1. The best way to deal with the geometry and joinery of the tabletop is to draw it out full-size on a 4x4' piece of 3/4" MDF or other sheet stock (see Fig. 2).

### Build the Outer Ring

2. Measure the length (long point to long point) of a section of the outermost ring (A) on the pattern board. The measurement should be at or close to 11-15/16".

3. Using a sled (see Fig. 3) cut a 15° angle on one end of all the ring segments. Then add a stop block and cut all the segment pieces to final length.

4. Dry-fit the segments on the pattern board to assure all the miters are tight. You may have to adjust the angle of the last miter. If you do, mark the joint so it can be reassembled correctly.

5. After the dry-fitting, cut the slots for the spline joints into the mitered ends of each outer ring segment on a router table. Cut splines (L) to fit the slots.

6. Add backer blocks to support the inside edge of the outer ring (see Fig. 4).

7. Cut the cam locks on the drill press using a 2-1/2"-dia. hole saw with the drilling stock angled at 10° (see Fig. 5).

8. Screw the cam locks onto the pattern board so the short radius is just shy of the spacer. The sacrificial spacers keep the cam locks from being cut as the ring is routed out in the following steps (see Fig. 6).

9. Glue up the outer ring (see Fig 4).

### Rout the Outer Ring

10. Screw a 1"-thick pivot block on the center of the pattern board.

11. Make the trammel shown in Fig. 7.

12. Chuck a 1/4" upcut spiral bit in your router and attach it to the trammel. Set the bit to cut 3/16" deep. Hook the trammel on the pivot block using the 22-1/8" hole. Turn the router on and plunge the bit

into the ring. Swing the trammel slowly around (see Fig. 8). Drop the carriage another 3/16" and make a second pass. Repeat until there's about 1/4" of material at the bottom of the ring. **Important:** Don't cut all the way through the ring. You need enough material so the cam clamps can continue to hold the ring in place.

13. Hook the trammel on the pivot block using the 18-7/8" hole and cut the inside edge of the ring in the same manner as the outer edge.

14. Remove the ring from the pattern board. Use a jig saw to remove the remaining stock from the ring. Don't try to flush-cut the edges but leave a slight tab.

15. Remove the tabs with a flush trim router bit.

16. Rout a 1/4" x 1/2"-deep groove all the way around the inside edge of the ring, centered on the thickness.

### Make the Tapered Slats

17. Cut the table slats (B) to length.

18. Using the slat taper sled (see Fig. 3), cut a 15° angle on one edge of each of the slat pieces. Add the stop block to the sled and cut the opposite edge to make the slats the correct size.

19. Secure a slat on the pattern board for routing. Install a 3/4" straight bit in the router. Set the trammel on the pivot point through the 19-3/8" hole (see Fig. 9). The illustration shows the inner rabbet being cut. Swing the trammel to make the first tongue cut. Then flip the slat over and make the second cut to complete the tongue. It's best to start with a shallow depth of cut and gradually increase the depth until the tongue is a perfect fit. Check the tongue's fit in the ring's groove and make any necessary adjustments. Then rout tongues on all the slats.

20. Shape the tongue with a sander to match the arc of the shoulder.

21. Cut the rabbet for the half-lap joint on the narrow end of the slat with the trammel set in the 3-7/8" hole (see Fig. 9). Make sure the slat's good face is up for this step.

22. Dry-assemble the slats in the outer ring and measure the exact diameter of the center hub.

### Make the Center Hub

23. Cut and miter the four hub sections (C). Rout slots for splines and epoxy the hub blank together.

24. Draw a circle that matches the hub diameter. Cut the circle on the band saw and sand smooth.

25. Rabbet the underside of the hub (see Fig. 10) so the hub nestles into the recess created by the slat rabbets. Don't cut the hole in the center of the hub yet.

**Glue the Top Assembly**

26. Chamfer all the top edges of the slats, outer ring and hub with a sanding block. The chamfer creates a detail that's visually pleasing while it disguises any areas where a joint may be less than perfect.

27. Mix about 4 oz. of slow-set epoxy. Glue the slats to the outer ring first. Align the center of every other slat with a joint on the outer ring. Eyeball the gaps between slats. Be sure to wet both the slot and tongue before inserting. Scoop up any squeeze-out that is hard to get at with a cotton-tipped swab and then wipe the area with acetone.

28. Coat the rabbets on the slats and the hub with epoxy. Carefully position the hub in the rabbets. Then clamp it in position with a screw.

29. After the epoxy has thoroughly cured add the struts and braces (D, E and F) to the underside of top (see Fig. 1).

30. Use a hole saw to bore a 2-1/4" hole through the center of the hub.

**Build the Lower Ring**

31. Make a hardboard pattern of a lower ring segment (G, see Fig. 11). Use the pattern to trace four pieces onto the stock.

32. Cut the miters on a miter saw and band saw the curves. Place the four sections together and check the fit.

33. Rout a pair of 1/4" x 1-1/2" -deep slots into each miter. Epoxy the ring together with splines (L).

34. Once the epoxy has set, sand the inside of the ring with a sanding drum and the outer edge with a belt sander. Label the top and bottom of the ring.

35. Lay out the leg positions on the ring and drill holes for dowels and screws on the drill press.

**Assemble the Base**

36. Make patterns for the upper (H) and lower (J) legs (see Fig.11). Rough-cut the legs with your band saw then attach a pattern and rout with a pattern bit.

37. Clamp a pair of hand screws on the lower ring along the leg layout lines. Slip an upper leg snugly between the hand screws. Use a 1/8" bit to drill a pilot hole into the upper leg, using the 5/32" hole in the ring as a guide.

38. Lock the leg in place with a #8 x 3" screw.

39. Drill two 1/2"-dia. x 1"-deep dowel holes into the upper leg (see Fig. 1).

40. Remove the upper leg but keep the hand screws in place. Insert the lower leg, secure with a screw and drill the dowel holes. Repeat the process for each set of legs.

41. Cut your dowels 1/8" shy of the total depth of the hole. Sand a slight flat on one edge to give the excess epoxy an escape route.

**Woodworker's Tip:** If your dowel stock is a little tight, try spinning the dowel in a drill as you sand lightly with 80-grit sandpaper to reduce the diameter.

42. Dry fit a lower leg on the ring with dowels.

43. Drill a 1/4" pilot hole all the way through the ring and the lower leg for the lag bolt (see Fig. 1).

44. Remove the lower leg and repeat the process for the upper leg using a 3/16" bit. Do not drill all the way through!

45. Use a Forstner bit to drill a 3/4"-dia. counter bore in the lower leg that's deep enough to hide the lag screw head and washer.

46. Mix the epoxy and fasten one pair of lower and upper legs to the ring. Be sure to wet each hole and dowel. Drive a lag screw from the lower leg through the ring and into the upper leg until it draws tight. Repeat for all the legs and let the epoxy fully cure.

**Final Assembly**

47. Cut tabletop fastener plates (K) from 1/8"-thick steel. Prime plates with a rustproof paint.

48. Attach the fastener plates to the tops of the upper legs, then flip the leg assembly upside down and drill pilot holes for the lag bolts. Attach the top with lag bolts and washers.

49. Mount the tabletop to the base.

**PROTECTING YOUR PROJECT**

Any type of wood that's used outdoors needs protection from water damage. There are a variety of protective coatings available, including clear and tinted wood protectors and semi-transparent and solid stains. Each of these finishes has a different look and maintenance requirement.

To provide complete protection for your project, use Thompson's® WaterSeal® Advanced Tinted Wood Protector or Thompson's® WaterSeal® Waterproof Plus Tinted Wood Protector. Both products not only prevent water damage, but also resist damage from mildew and ultraviolet radiation in sunlight (UV), and they exceed industry standards for waterproofing on wood. Plus, the transparent tint will give plain pine just the right amount of rich wood-tone. These products are available in four beautiful sheer wood-tones.

**Woodworker's Tip:** Always be sure to choose a waterproofer that claims to exceed industry standards for waterproofing on wood.

### FINISHING TIPS

- Coverage: The approximate coverage of Thompson's® WaterSeal® Advanced Tinted Wood Protector and Thompson's® WaterSeal® Waterproofer Plus Tinted Wood Protector on pine is 200 square feet per gallon.
- When you apply Thompson's® WaterSeal® Advanced Tinted Wood Protector or Thompson's® WaterSeal® Waterproofer Plus Clear or Tinted Wood Protector, do not mix it with other waterproofing products, because variations in the final appearance of the surface being treated may result. Also, do not thin these products.

### Recommended Finish

For the best protection against sun and water damage, use Thompson's® WaterSeal® Advanced Tinted Wood Protector (also available in Natural).

**50.** Before applying Thompson's® WaterSeal® Advanced Tinted Wood Protector, the wood surface must be free of all dirt, wood dust and contaminants. This product can be applied to damp, freshly cleaned wood. If the wood needs cleaning, use Thompson's® WaterSeal® Deck Cleaner & Brightener or Thompson's® WaterSeal® Deck Wash. Read and follow the directions found on the back of the can. After the cleaning is done, read and follow the directions found on the back of the can of the Tinted Wood Protector. Then do a trial test before full application. The surface may darken slightly with application and color appearance is different when the wood is fully dry.

**51.** To ensure good penetration, do not apply this product in direct sunlight or on hot days. Do not apply if rain is expected within 48 hours. Also, temperature must be above 50° F. and below 95° F. and remain above freezing for 24 hours.

**52.** Shake or stir contents for a minimum of 2 minutes before use. Intermix all containers (of the same color) to be used to assure color uniformity.

**53.** Apply using a paint pad or brush. Do not apply using a roller. For small projects, a brush is the preferred applicator.

**54.** Apply only one thin, even coat. **DO NOT APPLY A SECOND COAT.** A heavier or additional coat will not improve performance or appearance. Avoid puddling. Tackiness will result if overapplied. Tackiness may also occur after application if overnight temperature falls below 50°F. within 48 hours of application. Drying time will vary depending on wood surface and humidity. Allow a minimum of 12 hours before using the table.

**55.** Brushes and equipment used for water-based products must be cleaned with soap and water; brushes used for oil-based finishes must be cleaned with mineral spirits. Dry product can be removed with mineral spirits.

### Alternate Finish

**56.** Before applying Thompson's® WaterSeal® Waterproofer Plus Tinted Wood Protector Sheer Honey Gold, read and follow the directions found on the back of the can. Be sure that both surface and air temperature are above 50° F. during application and for 48 hours

after application. And, if you're working outside, do not apply product if rain is forecasted within 24 hours of application.

**57.** The surfaces must be free of all dirt, wood dust and all other contaminants. To clean the wood, use either Thompson's® WaterSeal® Deck Cleaner & Brightener or Thompson's® WaterSeal® Deck Wash. If the surface is damp or wet from cleaning or weather, allow the surface to dry thoroughly (a minimum of 48 hours) before application.

**58.** Do not mix the product with other waterproofing products because variations in the final appearance of the surface being treated may result.

**59.** Before applying the product over the entire surface, a small trial patch is recommended.

**60.** In most applications, only one light coat is necessary. Apply with a brush, roller or applicator pad. Regardless of which application method is used, remove excess within 15 minutes by redistributing it to drier areas or wiping it off.

**61.** Oiliness and tackiness will result if overapplied, or applied to wet or damp surface or if overnight temperature falls below 50° F. within 48 hours of application.

**62.** Allow at least 48 hours to dry before you use the patio table.

**63.** Clean brushes and equipment with mineral spirits, then rinse with clean water.

**NOTE:** The length of protection will vary depending on environment. Perform the following splash test once a year to see whether reapplication is necessary. Sprinkle water on various sections of surface to be sealed. If water absorbs and darkens color of substrate within 5 seconds, the surface is porous and considered ready to be treated. If water beads up or otherwise sits on top of surface, then surface doesn't need protection at this time. For maximum protection from color change and other damage caused by the sun, reapplication is recommended every year. Vertical and horizontal surfaces will experience color changes at different rates.

### PRODUCT SAFETY

For your safety and the safety of those you work with, always read the safety warnings, which manufacturers print on their labels, and follow them to the letter. Typical safety advice and instructions will contain information such as the following:

**WARNING!** Removal of old paint by sanding, scraping or other means may generate dust or fumes that contain lead. Exposure to lead dust or fumes may cause brain damage or other adverse health effects, especially in children or pregnant women. Controlling exposure to lead or other hazardous substances requires the use of proper protective equipment, such as properly fitted respirator (NIOSH approved) and proper containment and cleanup. For more information, call the National Lead Information Center at 1-800-424-LEAD (in U.S.) or contact your local health authority.

Contents are **COMBUSTIBLE**. Keep away from heat and open flame.

Contains **ALIPHATIC HYDROCARBONS**.

**VAPOR HARMFUL.** Use Only With Adequate Ventilation. To avoid overexposure, open windows and doors or use other means to ensure fresh air entry during application and drying. If you experience eye watering, headaches, or dizziness, increase fresh air supply, or wear respiratory protection (NIOSH/MSHATC23C or equivalent), or leave the area. Avoid contact with eyes and skin. Wash hands after using. Keep container closed when not in use. Do not transfer contents to other containers for storage.

**FIRST AID:** In case of eye contact, flush thoroughly with large amounts of water for 15 minutes and get medical attention. For skin contact, wash thoroughly with soap and water. In case of respiratory difficulty, provide fresh air and call physician. If swallowed, get medical attention immediately.

**DELAYED EFFECTS FROM LONG-TERM OVEREXPOSURE.**

Contains solvents that can cause permanent brain and nervous system damage. Intentional misuse by deliberately concentrating and inhaling contents may be harmful or fatal.

**WARNING:** This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

**DO NOT TAKE INTERNALLY.**

**KEEP OUT OF REACH OF CHILDREN.**

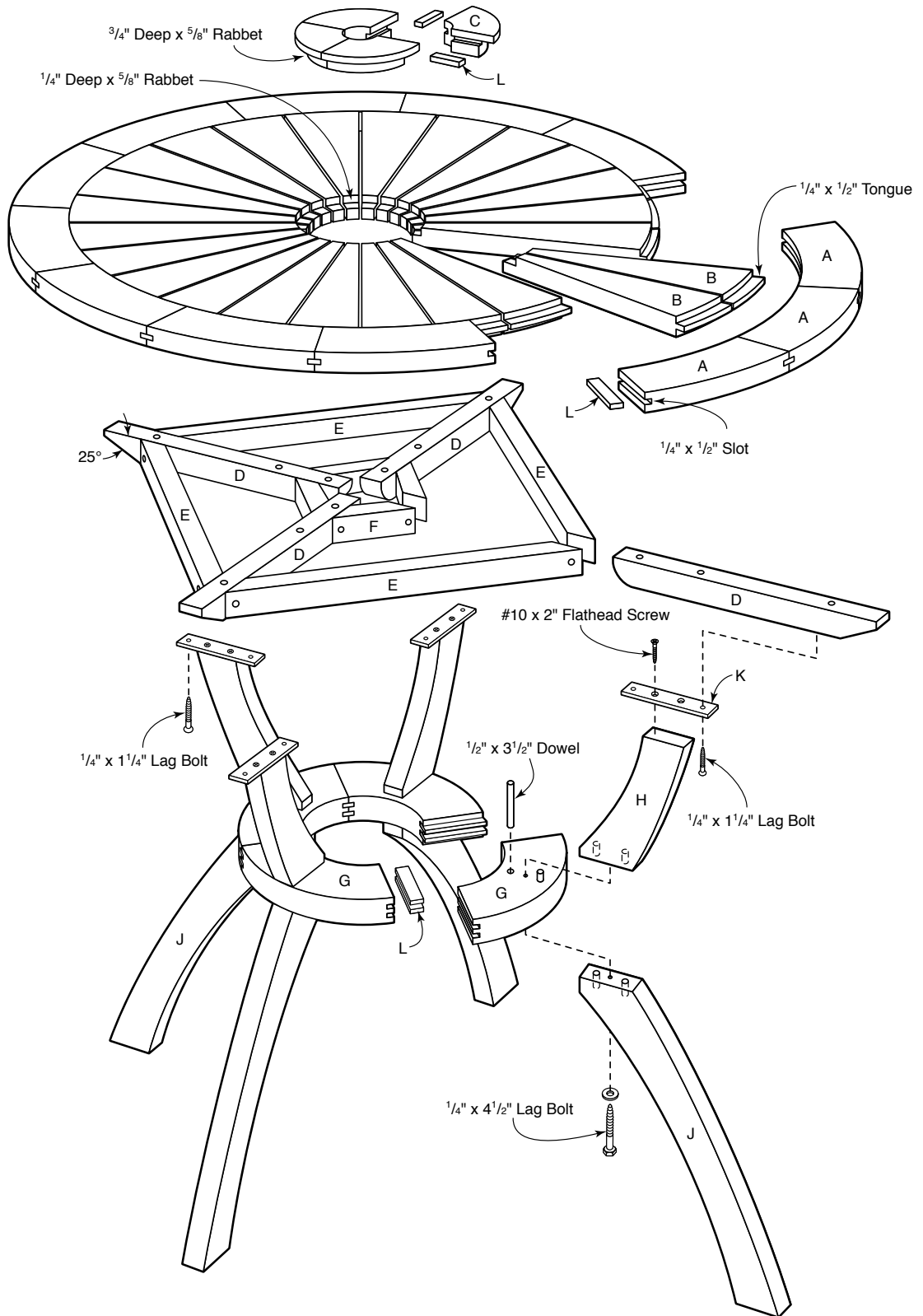
**SAFE DISPOSAL OF RAGS AND WASTE.**

**DANGER:** Rags, steel wool, other waste soaked with this product, and sanding residue may spontaneously catch fire if improperly discarded. Immediately place rags, steel wool, other waste soaked with this product, and sanding residue in a sealed, water-filled metal container. Dispose of in accordance with local fire regulations.

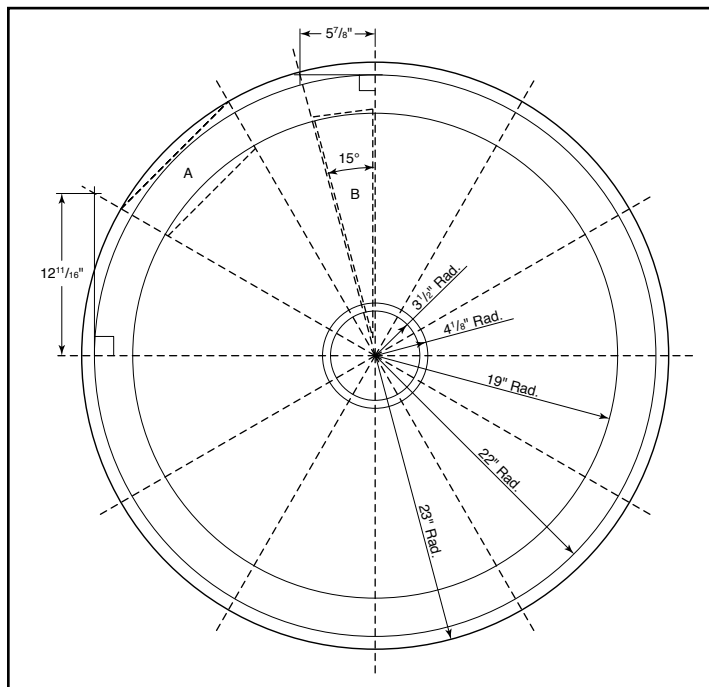
This project originally appeared in *American Woodworker* magazine, #129, July 2007, page 42.

**American.**  
**Woodworker**

**FIG 1.**

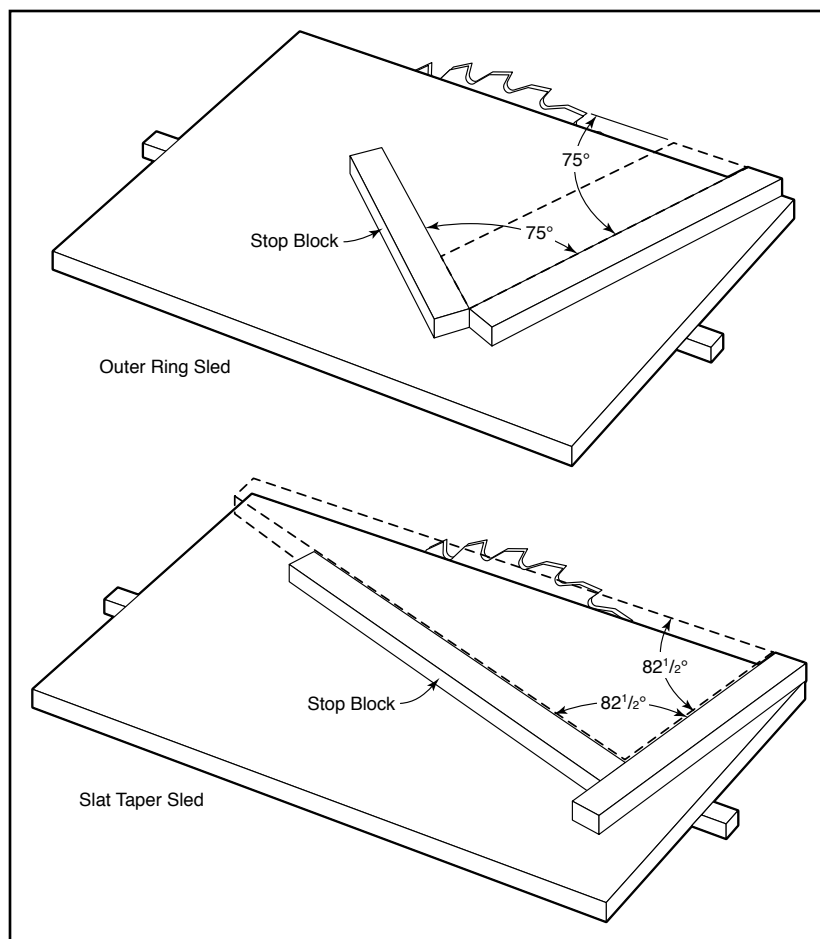


**FIG 2.**



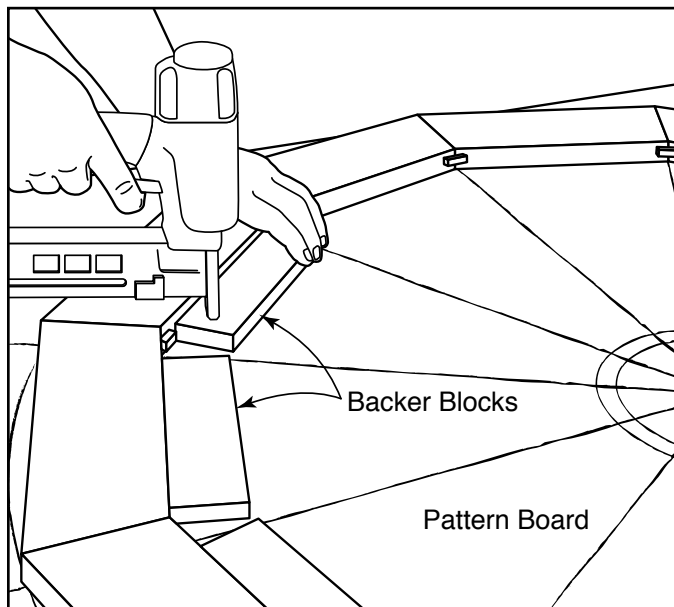
When making this pattern board, use the trammel (see Fig. 7) to draw circles with the following radii: 3-1/2", 4-1/8". This marks the radius of the hub and the depth of the rabbet on the underside. Next draw arcs at 19" and 22" to mark the outer ring. Draw one more mark at 23" to establish the long points for your mitered outer ring sections. Next, section the whole circle into four equal quadrants using a straight edge and a square. Use the square to make a mark 12-11/16" up from the 9:00 mark on the 22" ring. Make the same mark below the line. Repeat at the 12:00 position. Then use a straight edge to draw the lines shown, which define the size and shape of the ring segments (A). From the 12:00 position on the 22" radius, use a square to measure out 5-7/8" and draw the line shown, which defines the size and shape of the top slats (B).

**FIG 3.**

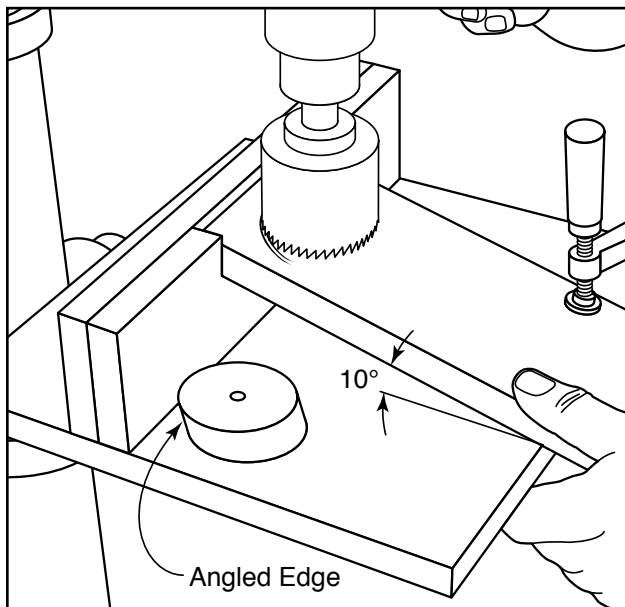




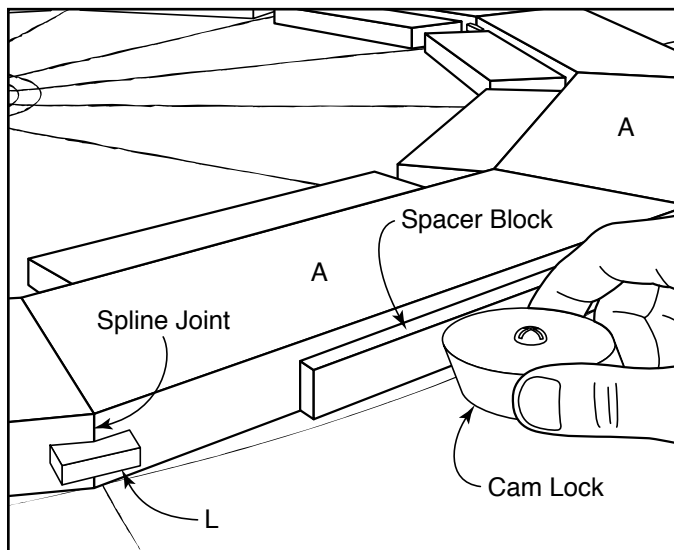
**FIG 4.**



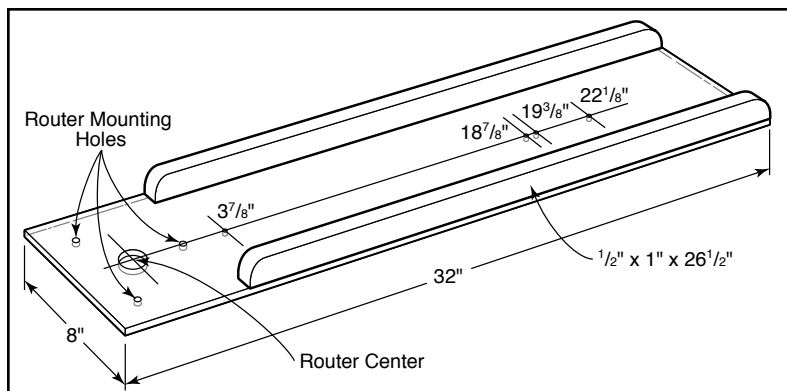
**FIG 5.**



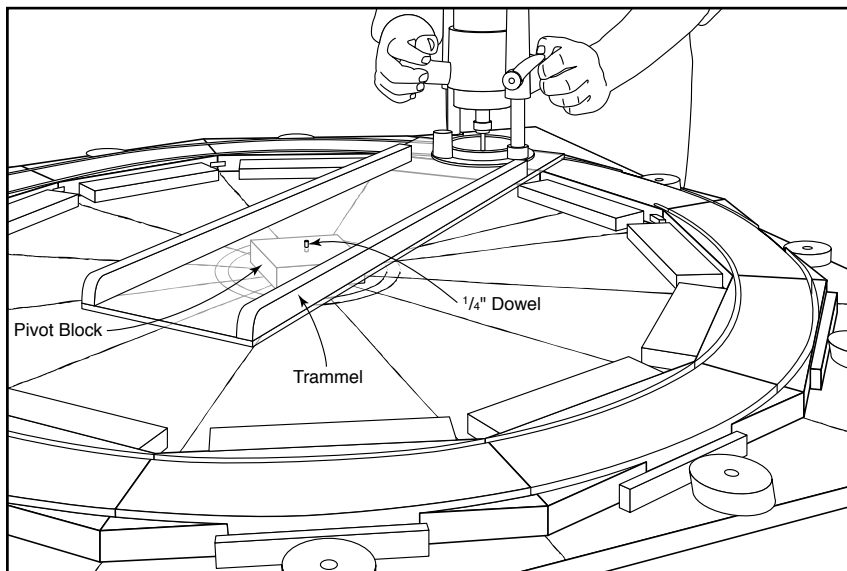
**FIG 6.**



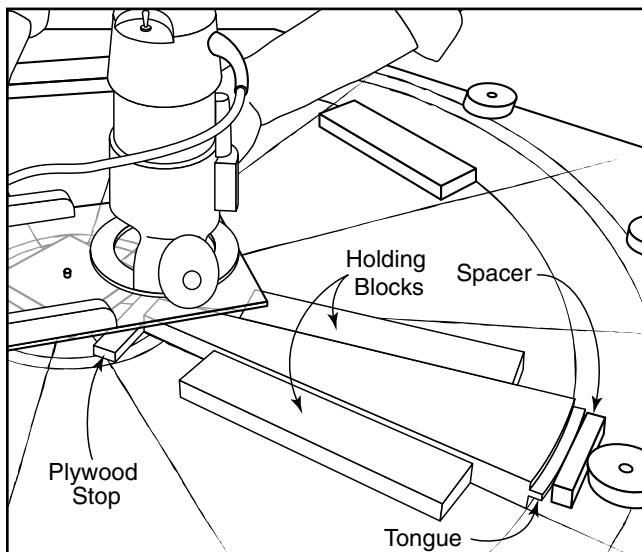
**FIG 7.**



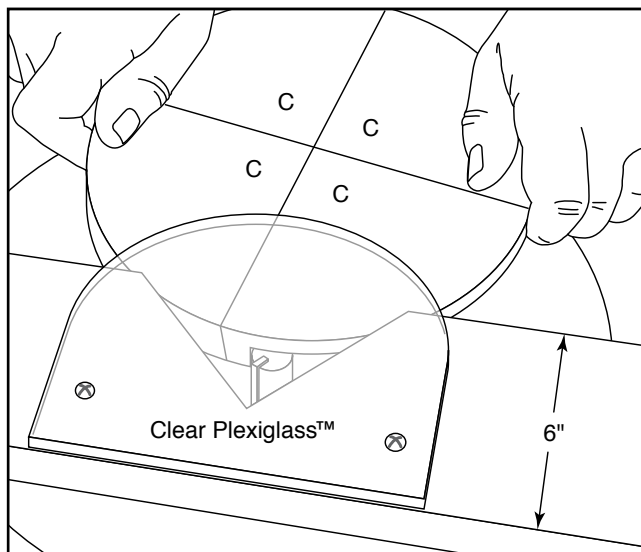
**FIG 8.**



**FIG 9.**



**FIG 10.**



**FIG 11.**

