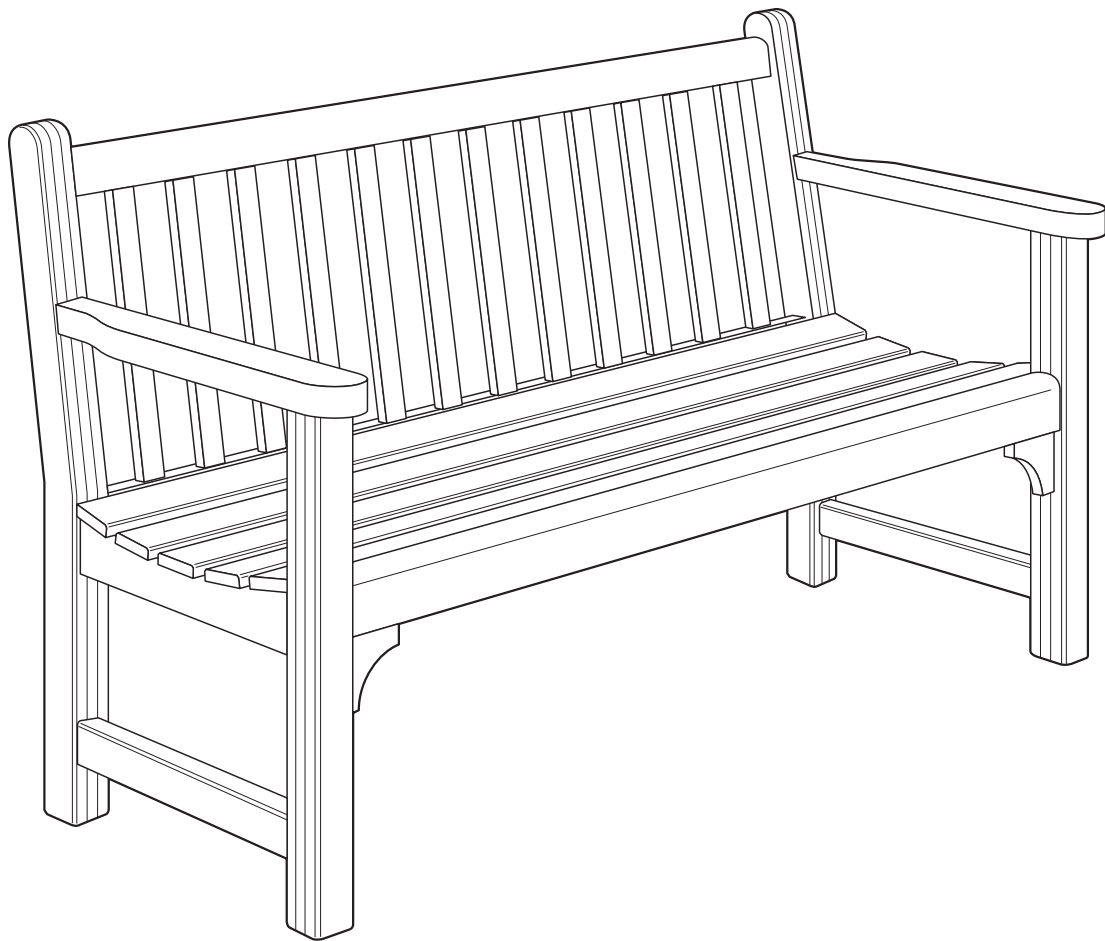


WOODWORKS: INTERMEDIATE PROJECT 2005-2006 GARDEN BENCH



Traditionally made of teak, these benches have long graced English parks and gardens, aging gracefully through years of use and weather. This version is made of cedar, but you could also use white oak, redwood or cypress. Whatever wood you use, it's a good idea to finish your bench with a waterproofer. This project uses traditional mortise-and-tenon construction for extra durability. Normally, you might avoid this type of joinery in favor of easier methods, such as dowels or even drywall screws, but the superior strength of a mortise-and-tenon joint will ensure long-term sturdiness and is consistent with the bench's classic design. This project is perfect for learning this joint because cedar compresses easily, so it will fit together even if it's not perfectly cut.

Other skills you will learn are face-gluing and making dowelled joints. Face-gluing the boards that make up this bench's legs isn't difficult; just follow the instructions. Dowelling requires care and patience more than anything else. And after it's assembled, you'll learn more about applying and using finishes to enhance the wood's natural beauty and ensure that it's well-protected.

TOOLS REQUIRED

Hand Tools

- Pipe clamps
- Dowelling jig
- Square
- Wood files
- Sanding block
- Chisels
- Mallet
- 3/8" plug cutter
- Paintbrush and paint tray

Power Tools

- Table saw or radial arm saw
- Router and a straight bit and 3/16" and 3/4" rounding-over bits
- Portable jigsaw or band saw
- Electric drill or drill press
- Electric sander
- Jointer (optional)

Miscellaneous

- Tape measure
- Pencil
- Safety glasses
- 120-, 150- and 220-grit sandpaper
- Clean, lint-free cloths
- Respirator
- Gloves for finishing
- Mineral spirits (for oil-based wood protector)
- Water-filled metal container with tight-fitting lid (for oil-based wood protector)
- Minwax® Stainable Wood Filler
- Waterproof glue (resorcinol)

SHOPPING LIST

NOTE: Instead of cedar, you can also use white oak, redwood or cypress, all of which are naturally rot-resistant. Whichever wood you choose, be sure to select a mostly knot-free grade.

Item	Quantity
2" x 4" x 8' clear cedar	4
1" x 6" x 8' clear cedar	6
#8 3" galvanized deck screws	16
#8 2" galvanized deck screws	4
6d galvanized finish nails	20
5/16" x 1-1/2" dowel pins	48
1/4" birch dowel rod	18"

CUTTING LIST

Key	Part	Pcs.	Dimensions
A	back legs	2	2-1/4" x 5-1/4" x 3 3/4"
B	front legs	2	2-1/4" x 2-1/4" x 2 3/4"
C	arms	2	1-1/2" x 3-1/2" x 21"
D	back seat rail	1	1-1/2" x 3" x 58-1/2"
E	front seat rail	1	1-1/2" x 3" x 58-1/2"
F	side seat rails	2	1-1/2" x 3" x 16-1/2"
G	seat supports	2	1-1/2" x 3" x 16-1/4"
H	top rail	1	1-1/2" x 2-1/2" x 58-1/2"
J	leg braces	2	1-1/2" x 2" x 16-1/2"
K	front rail braces	2	3/4" x 3-1/2" x 3-1/2"
L	seat slats	5	3/4" x 2-1/2" x 60"
M	back slats	12	3/4" x 1-1/2" x 14-1/2"
N	tenon pins	8	1/4" - dia. x 2" birch dowels

WOOD FINISHING PRODUCTS

Recommended Finish

Thompson's® WaterSeal® Advanced Natural Wood Protector

Alternate Finish

Thompson's® WaterSeal® Waterproofer PLUS Tinted Wood Protector, which is available in five colors: Honey Gold, Natural Cedar, Rustic Red, Nutmeg Brown and Coastal Gray

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 instructor.

- Carefully and fully review plans and instructions before putting a tool to the project lumber.
- Work sensibly and safely. Wear safety goggles and 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

Woodworker's Tip: *To have stock thick enough for the legs of the bench, you'll probably have to laminate three thicknesses of 3/4" material. (The Shopping List assumes this.) Cut the boards an inch or two longer than you need, and bond them together with waterproof glue (Fig. 2). When you're gluing, line up the edges of the boards to minimize work later. Don't use regular carpenter's glue for an outdoor project like this. It won't stand up to the weather. You can use a resorcinol glue, which comes in two parts, a liquid and a powder. This is an excellent glue that should be applied at room temperature or above.*

Building the Legs and Frame

1. From a triple lamination of 1x6s, cut both front legs (B) to the dimensions shown on the Cutting List.
2. From another triple lamination, rip each back leg (A) to a width of 5-1/4".
3. Lay out the angle cuts on the back legs according to the dimensions shown in Fig. 3. Cut out the legs, using either a band saw, a jigsaw with a long blade, or even a handsaw to cut the angled part of the back legs. Fig. 3 also shows the dimensions for rounding the tops. Use a jigsaw for these cuts.
4. Cut out the seat supports (G) and side seat rails (F) according to the dimensions shown in Fig. 4. Cut out the arms (C) according to the dimensions shown in Fig. 5. Cut out the front rail braces (K) according to the dimensions shown in Fig. 1.

Cutting the Mortises and Tenons

5. Lay out and cut tenons on the ends of the rails (D, E, F, and H) and leg braces (J) according to the dimensions shown in Fig. 1. You can cut these entirely with a handsaw, but you will get more accurate results by using a router to remove the waste from the "cheeks" (flat sides) of the tenon. Use the router with its fence attachment, and set it to make a 1-1/2"- wide x 1/2"- deep cut.
6. Cut the tenons to width with a small handsaw. Cut them a little oversize, then file them later to fit tightly into the mortises.

7. Pencil in the outlines of the mortises on the legs, drill 5/8" holes inside the outlines to clear out most of the waste, and then chisel out and square off the sides and ends. A drill press or dowelling jig (shown in Fig. 6) will ensure that your holes are vertical. Otherwise, you can hold a square against the wood to guide the drill.

8. Test the fit of each tenon in its corresponding mortise, and file the tenon or chisel the mortise to adjust the fit. The tenon should be snug and hard to push in by hand, but easily tapped in (not pounded) with a wood or rubber mallet.

Assembling the Bench

9. Drill holes for the plugs and clearance holes for the screws in the arms (C), front and back seat rails (D and E), front rail braces (K), and back legs (A). Drill dowel holes for the back slats (M) using the dowelling jig.

10. Using a router and 3/16" rounding-over bit, round the edges of the legs (A and B), the leg braces (J), the bottom edges of side seat rails (F), and the exposed edges of the front rail braces (K). Also round the edges of the back slats (M), the top edges of the seat slats (L) including the ends, the bottom edges of the top rail (H), the top and bottom edges of the back seat rail (D), and all edges of the front seat rail (E) except the front top edge. Rout slowly to avoid splintering as you cut. Finish-sand all pieces with 220-grit sandpaper.

Woodworker's Tip: *When routing cedar, you may have trouble with the wood chipping out along the length of a cut, especially when you're rounding over the edges. You can reduce tear-out by routing slowly, using a sharp bit and cutting in a few shallow passes until you reach the desired depth.*

11. Assemble the end pieces (A, B, F, and J). Use waterproof glue and clamp the joints tightly until they are dry. Don't attach the arms yet.
 12. The mortises in the legs for the back and front rails will be blocked at the bottom by the tenons of the side rail you just glued. Chisel this little piece of tenon out, along with any squeezed-out glue.
 13. Glue and insert the 5/16" dowel pins into the back slats (M). Assemble the back by gluing the slats into one rail first. Test fit the other rail, then glue it on.
- NOTE:** When assembling the back of the bench all slats should be fitted to the bottom rail before the top rail is put on.
14. Using a router with a 3/4" rounding-over bit, round over the top edges of the top rail (H) and the front top edge of the front rail (E).
 15. Finish-sand the remaining rails, the arms (C), the seat supports (G), and the front rail braces (K).
 16. Glue and clamp together the rails, the back assembly and the end assemblies. Drill pilot holes, then screw on the seat supports (G) and braces (K).

Woodworker's Tip: Your clamps might not be long enough for the final assembly of the bench. If you have some shorter pipe clamps, you can hook two together or buy a threaded plumbing coupler to screw the two pipes together. Another approach is to extend the reach of a single clamp with a long piece of plywood. Screw a block of wood onto it at one end to bear against the bench, and cut a hole in the other end of the plywood to house the "foot" end of the clamp (the one without the handle).

17. After drilling pilot holes, nail on the seat slats (E) and set the nail heads below the surface. Drill the holes for the tenon pins (N). Glue and tap them in flush with the surface. Wipe off excess glue. Attach the arms. Cut cedar plugs with a 3/8" plug cutter and glue them over the screws attaching the arms. Sand the plugs flush with the surface.

18. Give your bench a final sanding before applying the protective finish.

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.

We've chosen Thompson's® WaterSeal® Advanced Natural Wood Protector to provide complete protection for your project. It not only prevents water damage, but the coating also resists mildew and U.V. (ultraviolet radiation in sunlight) damage, and it exceeds industry standards for waterproofing on wood. This product is also available in five beautiful sheer wood tones.

FINISHING TIPS

- Coverage: The approximate coverage of Thompson's® WaterSeal® Advanced Wood Protector on cedar is 200 square feet per gallon. For the alternate finishes we will suggest later, the approximate coverage of Clear Wood Protector is 300 to 400 square feet per gallon, and Tinted Wood Protector is 250 to 300 square feet per gallon.

Recommended Finish

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

19. Before applying Thompson's® WaterSeal® Advanced Wood Protector, the wood surface must be free of all dirt, wood dust and contaminants. Read and follow the directions found on the back of the can. 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.

Woodworker's Tip: Cedar and redwood have natural characteristics that require special treatment to enhance beauty and waterproofing performance. If you're using weathered wood that needs cleaning, the wood may require a brightener to neutralize it and restore its color after using a wash or cleaner. Wait 48 hours after application of the brightener to apply this product.

If you only use water for cleaning, wait at least 2 hours before applying Thompson's® WaterSeal® Advanced Wood Protector. Allow longer drying time (4 hours) on overcast or cooler days below 60° F. It isn't necessary for the surface to dry completely before applying this product.

20. When applying this product, do not use it with other waterproofing products, as variations in the final appearance of the wood may result. Do not thin. To ensure good penetration, do not apply in direct sunlight or on hot days. Be sure that both surface and air temperature are above 50° F and below 95° F during application and for 48 hours after application. If you're working outside do not apply product if rain is forecasted within 24 hours of application.

21. 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.

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

23. Apply only one thin, even coat. DO NOT APPLY A SECOND COAT. A heavier, or additional coat will not improve performance nor appearance. Avoid puddling. Tackiness will result if over-applied. Tackiness may also occur if the 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 bench.

24. If using Thompson's® WaterSeal® Advanced, clean brushes and equipment with soap and water. If using oil-based waterproofer, clean brushes and equipment with mineral spirits. Dry product can be removed with mineral spirits.

Alternate Finish

25. Before applying Thompson's® WaterSeal® Waterproofer PLUS Clear or Tinted Wood Protector, 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.

26. The surfaces must be free of all dirt, wood dust and other contaminants. If the surface is damp or wet from cleaning or weather, allow the surface to dry thoroughly (a minimum of 48 hours) before application.

27. Cover plants and shrubs and move all objects that could come in contact with Wood Protector.

28. When you apply 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.

29. Before applying Wood Protector over the entire surface, a small trial patch is recommended to verify color.

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

31. Use only with adequate ventilation. Oiliness and tackiness will result if over-applied or applied to wet or damp surface or if overnight temperature falls below 50° F within 48 hours of application. Excessive oiliness caused by over-application may be removed by scrubbing wood with a concentrated degreaser.

32. Allow at least 48 hours to dry before you hang the swing. Drying time will vary depending on the substrate, temperature and humidity.

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

IMPORTANT: Place rags, steel wool and waste immediately after use in a sealed, water-filled metal container.

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 Informations Center at 1-800-424-LEAD (in US) or 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 over-exposure, 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 OCCUPATIONAL EXPOSURE.

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

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

DO NOT TAKE INTERNALLY. KEEP OUT OF THE 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.

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FIG 1. BENCH DETAIL

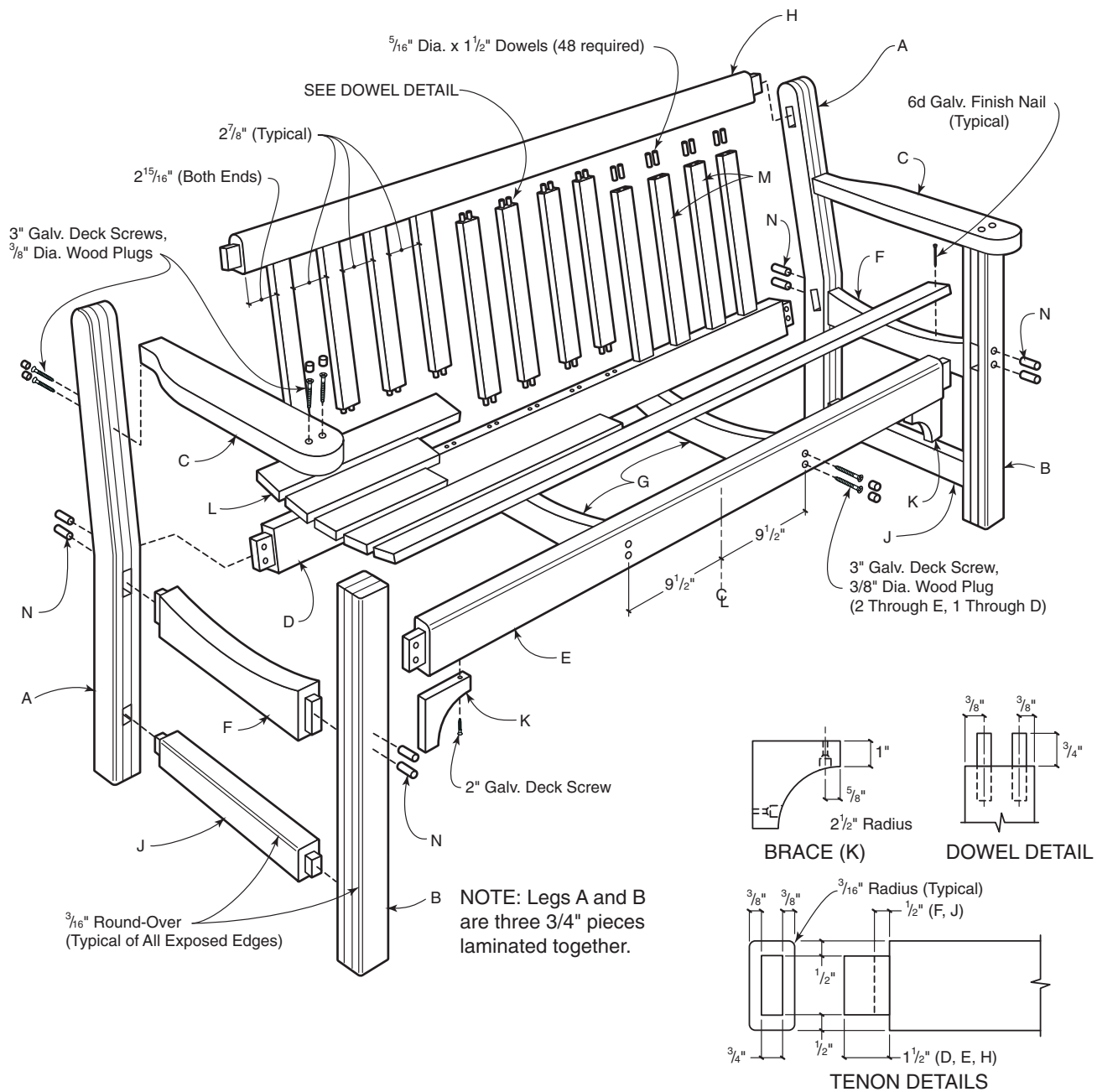


FIG 2. MAKING THE BACK LEGS

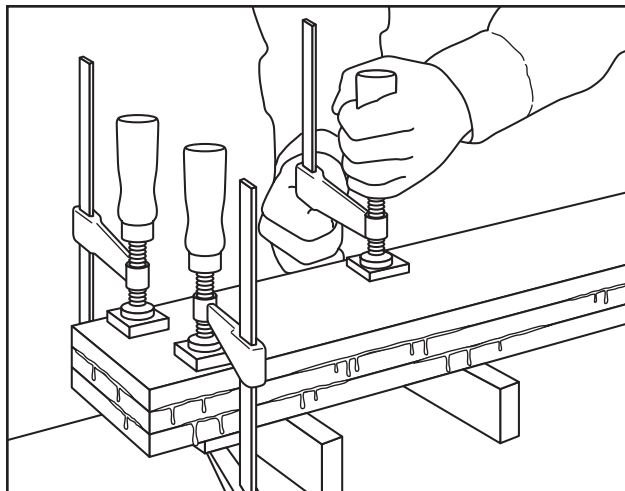
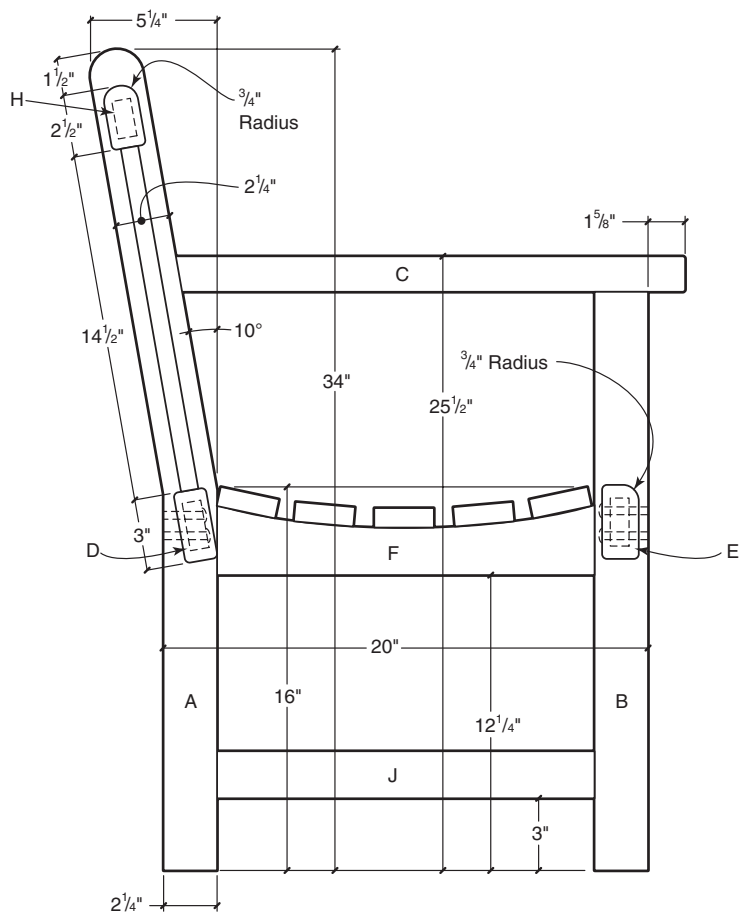


FIG 3. SIDE SECTION VIEW



NOTE: Legs A and B are three pieces laminated together.

FIG 4. SEAT RAIL (F) AND SUPPORT (G) DETAIL

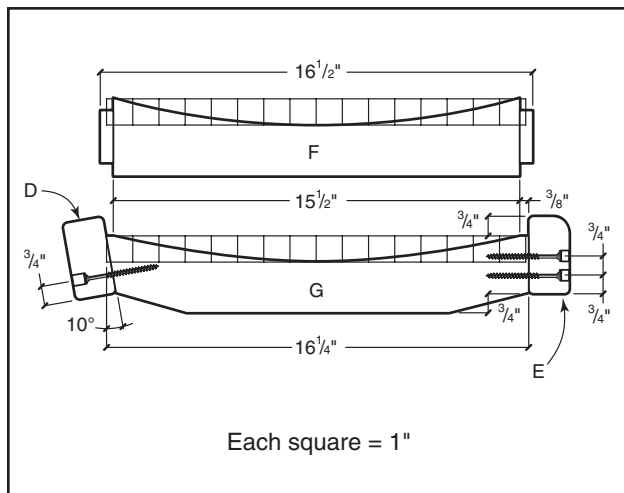


FIG 5. ARM (C) DETAIL

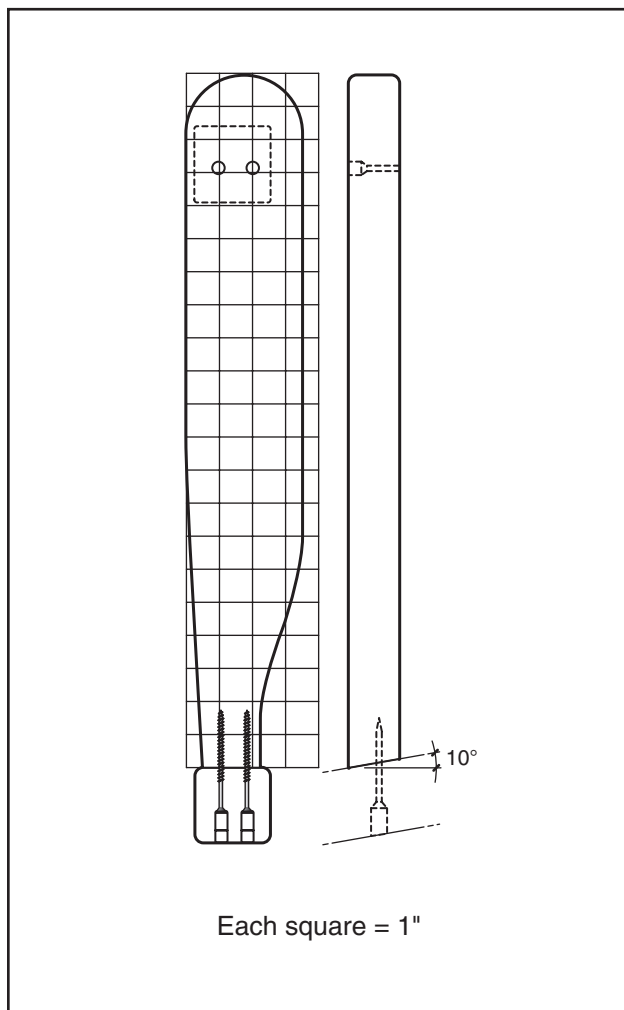


FIG 6. DOWEL THE BACK SLATS TO THE BACK RAILS

