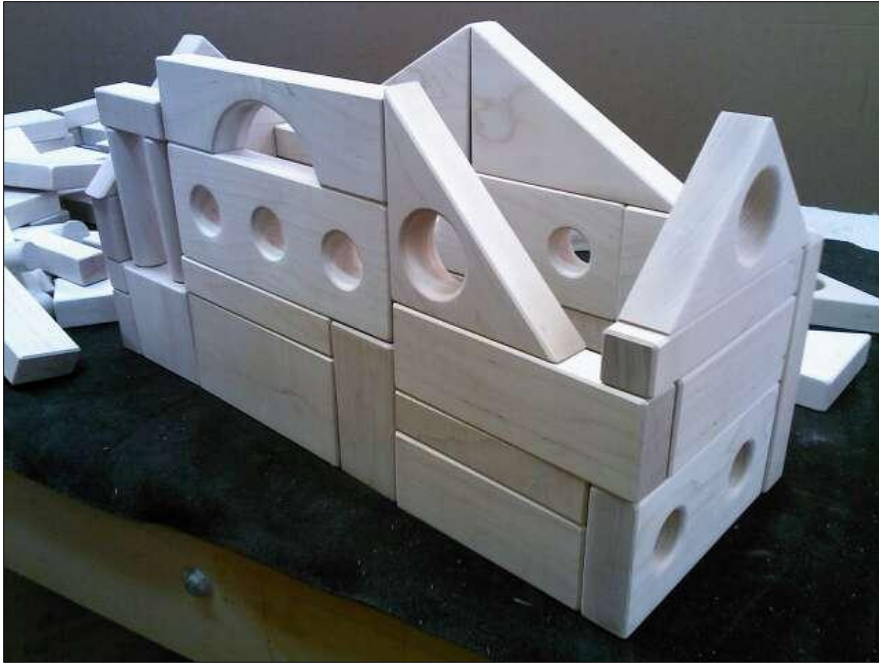


Toy Wood Block Set



Project Overview:

This project requires basic woodworking skills and access to woodworking machines. Woodworking machines have sharp cutting edges and are **NOT** forgiving. You should be properly trained in the use of these machines. Ensure that you wear safety glasses and hearing protection, use push sticks, hold-downs, clamps and a cutting sled to cut the blocks safely.

This wood block set is made for children. It is made from hard maple which is dense and does not splinter. These blocks **DO NOT** have any applied finish. They will take on a patina from handling after time. The sizes and shapes can be customized to your specifications.

The blocks in this set are all 1" thick and sized in 1" increments. Keeping the sizes in 1" increments allows for uniform stacking arrangements. There are between 4 and 6 blocks of each size and shape in this set. **NOTE: Precise measurements are not important. This is a toy set.**

An important consideration is child safety. The edges of each piece is "eased" (rounded off) to eliminate sharp corners and edges. Children love to put things in their mouths, so the size of the smallest piece in this set is 1" x 1" x 3". **DO NOT SIZE PIECES THAT MIGHT CAUSE A CHILD TO CHOKE.**

Rectangular blocks are sized accordingly: 1" wide blocks are 3", 4", 5" and 6" in length; 2" wide blocks are 2", 3", 4", 5" and 6" in length: and 3" wide blocks are 3", 4", 5" and 6" lengths. Angled blocks are at 45 degrees in 6" and 8" lengths. The 30/60 degrees blocks are 6" in length. The round dowels are 1" diameter. Holes and arches vary in diameter between 1 1/8" to 4".

Materials Needed:

- Approximately 15 linear feet of rough sawn hard maple. 1 1/4" thick and 6" to 8" wide.
- Approximately 6 feet of 1" hard maple dowel.
- Approximately 12 feet of 3/4" thick, 8" wide poplar (for box).
- 150 and 180 grit sandpaper
- Shellac (spray can)

Tools & Equipment Needed:

- Table saw with a cross cut sled and a very sharp blade.
- 8" jointer
- Miter saw
- Biscuit jointer
- Drum sander
- Disc sander
- Drill press with large (1" to 4") diameter Forstner bits.
- Router (hand held and router table)
- Block plane
- Chisels
- Bar clamps

Step #1: Stock Prep

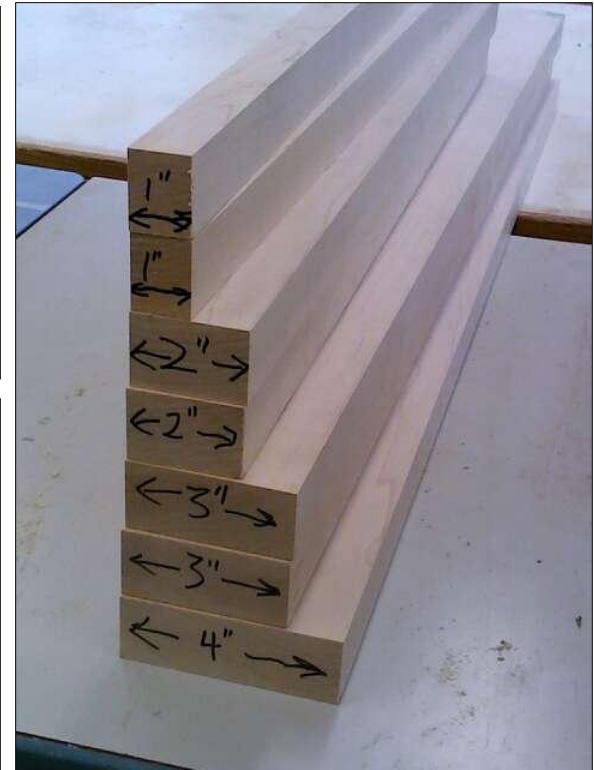
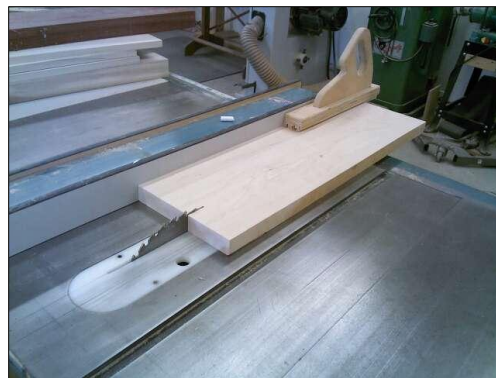
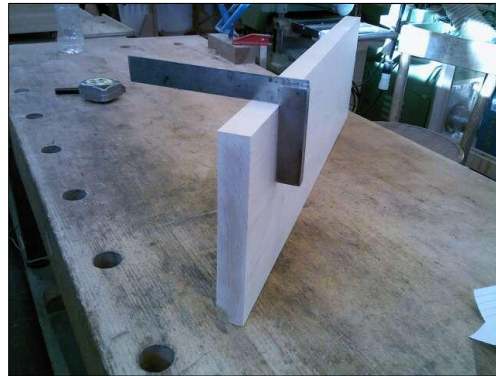
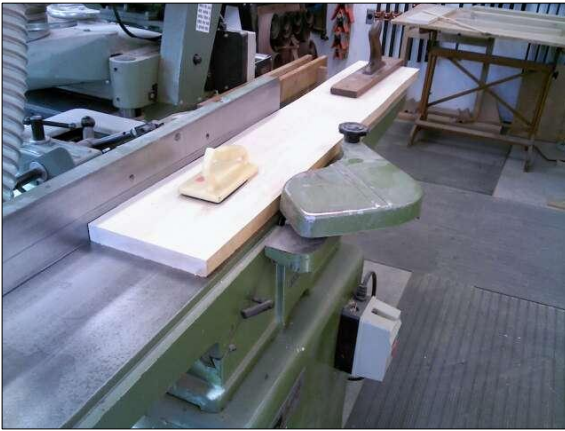
All the blocks are made from hard maple.

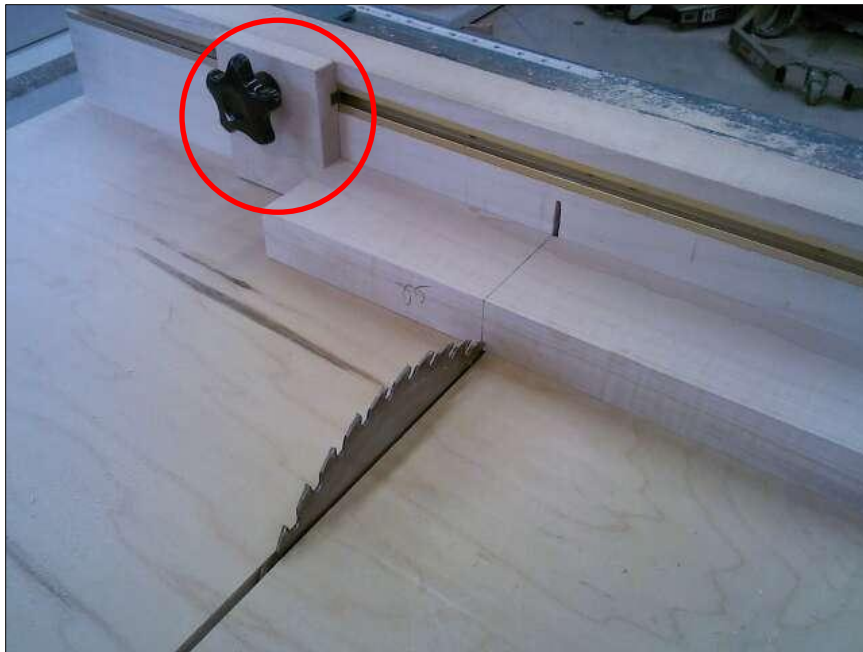
Purchase 1 ¼" thick rough lumber, 6" to 8" in width.

- Flatten one face of each piece of lumber using a jointer.
- Use a planer or a drum sander to make the opposite face parallel and sized to 1" thick. (*If using a drum sander, finish sand to 180 grit.*)
- Use a jointer to make the edges 90 degrees to the face of the board.
- Rip saw the boards on a table saw to the following widths:

- 1", 2", 3" and 4"

NOTE: It is recommended that you surface the cut edge (use the jointer) to ensure it is clean and flat.





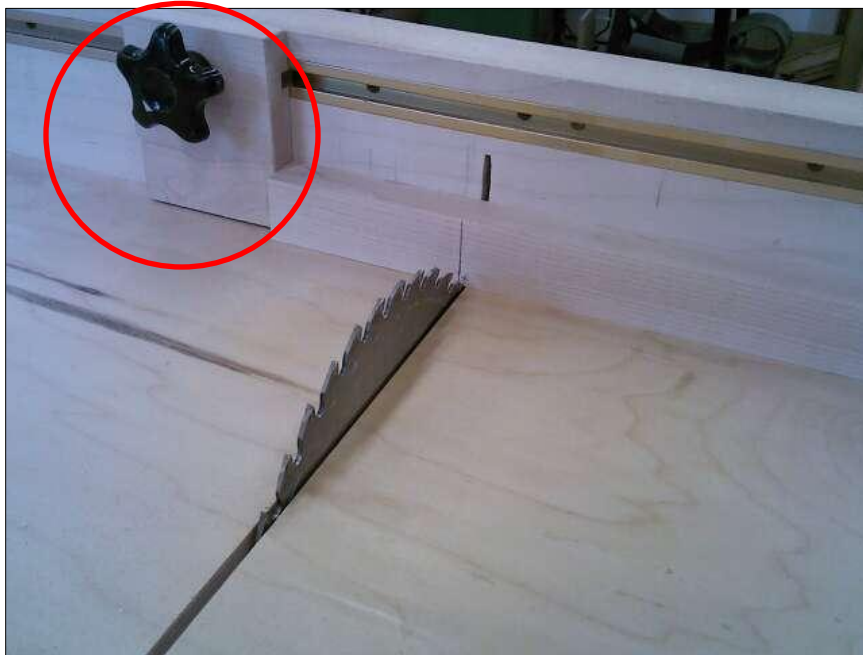
Step #2: Cutting Blocks (90 degree cuts)

Once the boards have been sized to 1" thick it is time to cut the blocks to lengths of 2" to 6" at 1" increments. (*The minimum length of the 1" x 1" blocks is 3" for safety reasons*).

The safest and most efficient way to cut the blocks to the various lengths, is to use a cross-cut sled on the table saw.

The use of a stop block (*highlighted*) ensures that each block is cut to the same length.

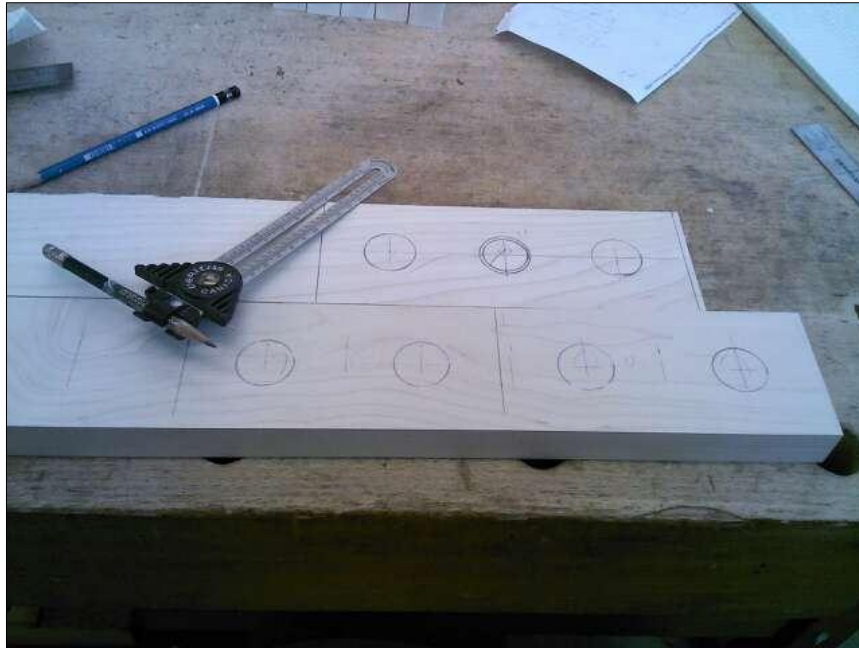
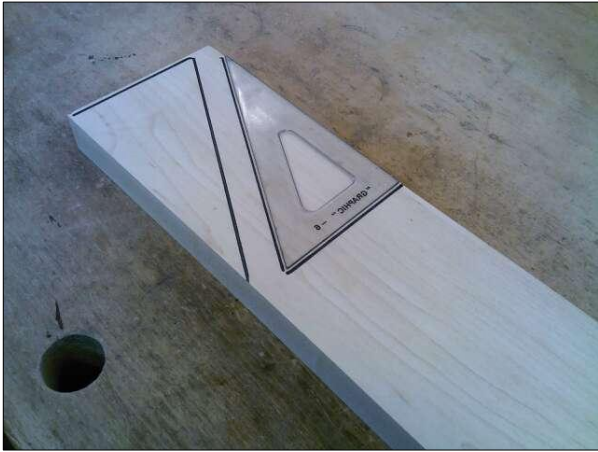
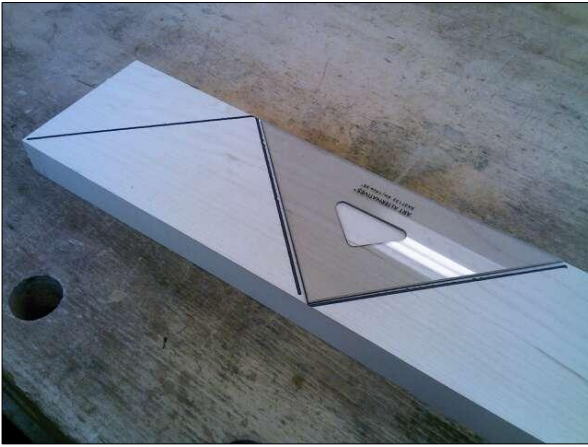
Maintain the stop block's position to cut the various width block's lengths.



Step #3: Layout Angled blocks

Using a square and angle templates, layout the 45 degree and 30/60 degree blocks. Maximize the use of the wood and the saw cuts by reversing the template as indicated on the top left photo.

Some of these blocks have holes cut into them. Using a compass, layout the position of the holes as well.





Step #4: Drill Holes

Using a variety of forstner drill bit sizes (*forstner bits are large flat bottom drill bits*), drill the holes in the stock **BEFORE** cutting the angles. This provides you a better way to secure the wood for drilling large holes.

NOTE: *The larger the diameter of the drill bit, the slower the drill speed. A 2" or larger forstner drill bit requires a drill speed of 250 RPMs. Change the belt configuration on the drill press accordingly (see photo on lower right).*

This wood block set contains blocks that have arches. These arches are created by drilling a large diameter hole in the rectangular stock and then cutting the block in half (*step #7*).



Step #5A: Cutting Angled Blocks Using a Miter Saw

This set contains triangular blocks that are cut at 45 and 30/60 degree angles.

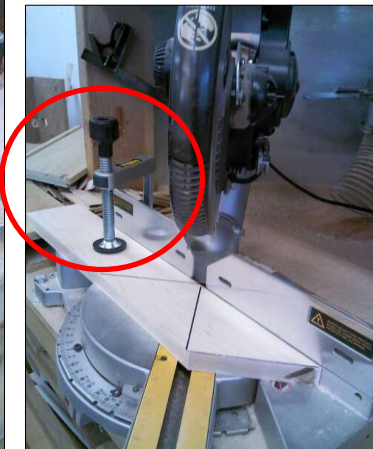
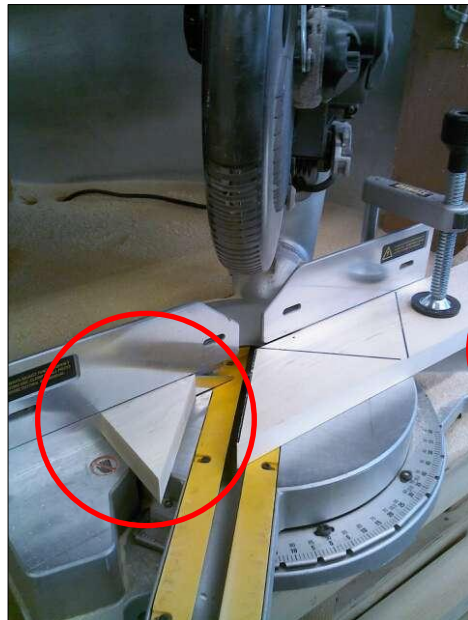
These cuts are made on 3" and 4" wide boards to achieve angled blocks with 6" and 8" wide bases. A by-product of cutting the larger triangle is an offcut triangle of 2 3/4" tall, 5 1/4" wide (see highlighted area in lower left photo and the photo on the bottom right. I included these offcuts in the set even though they do not follow the 1" increment).

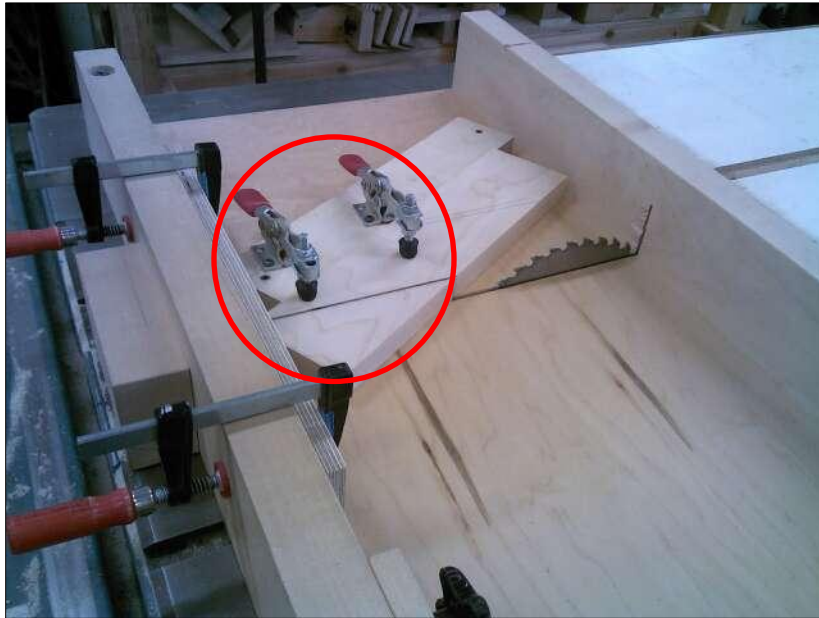
A miter saw can cut the 45 degree blocks. You can either rotate the saw (as shown in the photos) to cut the reverse angle or flip the board over. For safety reasons, the 30/60 degree blocks are cut using a cross-cut sled (step#5B).

NOTE: It is best to leave the lumber at least 18" long when making this cut. When the saw blade is rotated to 45 degrees, there is limited space to hold the stock in place. Use a hold down (highlighted in photo) or clamp to secure the board to the saw.

SAFETY NOTES:

- **DO NOT HOLD THE BOARD WITH YOUR HANDS.**
- **SECURE LUMBER TO SAW WITH CLAMPS OR HOLD-DOWNS**
- **KEEP HANDS AWAY FROM THE BLADE.**





Step #5B: Cutting Angled Blocks Using a Cross-cut Sled and Table Saw

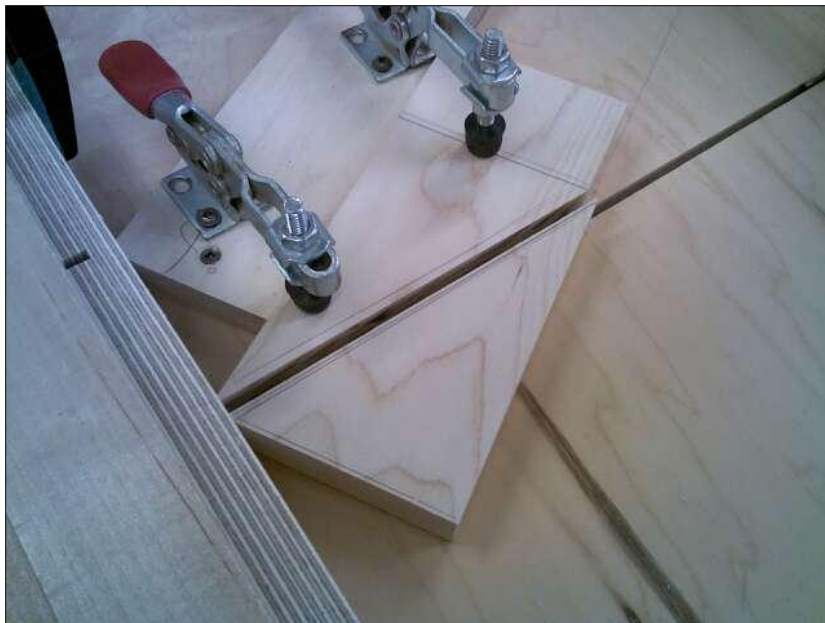
Miter saws are limited to the angles they can be set. The 30/60 degree blocks are best cut using a cross-cut sled and table saw.

This approach is safer and can also be used to cut the 45 degree blocks.

An auxiliary fence, set as the desired angle (45 or 60 degrees) is attached to the cross-cut sled.

Hold-down toggle clamps are attached to the auxiliary fence to secure the material.

This method provides a greater degree of safety and allows the user to use shorter pieces of lumber.



Step #6 Rounding the Edges of Holes

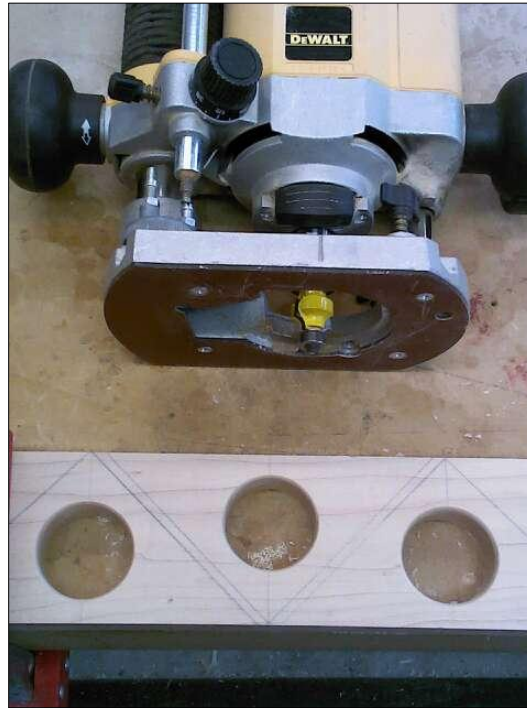
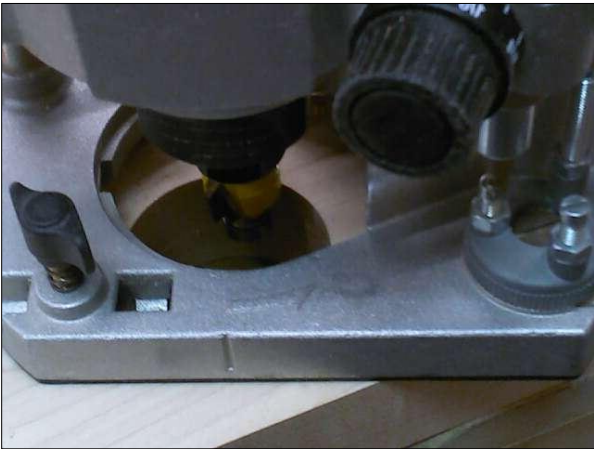
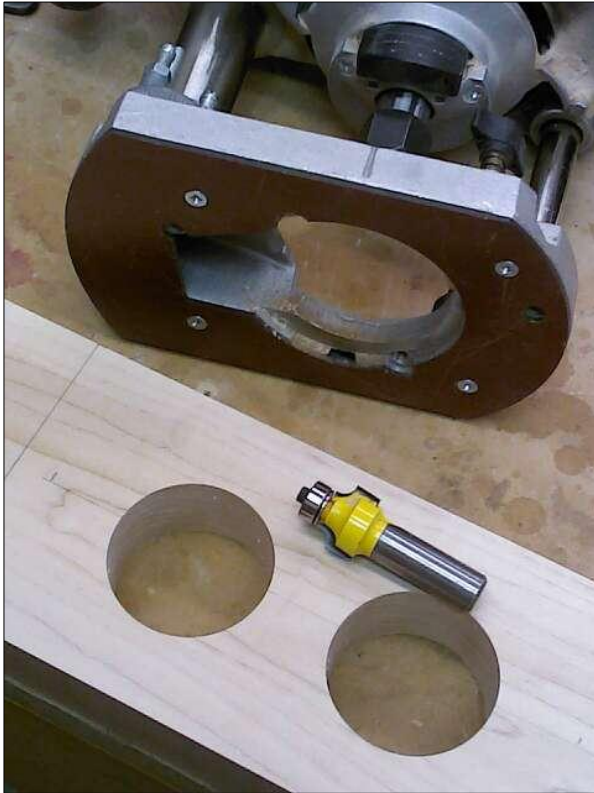
The edges of the holes are eased with a quarter round router bit and plunge router.

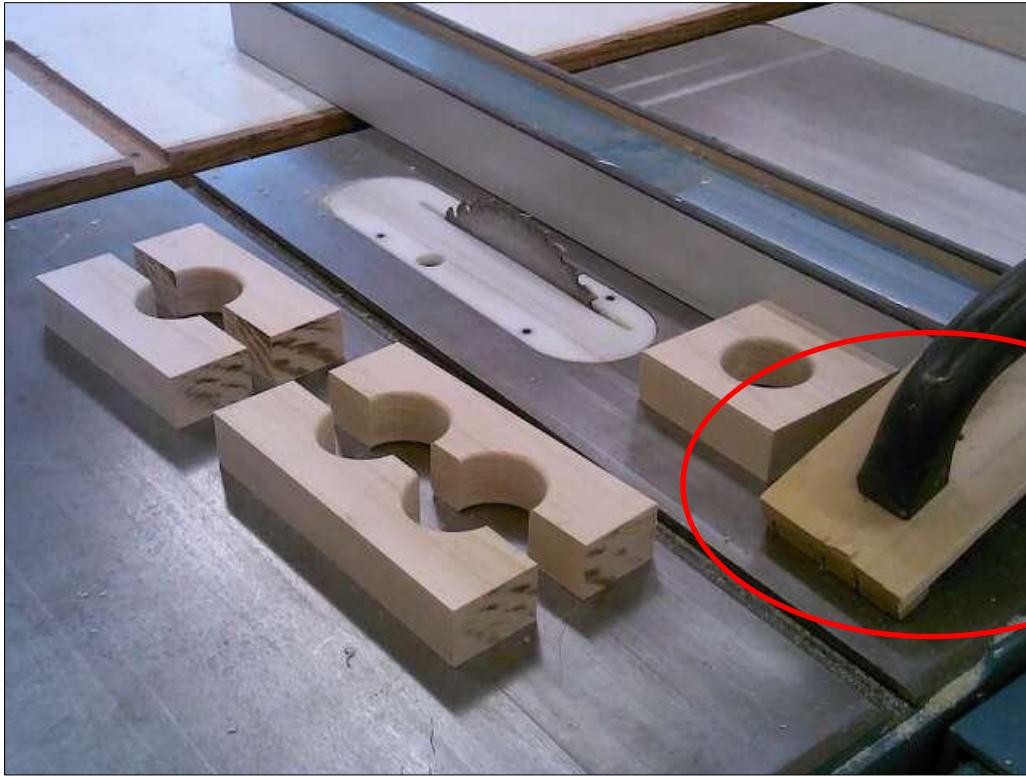
The purpose of rounding the edges is to make the blocks more pleasing to handle and play with.

It is easier to round over the edges before the blocks are cut to length or cut in half. Round over each side of the block.

Use a plunge router with a $\frac{1}{4}$ " round over bit.

The depth of cut is shallow, just enough to ease the edges.





Step #7: Cutting the Hole Blocks

In order to create the arched blocks, use a table saw to cut the blocks with holes in half.

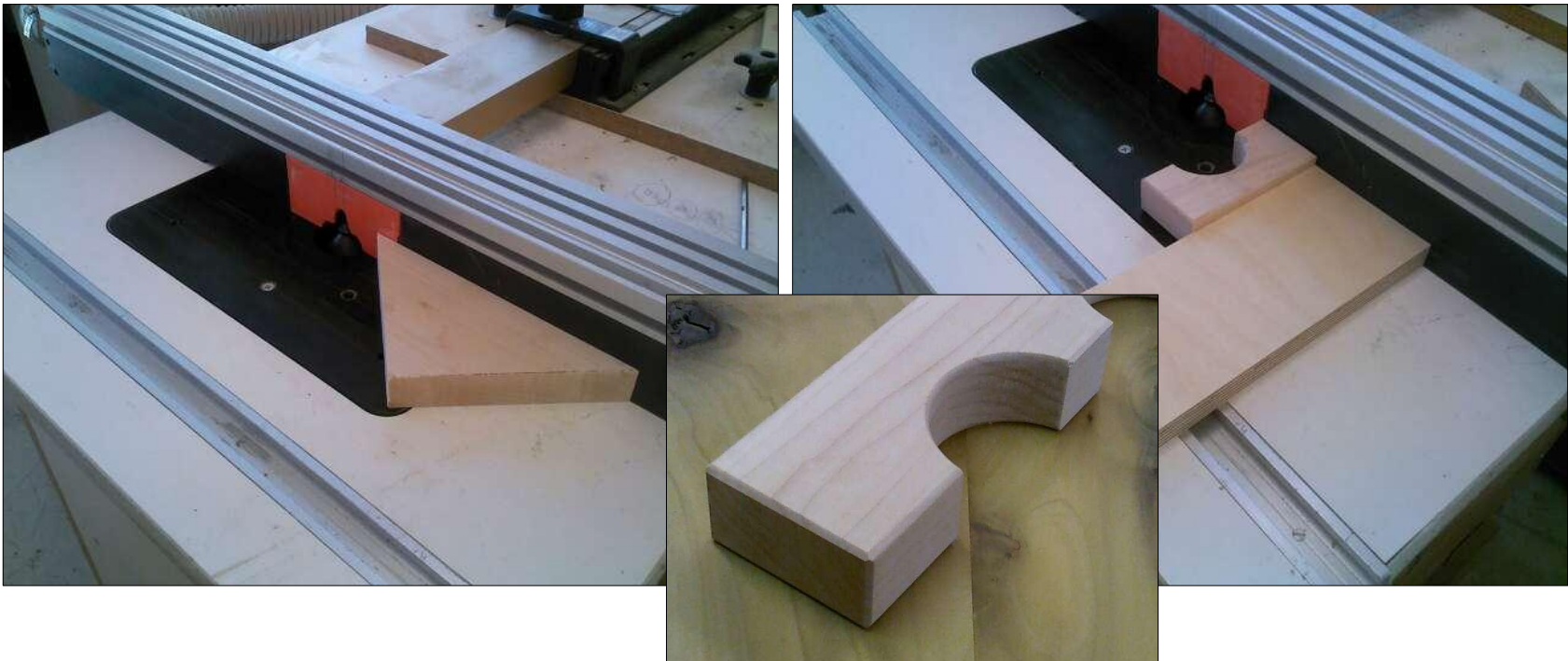
SAFETY NOTE: Use a push block to cut the block.



Step #8: Ease the Edges of the Blocks

Use a chamfering bit (*insets*) on a router table to ease the edges of each block.

For the smaller blocks, use a larger board as a push block to guide the block over the cutting edge (*photo lower right*).



Step #9: Sand the Blocks

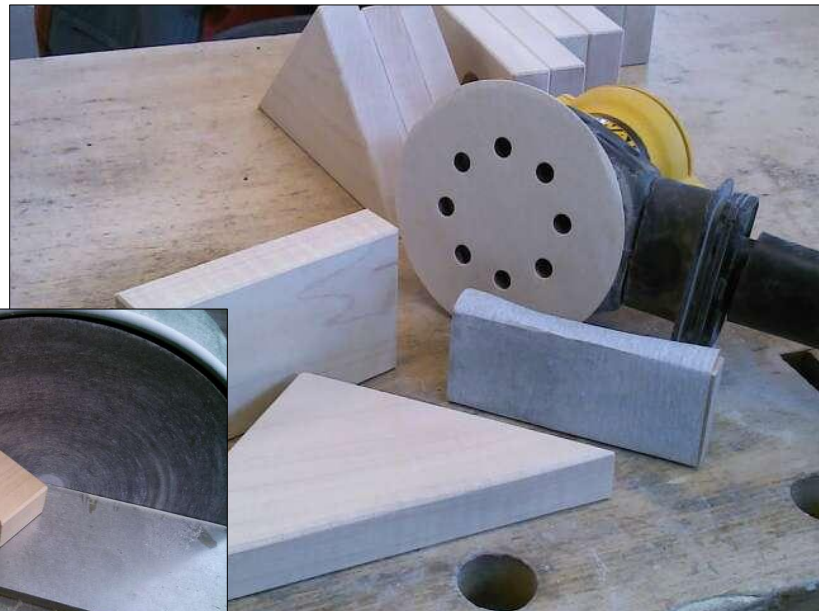
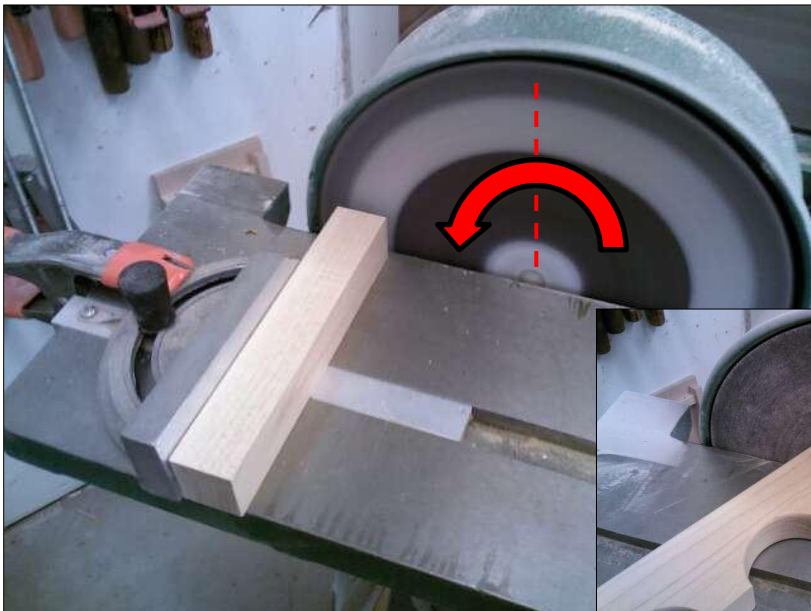
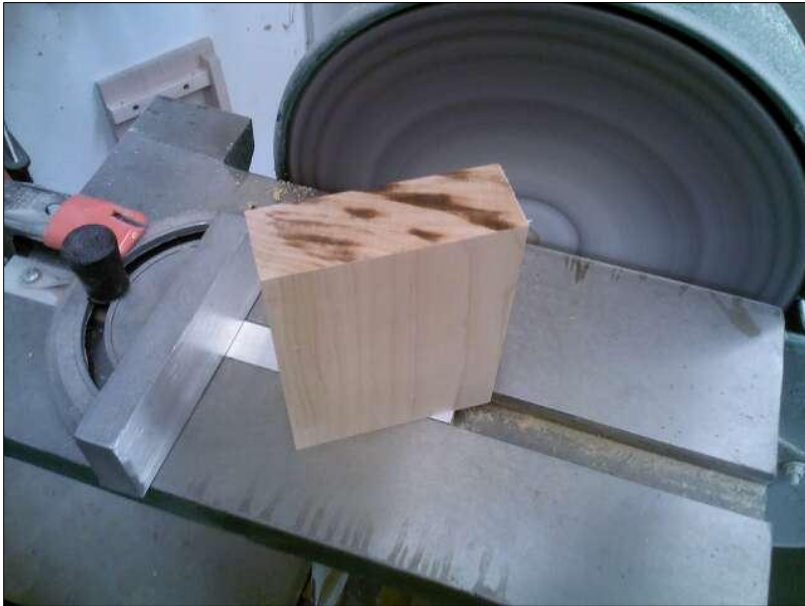
The cut edges of the blocks may have rough edges or burn marks from the table saw (left photo).

Using the miter guide on a disc sander to ensure a 90 degree edge and sand the ends of each block.

You can also use the disc sander to chamfer the corners of each block (*inset photo*).

Use a random orbit sander and sanding block to smooth the faces and edges of each block. Use 150 to 180 grit sandpaper.

SAFETY NOTE: You can only use half of the surface area of the disc on the sander because of the disc rotation (*lower left photo*).





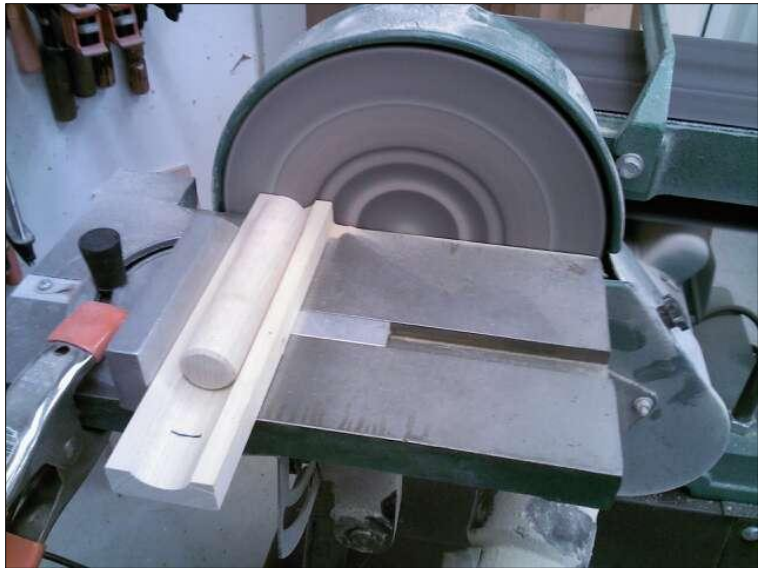
Step #10: Cut the Dowels:

The hard maple dowels was purchased from *Woodworkers Supply*. Part number 863-751 is for a 1" x 36" dowel rod. The cost is \$7.99. You will need 2 dowels for this set.

I cut the dowels with a hand saw. I made a simple jig to hold the dowel rod steady. *(You can cut the dowels with a miter saw or on a cross-cut sled, but there is a good chance the dowel will spin.)*

Cut the dowel to 4", 5" and 7" lengths.

Use a disc sander and a jig to sand and ease the ends of the dowels.





Step # 11: Make the Storage Box

I made a storage box to hold the block set. The storage box is constructed from poplar. You can use any type of wood. I used poplar because it is readily available, cheap and comes in wide boards.

The finished outside dimensions of the box is 20 ¼" long, 12 ½" wide and 7 ½" tall. Inside dimensions are 19" x 11 ¼" x 6 ¼". The box is sized for this set of blocks.

- Purchase 15 linear feet of ¾" rough poplar.
- Use a jointer to flatten one face of each board
- Use either a planer of a drum sander to make the opposite face parallel and dimension the boards to 5/8" thick.





Step #12: Box (Case) Construction

This storage box is constructed with through dovetail joints.

I used a Leigh dovetail jig to cut the dovetails. The process for making through dovetails are detailed with the supplied instruction manual for your specific dovetailing jig. Make the dovetails slightly proud (longer) of the case.

The box can be constructed with a variety of joinery techniques. Choose the technique that you are most comfortable with.





Step #13: Cut the Grooves for Box Top and Bottom

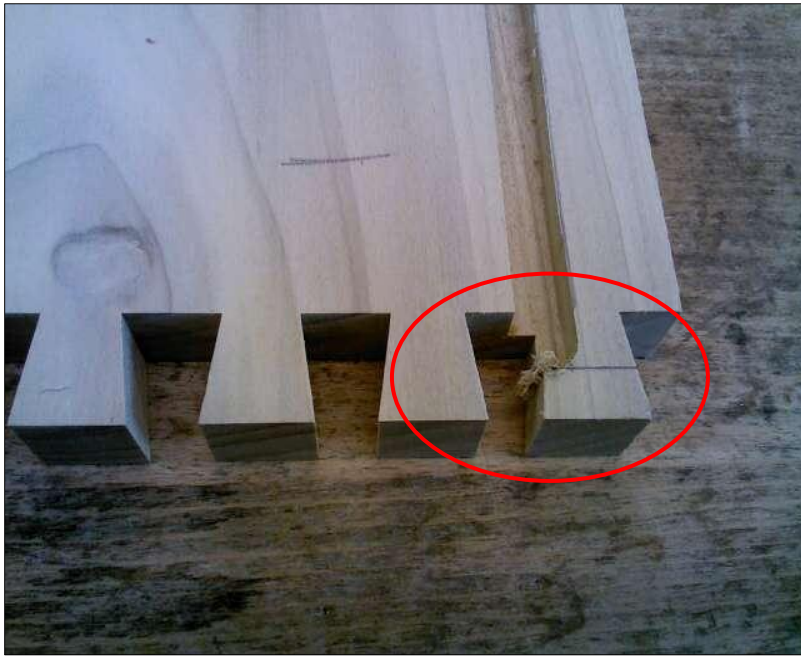
The top of box slides into grooves cut into the sides and back of the box (*bottom right photo*). The front top edge of the box is cut to accommodate the top rail.

The bottom of the box fits into grooves on all four pieces of the box.

The grooves are cut on a router table fitted with $\frac{3}{8}$ " and $\frac{1}{2}$ " straight router bits. The groove for the top is $\frac{3}{8}$ " and the groove for the bottom is $\frac{1}{2}$ ". The depth of the grooves is $\frac{5}{16}$ " (50% of the thickness of the sides, front and back).

Because of the through dovetail joints, all the grooves have to be cut just shy of the end of the boards. In the *bottom left photo* you will notice a pencil mark on the router table fence and another pencil mark on the "pin" board. These marks indicate the stopping points of the cutter. If you go through the end of the boards, then the groove will be exposed on the outside of the box. These are called "stopped" grooves. The *bottom middle photo* shows that the groove stops short of the end of the "tail".



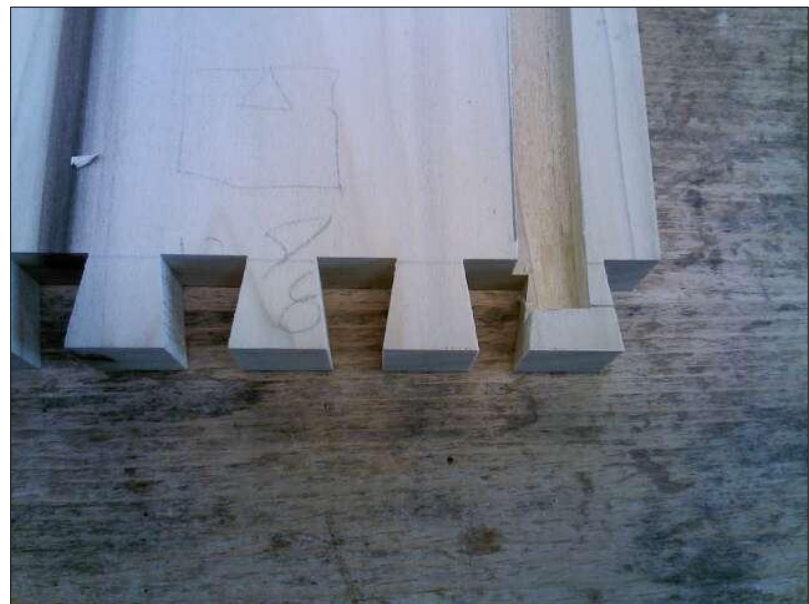


Step #14: Groove Clean Up

In order for the top and bottom to fit correctly, the ends of the grooves have to be squared off.

Use a chisel to square the ends of each groove.

CAUTIONARY NOTE: Because there is very little material left on the joinery ends of the boards, make the initial chisel cut across the grain. Use a very light touch or you will split-off the end of the tail or pin.

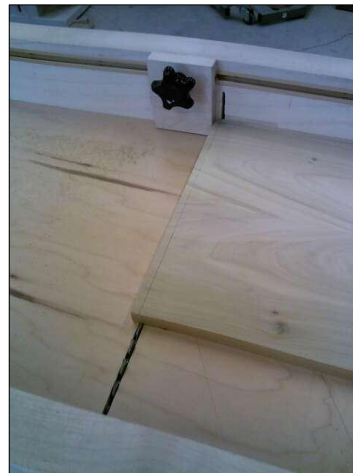
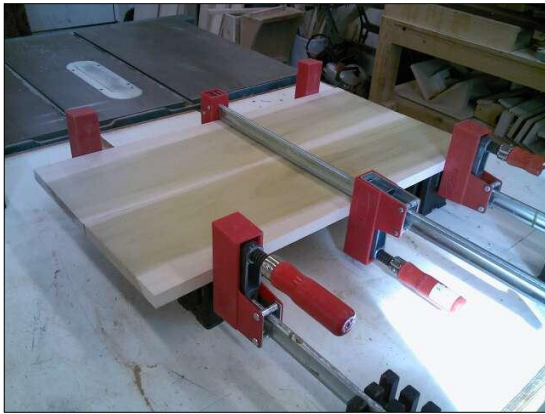


Step #15: Make the Bottom Panel

The bottom panel is 19 ½" long and 11 5/8" wide and is ½" thick. **(NOTE: Since the bottom panel is made from solid wood, you need to make it ¼" narrower than the actual inside groove to groove measurement. This will allow for wood expansion).**

The bottom is made of 2 boards. Rough cut size is 7" x 21"

- Purchase ¾" thick rough lumber, 7" to 8" in width.
- Flatten one face of each piece of lumber using a jointer.
- Use a planer or a drum sander to make the opposite face parallel and sized to ½" thick. *(If using a drum sander, finish sand to 180 grit.)*
- Use a jointer to make the edges 90 degrees to the face of the board.
- Saw the boards on a table saw to 7" wide.
- Cut the boards to a rough length of 21".
- Glue up the two boards. Let the glue set for at least 4 hours.
- Use a cross cut sled to cut the panel to 19 ½" long.
- Saw the panel to 11 5/8" wide.
- Use a block plane and ease all the edges of the panel.

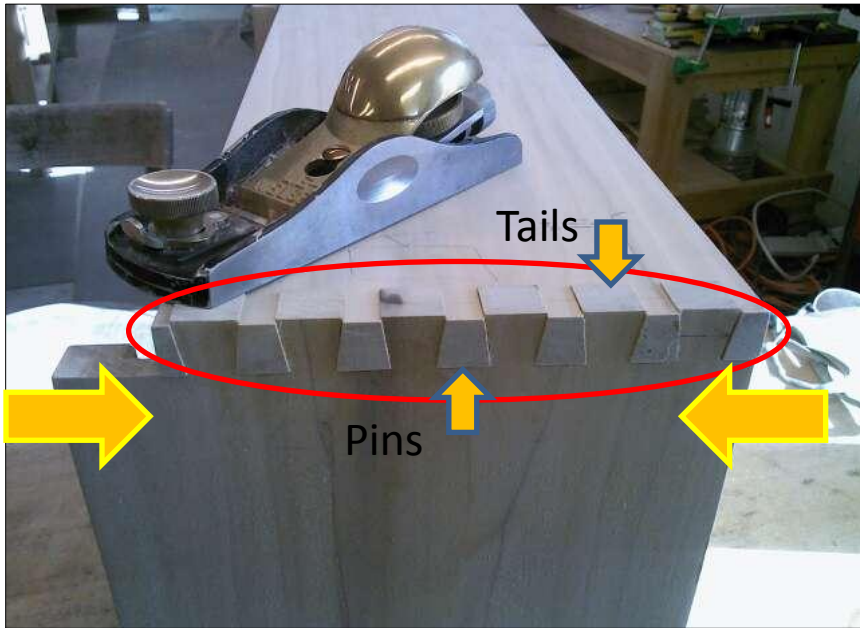




Step #16: Glue the Box

- Sand the inside surfaces of the box and the bottom panel with 180 grit sandpaper.
- Cut off the top “tail” on the front of each of the side pieces (*photo top left*). Use a chisel to remove any remnants of the “tail”.
- Dry fit the box with the bottom panel before gluing the case.
- Have your clamps setup before you apply the glue.
- Use *Elmer’s* white glue to glue the box together.
 - A small spot of glue is all that is needed on the **inside edges** of both the tails and the pins (*see highlight area on lower left photo*). Apply glue to the top and bottoms of the pins and tails.
 - **NOTE:** Do not glue the bottom panel. The panel is cut narrower and floats in the grooves to allow for wood expansion across the width of the panel.
- Assemble the box with the bottom in place. Apply clamps on all four corners, on both the top and bottom. Ensure that the dovetail joints are closed. Let glue dry 4-6 hours before

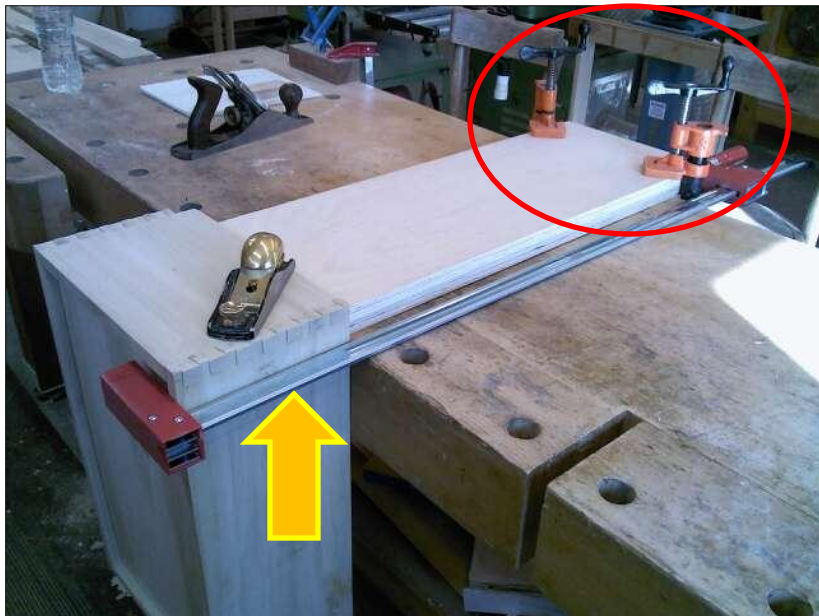




Step #17: Dovetail Clean UP:

After the glue has set, the dovetails will need to be cleaned up since they were cut slightly proud of the case (*top left photo*).

- Use $\frac{3}{4}$ " plywood to make a workbench extension in order to rest the box on.
 - Secure the plywood extension to the workbench using bar clamps (*highlighted in bottom left photo*).
- Set box over the plywood workbench extension and use two bar clamps to secure the box to the workbench (*bottom photos*).
- Use a low angle block plane to remove the excess material.
 - NOTE:** Plane from the ends towards the middle of the box in order to avoid breaking the end "pins" (*top photo*).
- Use either a random orbit sander or sanding block to finish sand the outside of the box.



Step #18: Make the Top

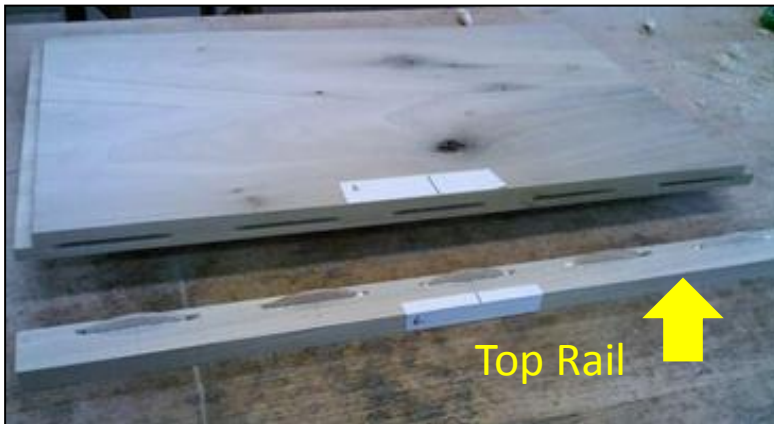
The top panel is 19 ½" long and 11 ½" wide and 5/8" thick. It will have an extra piece added to the front edge of the panel (*step #XX*)

The top has a 3/8" wide by 5/16" thick rabbet joint on the sides and the back.

The bottom is made of 2 boards. Rough cut size is 7" x 21"

- Purchase ¾" thick rough lumber, 7" to 8" in width.
- Flatten one face of each piece of lumber using a jointer.
- Use a planer or a drum sander to make the opposite face parallel and sized to slightly more than 5/8" thick. (*If using a drum sander, finish sand to 180 grit.*)
- Use a jointer to make the edges 90 degrees to the face of the board.
- Saw the boards on a table saw to 7" wide.
- Cut the boards to a rough length of 21"
- Glue up the two boards. Let the glue set for at least 4 hours.
- Run panel through drum sander and size to 5/8" thick.
- Cut the boards to the final size: 19 ½" long and 11 ½"
- Set table saw to cut a 3/8" wide cut (*allow for blade thickness*) and 5/16" high
 - Run panel through saw (*lower left photo*) on both sides and the back of the top
- Reset blade to 5/16" wide (*allow for blade thickness*)
 - Run panel *vertically* through saw (*lower middle photo*) on both sides and the back of the top (*inset photo, lower right*).





Step #19: Add the Top Rail

The top panel has a rabbet joint on the sides and back of the top panel. The front has a "rail" that is joined to the panel along the front edge with #10 biscuits.

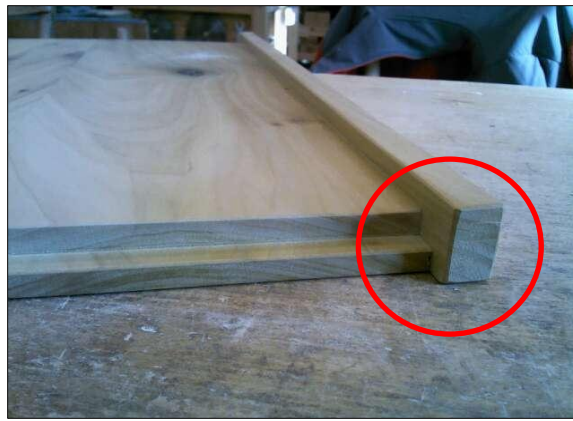
- Cut a piece of poplar 5/8" thick, 20 1/4" long and 1 1/16" tall.
- Mark the position for 5 biscuits on the front edge of the panel and the inside face of the top rail.

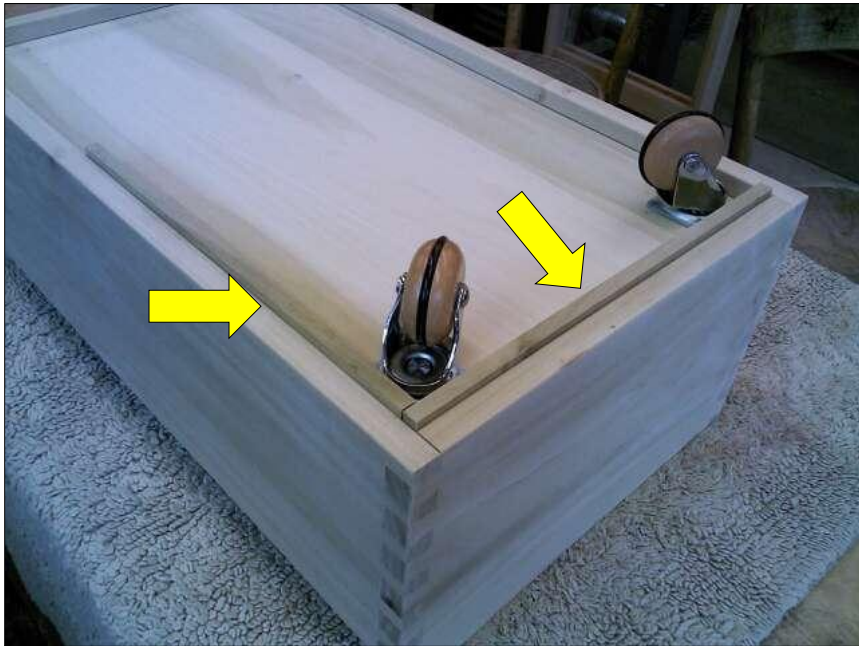
NOTE: The top rail is flush to the bottom of the top panel.

- Apply a piece of tape and mark the center of the panel and the center of the rail (*top left photo*).

NOTE: The rail overlaps the sides of the top panel (*bottom right photo*). The center marks ensure proper alignment of the rail.

- Apply glue to the biscuit slots in both the rail and the top panel.
- Place and seat the biscuits into the rail.
- Align rail and top panel to center marks and attach the rail to the top panel.
- Apply clamps to secure rail to top panel (*bottom left photo*).





Step 20: Add Wheels

I added wheels to the box to make it a little easier to maneuver since the blocks make the box heavy.

The box has a handle and swivel casters mounted to the bottom.

The casters were purchased from **Woodworker's Supply 1-800-645-9292.**

The casters are SELBY *Tomorrow's Casters*. The casters feature wheels that are solid, finished Beechwood. Part #141-755 - 2" OD caster w/tire x 7/8" wide, 2-5/8" overall height, 1-5/8" square plate. \$6.99 per caster.

- Use 3/8" spacers (highlighted in top left photo) to position the wheels.
- Secure the wheels with 3/8" long screws (*remember the bottom is only 1/2" thick so don't use screws that will go through the bottom panel*).





Step #12: Apply Finish

The box is finished with shellac. You can purchase Zinsser shellac is a spray can. Shellac is an alcohol based finish.

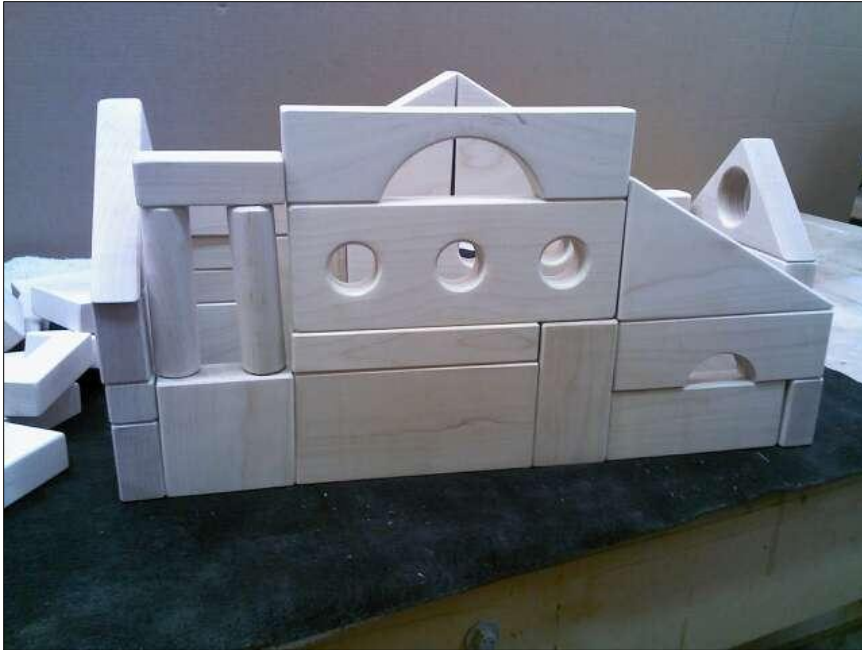
Remove the wheels before applying the finish.

Spray in a well ventilated area. Apply several coats as specified on the can.

The blocks **DO NOT** have any finish on them. I recommend that you do not finish them since children will be putting them in their mouth.

Completed Project

This block set contains 112 pieces of various shapes and sizes. You can supplement this set with additional blocks as you wish.



The set fits nicely into the box. Once the kids start playing with them, it is doubtful that the blocks will ever be stacked as neatly as shown below.

