

Alphabet Block Wagon

These Instructions are available to members of the Valley Woodworkers of West Virginia free of charge. However, they may be used only to make items for your own use. Use of these instructions to make items for sale is prohibited.

The alphabet block wagon is used as a storage place for alphabet blocks and as a toy itself.



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Materials Required

Rough hardwood lumber - Your choice of species; ~3-1/2" wide and 6' long (1.75 bdf).

Axels – (2) 5/16" diameter x 12-13/16" long cold rolled steel (West Virginia Steel 20' lengths cut to 12' and 8' lengths)

Wheels – 3" diameter x 1" wide x 5/16" bore soft rubber (ER Wagner Cushionex # 1G003146194; Reid Industrial Supply WC-1304-25

(8) Washers – 1/4" SSA Flat Washer (Rural King bulk)

(4) Hubcaps – Axle Cap Nut (Fastenal Item 11120390, 100 / package)

(8) Screws – 8 x 1-1/2 flat head square drive unplated (McFeeleys 0814-FSL-M)

Finish – ML Campbell Krystal post-cat conversion varnish, semi-gloss (~2.5 gal/100 cradles)

Materials to make 50 wagons:

Lumber - The total length needed for one wagon is about 52" rough length. Two boards this long cannot be cut from an 8' long board. 50 wagons require about 220' of clear lumber 3-1/2" wide, or 110' of clear lumber 6-3/4" wide.

Axles – 100 12-13/16" long (with ends beveled slightly ~ 1/32"). This is about 110 linear feet.

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NOTE! The final product is to be free of any cracks and knots larger than a pin head. Perform quality control throughout the project to identify parts that do not meet these requirements and discard them.

Prepare stock for sides and ends



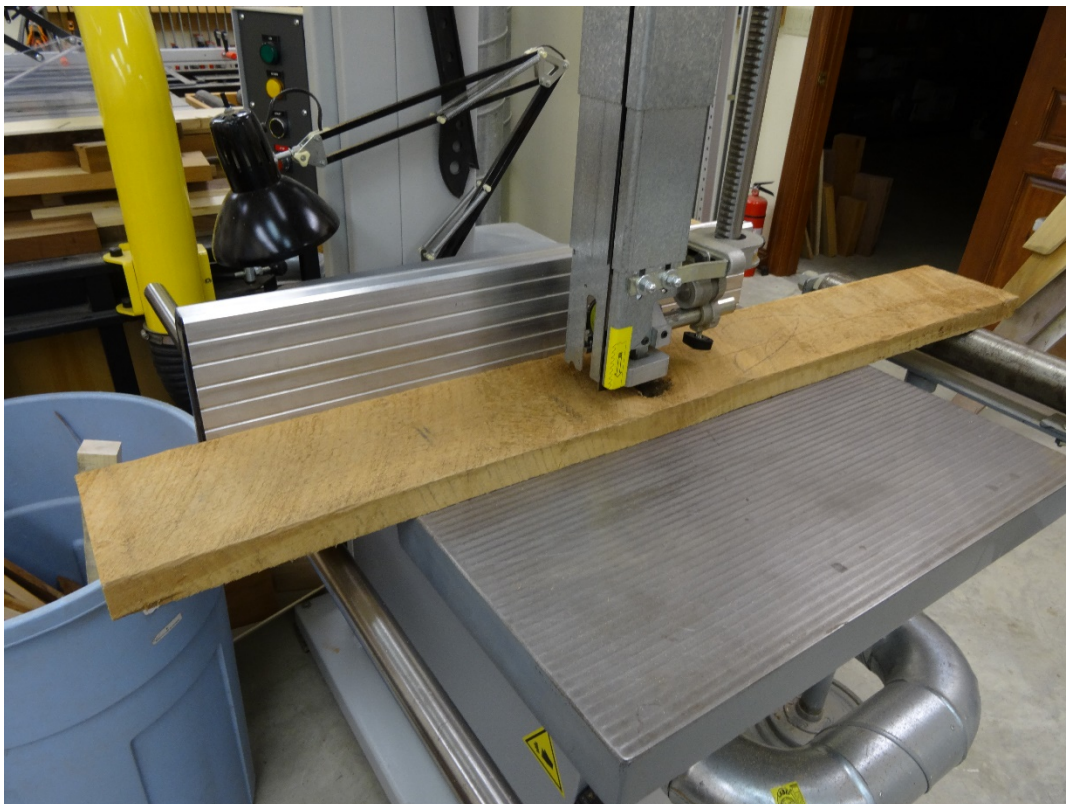
Cut the rough boards to 18" long. This is long enough to make one side or two ends. If the stock is clear and not twisted or bowed significantly, cut the stock to 36" long, which can yield two sides or four ends. Cut the stock to 27" and this will yield one side and one end. Keep in mind, the stock likely contains cracks and knots, so your yield may be less than expected.

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Joint one edge of the rough board until it is straight and free of defects.



Rip the board to 3-1/2" wide using the band saw fitted with a 3/4" or 1" wide blade. Maintain the jointed edge next to the fence. Save the off-cut for firewood.



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Joint the face of the board until it is flat.



Re-joint the previously jointed edge with the surfaced face of the board tight against the fence to ensure that it is square with the face.



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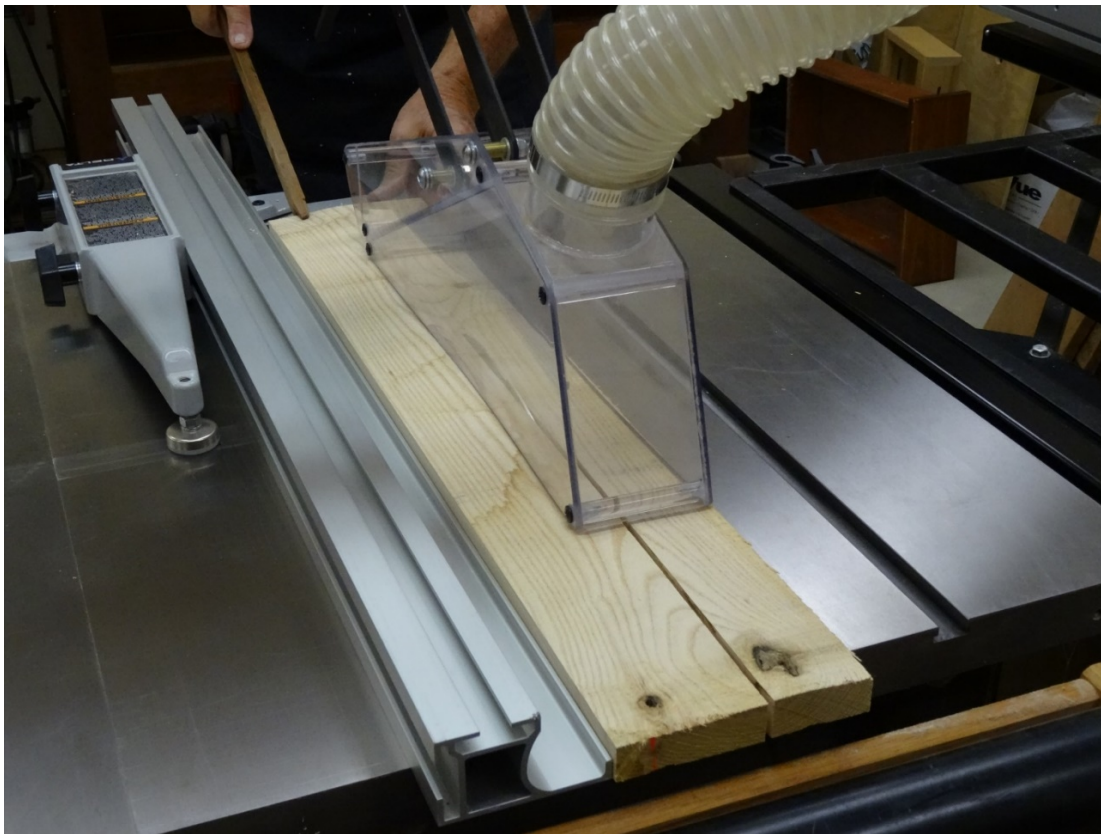


Plane the face of each board that was not jointed to approximately 0.650" thickness.

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Sand both faces of the boards with 120 grit to a total thickness of 0.625 ± 0.010 " (5/8").



Rip the boards for the sides to $3\text{-}3/16$ " wide. Rip the boards for the ends to $2\text{-}15/16$ " wide.

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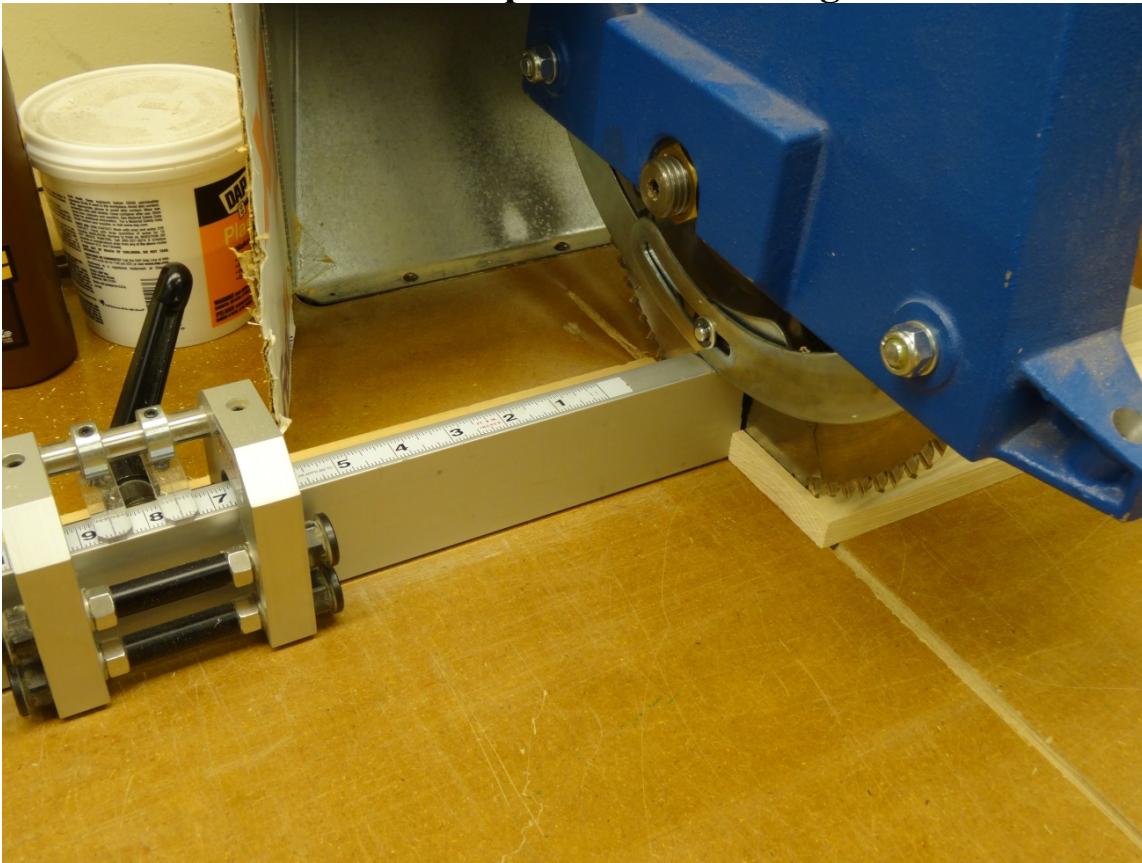
Joint the sawn edge of each board 1/32" to remove any saw marks.

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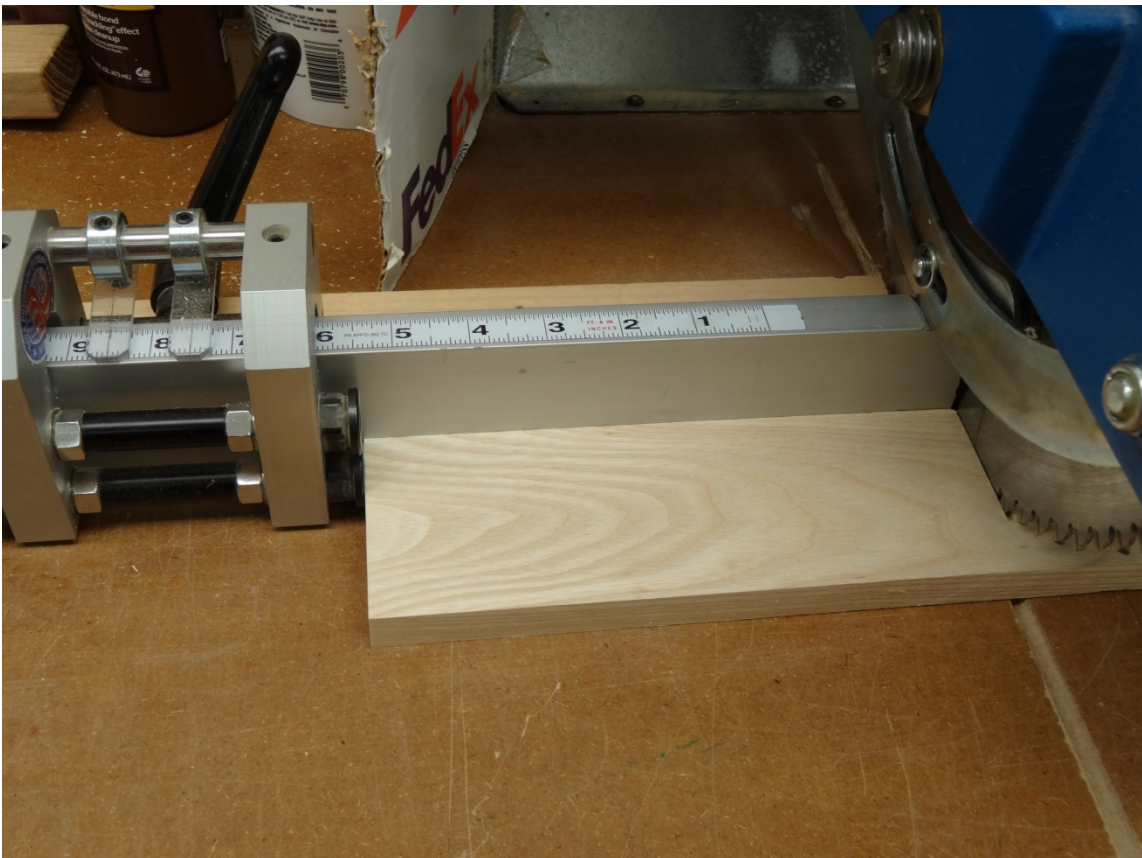


Sand both edges of each board to remove machine marks. Sand to a final height of 3.125" (3-1/8") for the sides and 2.875" (2-7/8") for the ends.

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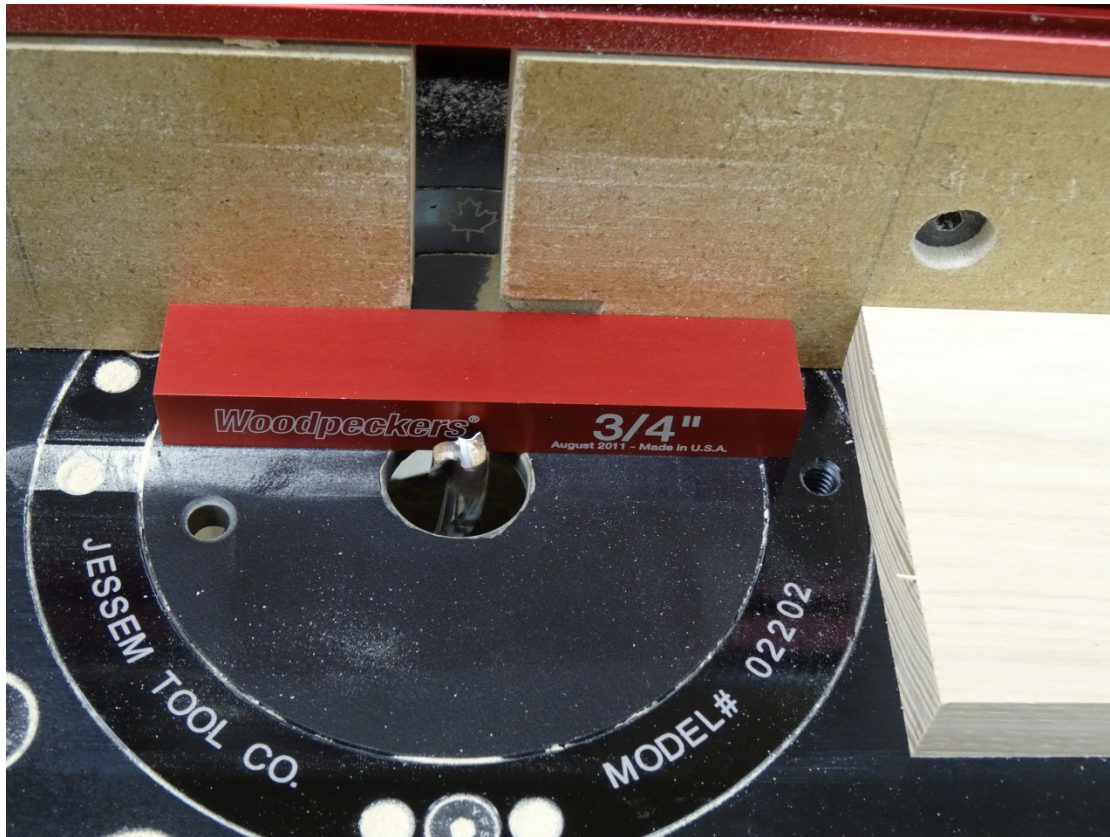


Cut boards to length. Trim end square, then cut ends to 8-1/2" long and sides to 16-1/2" long.

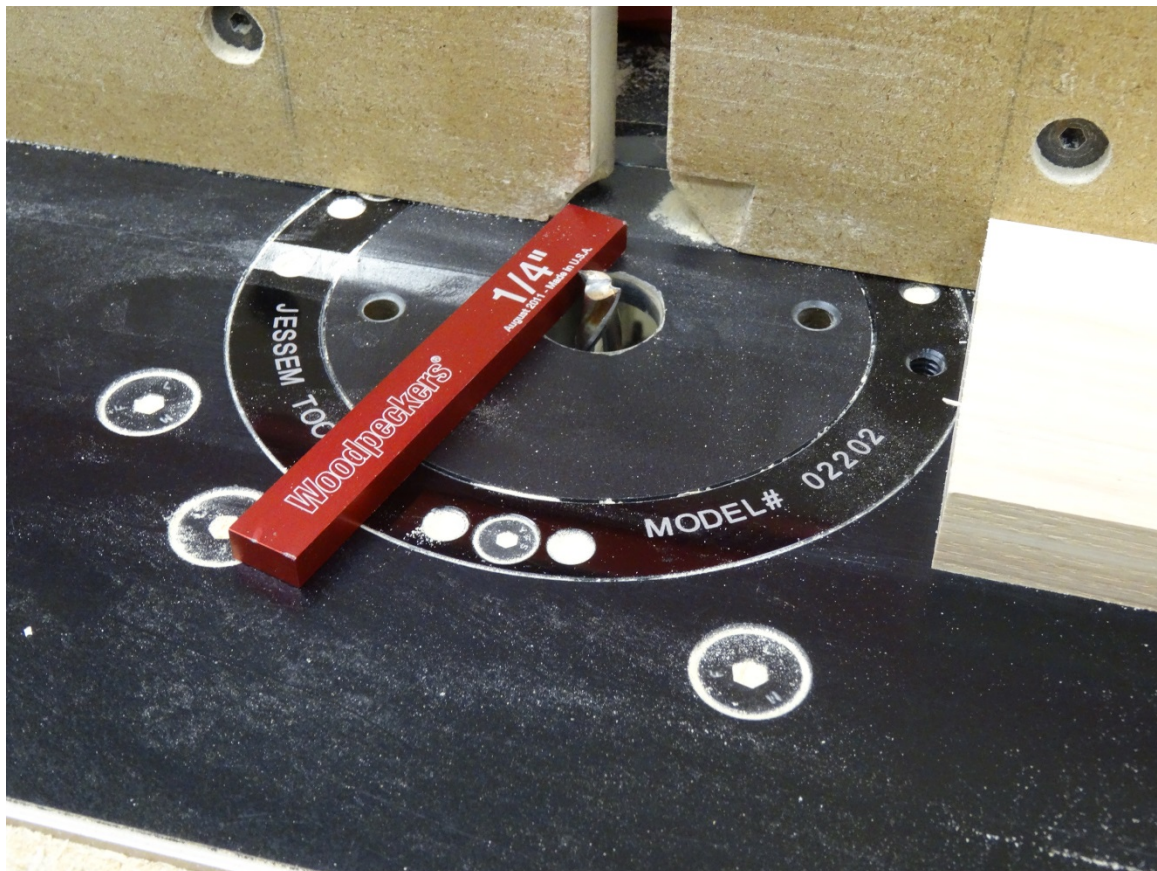


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Route grooves in sides and ends



Install 3/8" router bit in Router Table. Set the distance to the fence to 3/4" and the height to 1/4"



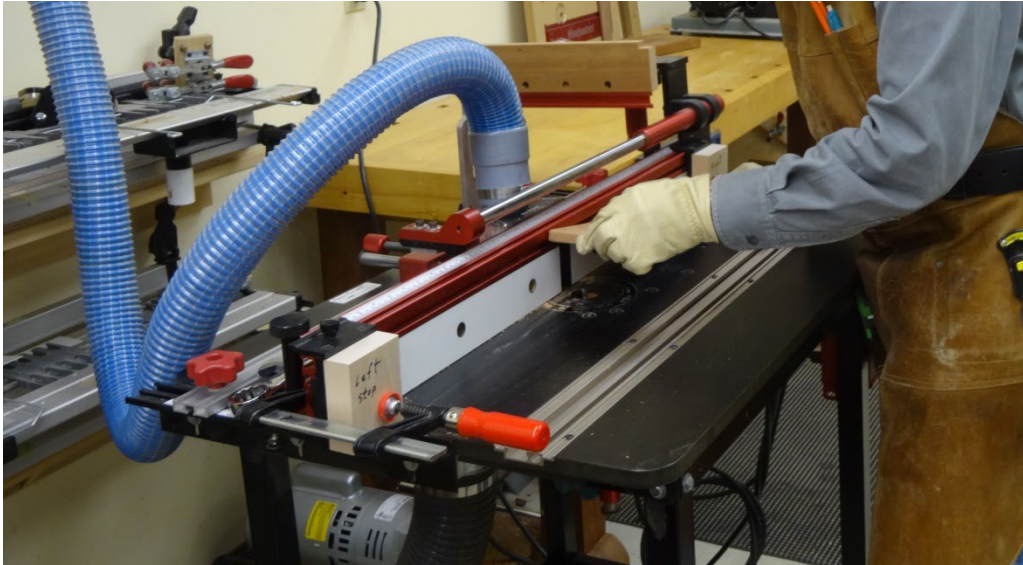
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Select the best side of the end and face it up. Select the best edge and face it away from the fence. Cut a groove in each end piece. Feed the board slowly and use hold-down and feather boards to keep the end tight against the fence and table top.



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With the $\frac{3}{8}$ " bit still at $\frac{1}{4}$ " high, set the distance from the fence to the router bit to $\frac{7}{8}$ ". Install a right and a left stop such that the distance from the stop to the far side of the router bit is $15\text{-}11/16$ ". Select the best face of the side and face it up. Select the best edge of the side and face it away from the fence. Place end of the side against the right stop and tight to the fence. Slowly lower the side onto the rotating router bit. Hold the side tight against the fence and the table top and feed it slowly until it reaches the left stop. Then reverse the direction and pull it back to the right stop while continuing to hold the side tight against the fence and table. Push the side toward the left stop about 1-2" and pivot the side up away from the router bit while continuing to hold the side tight against the fence.



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Drill axle holes and screw holes

Drill the axel holes:

Install a 21/64" brad-point drill bit in the drill press. Adjust the fence so that the distance from the fence to the center of the bit is 1/2". Adjust the depth stop so that the spurs of the bit just barely cut into the backup board. Adjust the right and left fence stops so that the distance to them is 13-7/8" from the center of the bit. Place a side on the table outside up and the bottom groove towards the fence. Slide the side against the fence and the left stop to drill the right axle hole. Slide the side against the fence and the right stop to drill the left axle hole.

Drill and countersink the screw pilot holes:

Install a 3/8" countersink with an integral 3/16" brad point drill bit. Adjust the distance from the fence to the center of the drill bit to 9/16". Adjust the right and left fence stops so that the distance to them is 15-9/16" from the center of the bit. Adjust the depth stop so that the counter sink cuts a hole 3/16" deep on the straight side. Place a side on the table outside up and the bottom groove towards the fence. Slide the side against the fence and the left stop to drill the right screw hole. Slide the side against the fence and the right stop to drill the left screw hole. Rotate the side 180° and drill two screw holes on the top of the side.



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Drill a rope hole in one end:

Install a 9/32" brad point drill bit in the drill press. Adjust the fence so that the distance from the fence to the center of the drill bit is 3/8". Adjust a fence stop so that the distance from the stop to the center of the drill bit is 4-1/4". Place the end against the fence and the stop with the grooved side down and towards the fence. Drill the rope hole.

Adjust the depth stop so that the bit spurs just barely cut into the backup board.

Round over corner of sides

Method 1 - Install a 7/8" diameter flush trim pattern bit in the router table. Place the round-over jig onto of a side corner. Adjust the height of the bit so that the top bearing rides against the jig and the flutes of the bit are slightly above the side. All round-overs are done with the round-over jig on top of the side on the upper right corner of the side. Round-over the diagonal corners on one side of the side and flip the side over and round-over the two remaining diagonal corners.

Method 2 – **NOTICE! This method requires the side to be cut to the exact width shown in the drawing. It must be + .000", - .0010" the width from the edge of the jig to the jig fence.** Install a 2-15/16" diameter rub bearing and a 2-15/16" diameter straight cutter on the shaper for counter-clockwise rotation. Position the rotation selector switch for counter-clockwise rotation. Place the side in the jig so that the end of the side is flush with the end of the jig. This position can be felt using your finger.



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Start the cut an inch or so to the right of the corner to be cut. Move the jig in a clockwise direction to make the cut while holding the jig tight against the rub bearing. Reposition the side as needed to cut the other corners.

Install a 1/8" round-over bit in the router table. Adjust the height of the bit so that the bottom of the cove on the bit is a few thousandths below the top of the table. If the bit is too high, a groove will be cut below the round-over that is difficult to remove. Round over the top, bottom and end edges of the sides. Also round-over the top and bottom edges of the ends.



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Flap sand the edges of the sides and ends to fair the round-overs and remove any sharp edges.

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Make the wagon bottom



Cross-cut a piece of $\frac{1}{2}$ " hardwood plywood $14\text{-}7/16$ " wide and the full 48" width of the plywood. Then cut to $8\text{-}1/16$ " long.



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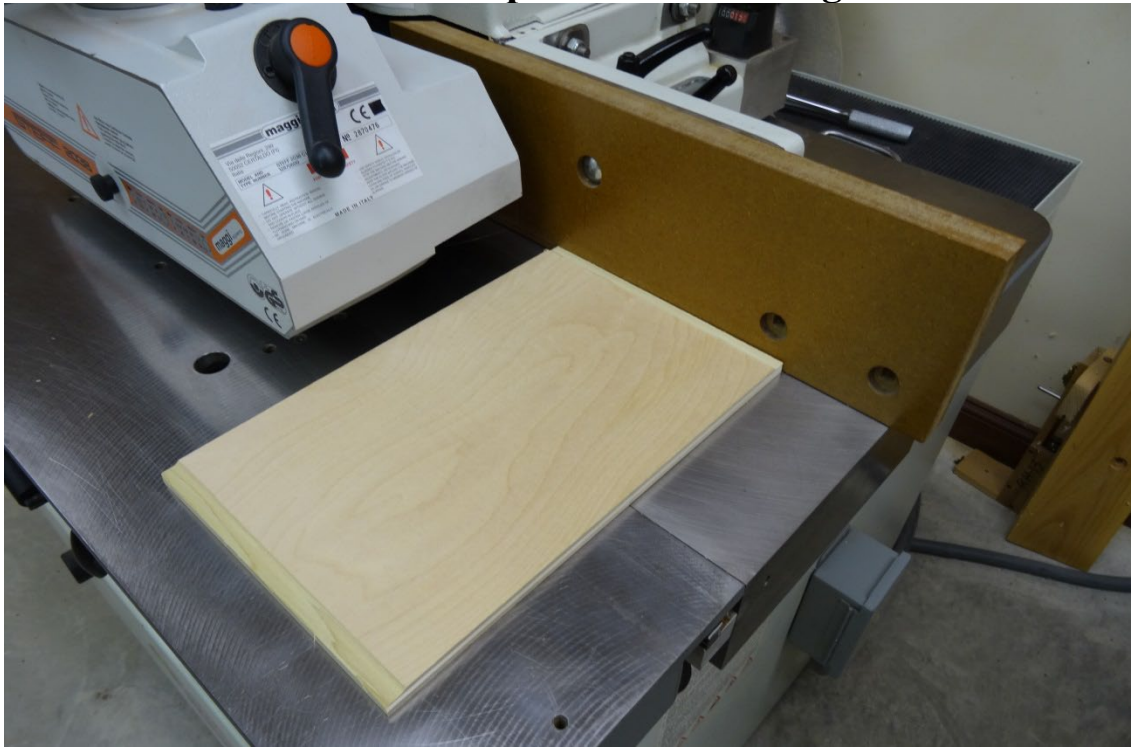


Install a raised panel back-cutter on the shaper spindle with the coved side down. Set the height of the cutter so that it cuts a 3/8" tenon that slips into the grooves cut into the sides and ends. Adjust the fence to minimize the opening and so that the width of the flat portion of the tenon is 5/16".

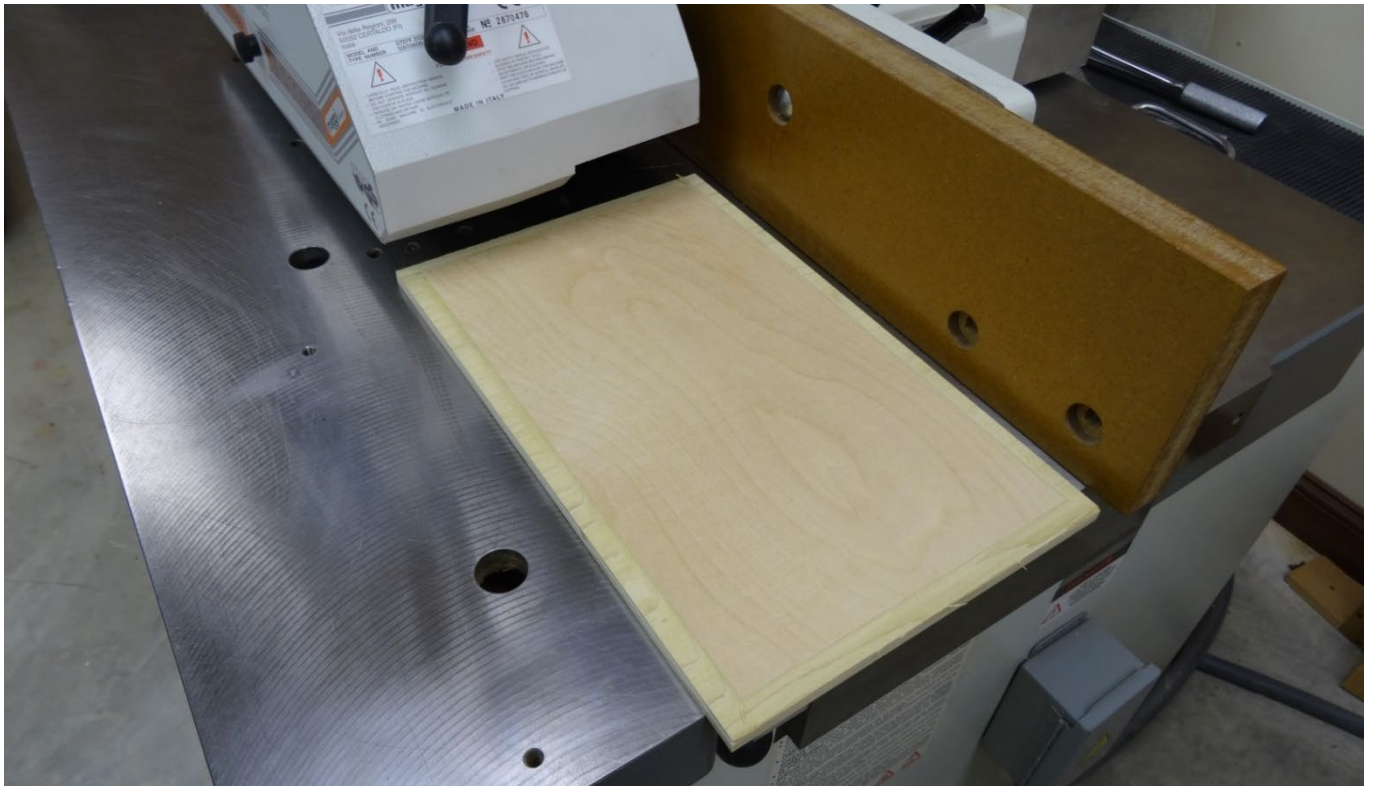


Place the bottoms on the shaper table good side down.

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Using the power feeder, cut the tenons on both ends



Cut the tenons on the sides. Flap sand the tenoned portion and edges to remove loose material and sharp edges.

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Assemble the wagon box



Assemble two sides, a bottom and two ends (with a rope hole in only one end). Then place the wagon in the assembly jig. Position the sides up against the side stops. Insert the frame that holds the sides and ends against the jig. Drill $7/64$ " pilot holes for the screws carefully aligned left and right to the center of the end. Install #8 x 1-1/2" flat head screws.

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Glue dowel buttons in the screw holes. Place the wagon on the workbench on its side. Use a small brush to place liquid hide glue in each countersink recess. Align the grain of the dowel button with the grain of the side and tap it into place. After all four buttons are installed on one side, flip the wagon over and place it on top of a button installation jig. This jig has two dados cut in it at the button locations to prevent the just installed buttons from being damaged while installing the new buttons. Place glue in each countersink recess and install the remaining four buttons.

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Finishing the block wagon



Suspend the wagon above the round-table using a cardboard box. Apply one coat of ML Campbell Krystal Semi-gloss post catalyzed varnish to the bottom and then the top sides of the box. Allow about 30 minutes and then sand the finish until it is smooth using a 3M Fine sanding pad. Use a brush head on the vacuum to remove the sanding dust. Then use a tack cloth for final cleaning. Apply a second coat of finish to the wagon box.

It takes about 2.5 gallons of finish per 100 wagons.

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Install the wheels



Place a hubcap in the hubcap jig and tap in a 5/16" cold rolled steel axle 12-13/16" long. Place a 5/16" SAE washer and then a 3" diameter, 1" wide soft rubber wheel followed by a second 5/16" SAE washer.



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Slide the axle assembly into the wagon axle holes while maintaining the hubcap in the hubcap jig. Place a 5/16" SAE washer, wheel and second washer on the axle.



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Use a ½” pipe nipple to hold the hubcap straight while tapping it in place.



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Make the pull rope



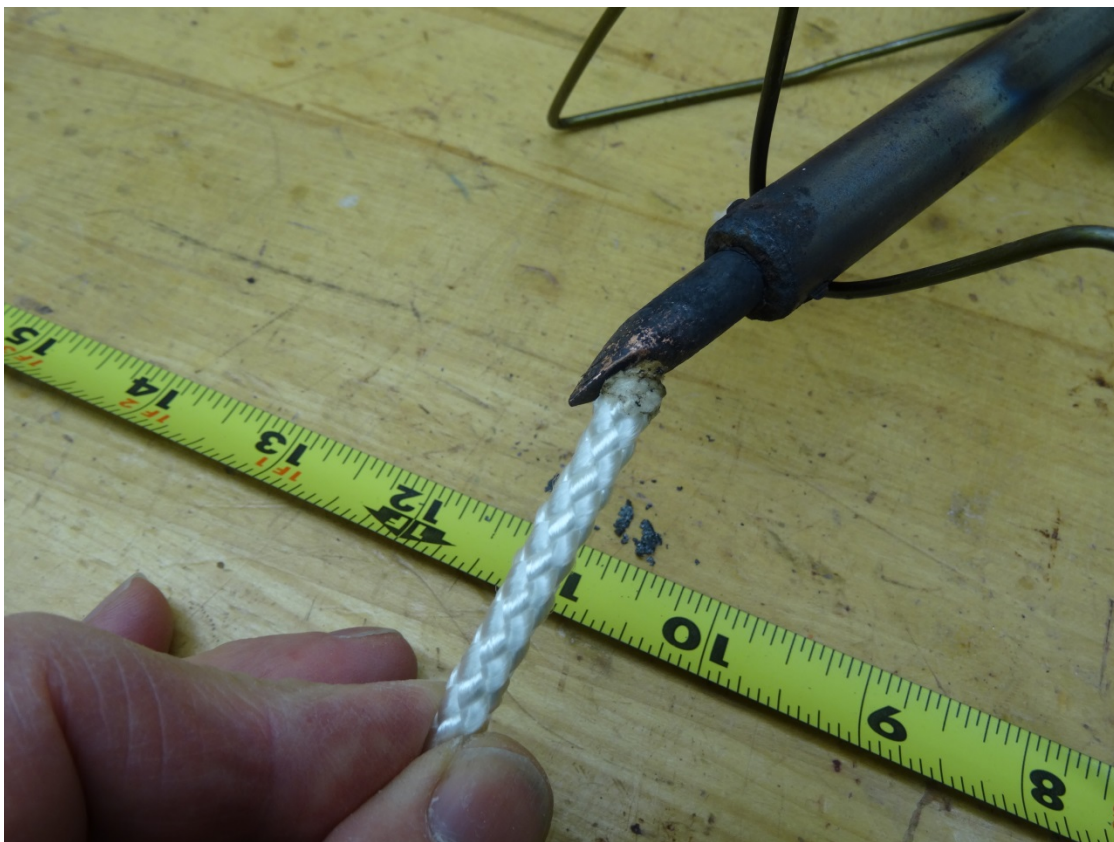
Apply one coat of salad bowl finish to the ball and let it dry for at least 24 hours.

Install a 1-1/8" Forstner bit in the drill press. Use it to center the ball drilling jig and then clamp the jig to the drill press table. Replace the Forstner bit with a 1/4" brad point bit. Drill a 7/8" deep hole into the center of the end grain of the 1-1/4" diameter ball.

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Cut $\frac{1}{4}$ " diamond braided polypropylene rope to 16" long using a soldering iron. Use the soldering iron to smooth the end of the rope.



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Then use your gloved fingers to bring the diameter of the end to a 1/4" tapered end. This must be done while the rope is hot.



Prepare to glue the ball to the rope.

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Fill the hole in the ball about one-half full with glue. Then push the rope into the hole while twisting it to ensure that the rope bottoms in the hole. Wipe off the excess glue with a wet rag.



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Let the glue dry for at least 24 hours before using the rope.

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Wrap the wagon for delivery



Assemble the materials needed.

- 16" wide shrink wrap (Zoro G0837347)
- Packaging tape
- Hot air gun
- Scissors
- Wrapping tool