

SketchUp: Another “Power” Tool To Improve Your Shop Work

A SAPFM Newsletter Article and Exercise

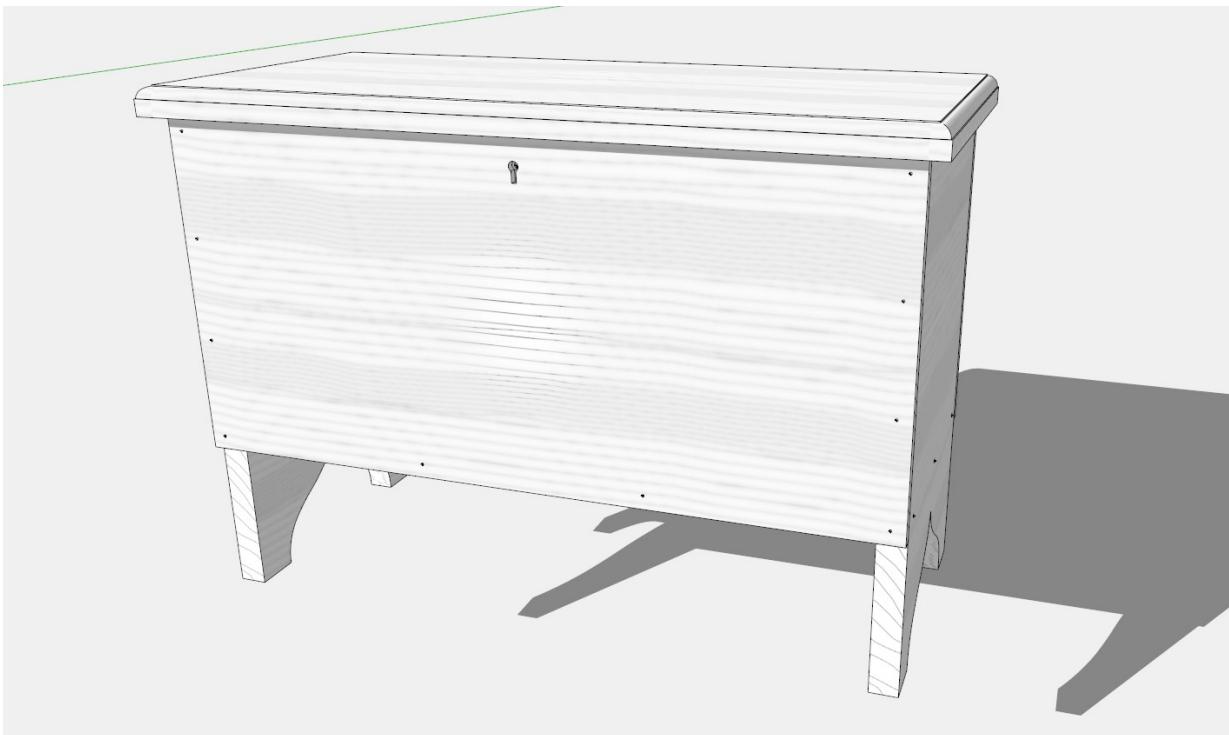
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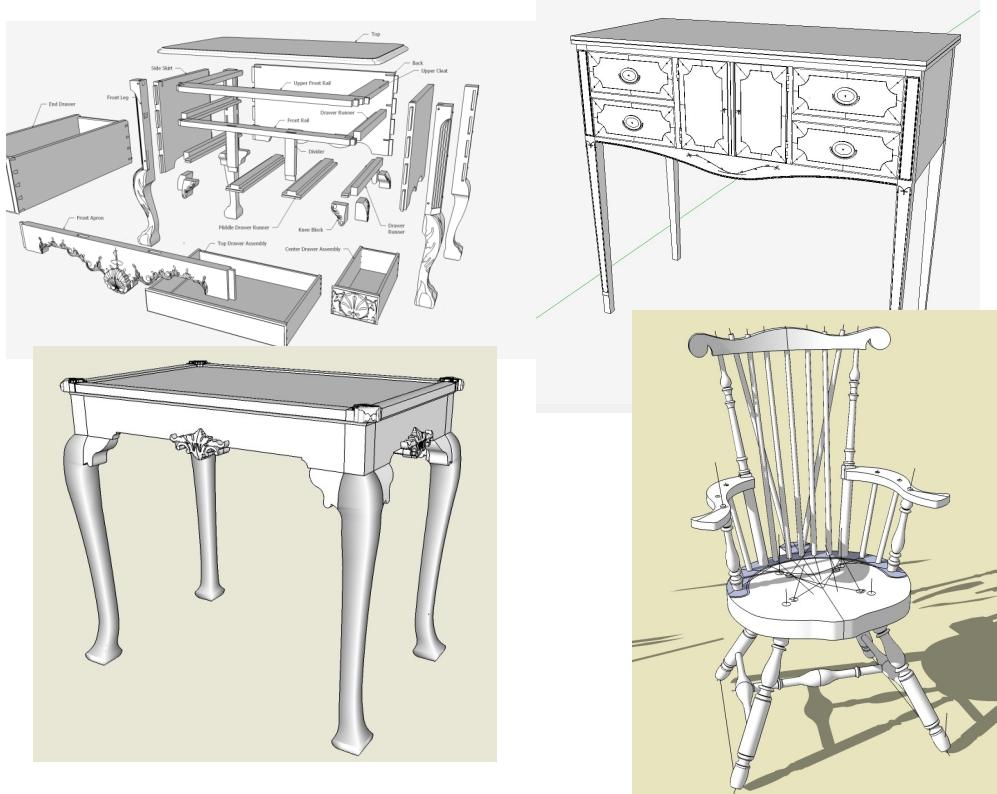
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Following is a download exercise in using SketchUp to create a design document for a Small Six-Board Chest as shown below. It's recommended that you print this document to have a ready reference while executing the SketchUp steps in design.

There are ten itemized steps in creating this 3D model, and each step is supplemented with computer screen captures, drawings, and on-line videos. To access the video, just click your mouse on the magenta color text links.



The Six Board Chest, with its basic rectilinear shapes, is an excellent beginning furniture project in SketchUp. But there is plenty of versatility in SketchUp to capture more complicated and angular pieces. I've shown below, a few pictures of more complex period furniture pieces. These pictures are 3D models from which detailed dimensioned drawings and full size templates made it possible for me to construct them in the shop.



The Small Six-Board Chest In the following pages, I will show steps in SketchUp for making a Period piece of furniture. See Figure 1. I've selected a Small Six-Board Chest found in a book by Russel Hawes Kettell titled *The Pine Furniture of Early New England*. In this book, the author provides a simple one-page drawing. As an exercise, several weeks ago I used SketchUp to duplicate the original style and content of his drawing. This is shown in Figure 2, on the following page. His drawing is remarkably good and could be used for shop construction. However, it omits details that make construction less efficient.

In addition to displaying and describing these steps in the following pages, I will also provide links to video vignettes for all the procedures.

Video 1—Import an Image and Trace Over



Figure 1—the chest under construction

Step 1 In my reproductions of period furniture, the first step is almost certain to be an import of a picture into SketchUp. The picture may be from a smartphone or a scanned photo from a book. In any case, this step is important for capturing shapes and sizes of the furniture components.

Snap a picture or scan Figure 2. In SketchUp, click on File in the Menu Bar, then choose Import from the pop-up menu. That will open the dialog box shown in Figure 3 (The box looks different on the Mac, but it works the same.) In the top window, tell SketchUp what file and folder holds the photo or scanned image.

On the right side of the dialog box are three buttons for import choices. The first option, Use as Image, is the easiest for replicating furniture pieces.

Orient the SketchUp screen for a front view, so the image will be

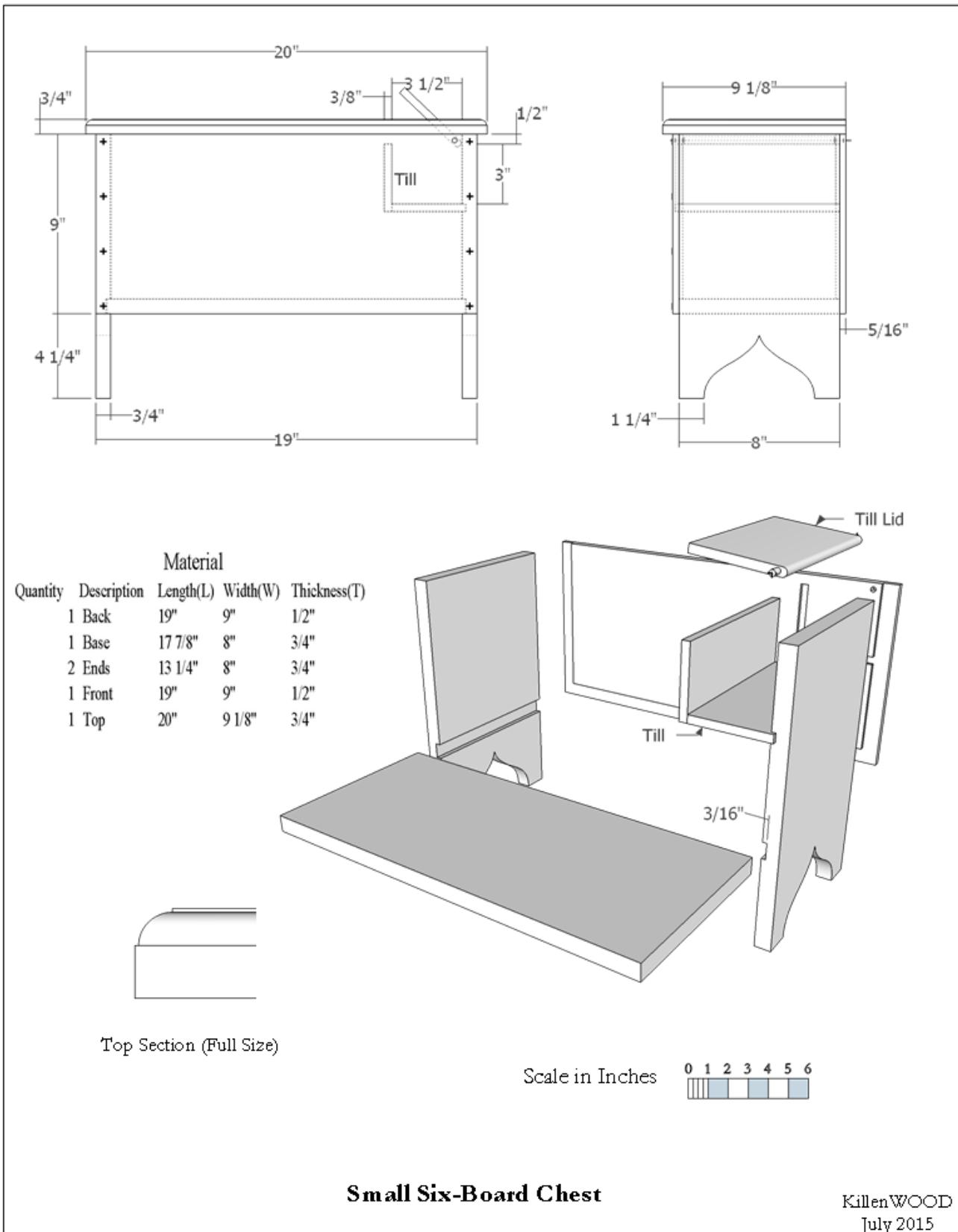


Figure 2. Kettell's Drawing of Small Six-Board Chest (My representation of Kettell's original drawing)

positioned on the blue-red plane. Otherwise, you'll have to rotate it once its imported.

Click on the Open button and the image will appear in SketchUp with one corner attached to the cursor. Click the mouse to anchor the image at the desired location. Drag the mouse upward to enlarge the image. Click the mouse when the image is the size you want. If the image is askew, because it's hard to place a book or magazine exactly square on the bed of the scanner, you'll need to straighten it using the Rotate Tool.

Next, scale the image to make it full size. You need to know only one dimension in the image to accomplish the proper scaling. Use the Tape Measure Tool to make the imported image full

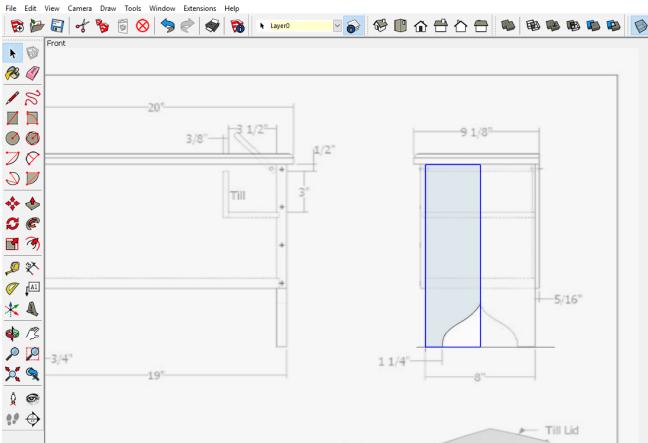


Figure 4. Trace over the half-shape of the End

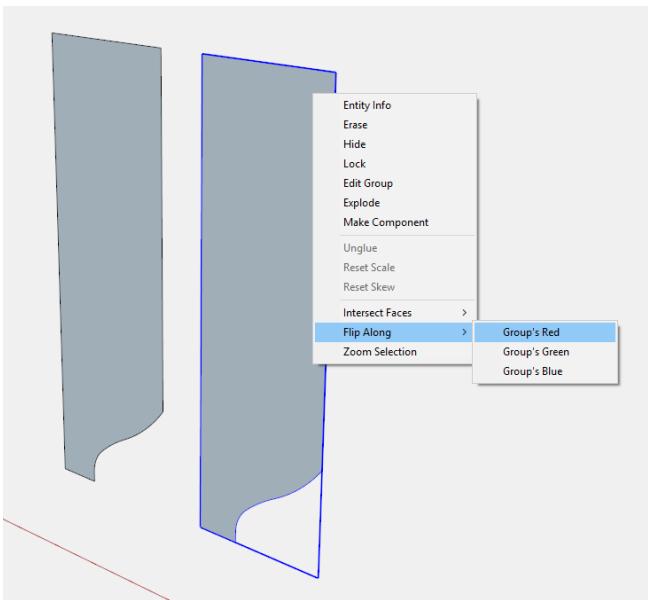


Figure 5. Copying and flipping the End component

Video 2—Make the End Component

Step 3 Use the Move Tool, tap the Ctrl key, and copy the trace over group. Move it down the red axis and click the mouse to fix position.

Use the Move Tool to make another copy of the Group and

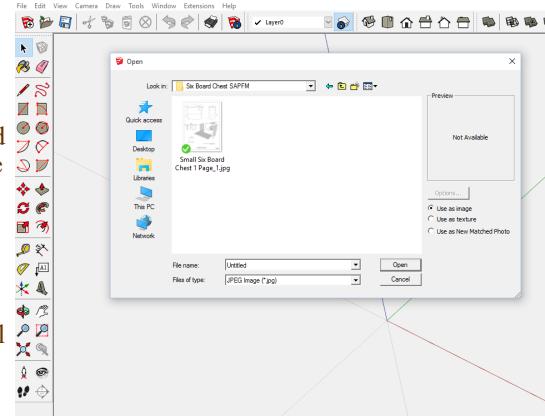


Figure 3. Import an Image

size. Select the tool and tap the Ctrl key (Option on Macs). Click the mouse at one end of a known dimension, then click on the other end. You will see the measured length in the Measurements Toolbar at the bottom right corner of SketchUp. Type the proper length for that dimension and press Enter. A dialog box will appear asking if you want to re-size the model. Choose Yes. The image will now be full size in SketchUp.

Step 2 Figure 4 shows the scanned image in SketchUp. On top of that image use the Line and Arc Tools to trace over the shape of the End component. It helps to accurately place Guidelines with the Tape Measure to accurately size the shape to the exact dimensions shown in the drawing. Then double click the mouse on the traced shape, right click, and choose Make Group from the pop-up menu. You can see the highlighted selected group in Figure 4.

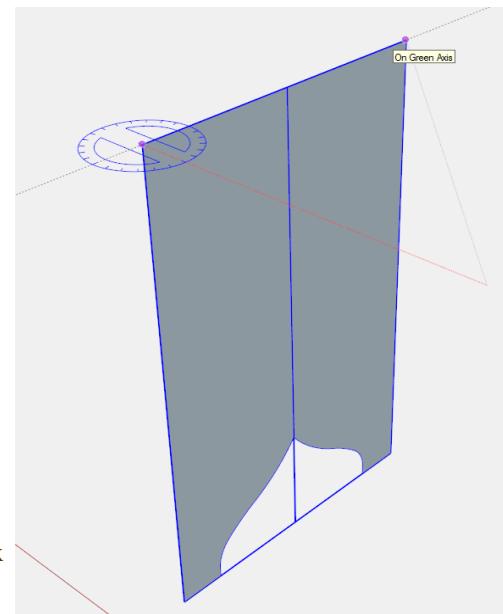


Figure 6. Rotate the combined halves 90 degrees to

move it down the red axis as shown in Figure 5. Right click on the copy, and select Flip along Group's Red axis. The right hand half shape will flip to its proper alignment for mating with the first half of the End.

Select both halves and use the Rotate Tool to align with the Green axis as shown in Figure 6.

Right click on each half and pick Explode from the pop-up menu. With the Select Tool, draw a selection box around both halves, right click and choose Make Component from the pop-up menu. Type the name of the component—End, and click on the Create button, as shown in Figure 7.

Right click on the new End component and choose Edit

Component from the menu. Pick the Eraser Tool and delete the centerline dividing the two halves.

Pick the Push/Pull Tool, click on the face of the End, and pull out a thickness, type 3/4 and hit Enter. Now we have an End component with its proper full-size, shape, and thickness. See Figure 8.

Step 4 Pick the Tape Measure and click it on the outside front edge of the End. Move the cursor down the Red axis, type 19 and hit Enter. Now there will be a vertical guideline 19-in. from the outside edge of the End.

Choose the Move Tool, tap the Ctrl key, click on the inside edge of the End, and copy the End down the Red axis and click when reaching the guideline. Then right click on the right End and choose Flip Along Component's Red as shown in Figure 9.

Set guidelines to show the location and depth of the groove for the Bottom component fitting between the two

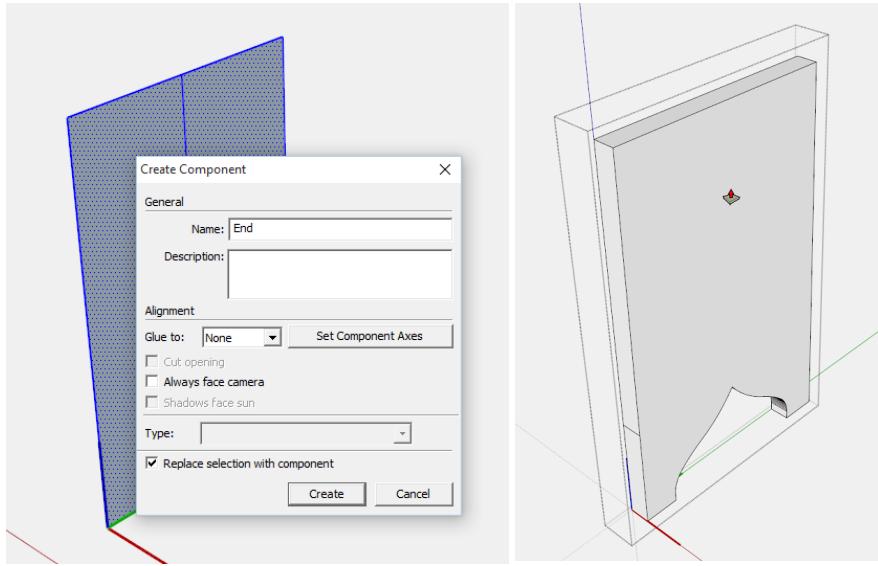


Figure 7. Select both halves, right click, and choose Create Component. Name it End.

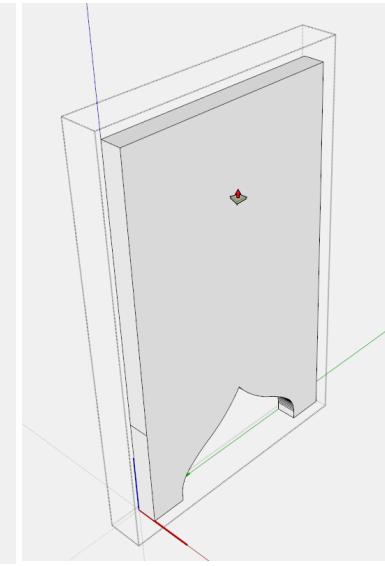


Figure 8. Use the Push/Pull Tool to give the End a 3/4-in. thickness

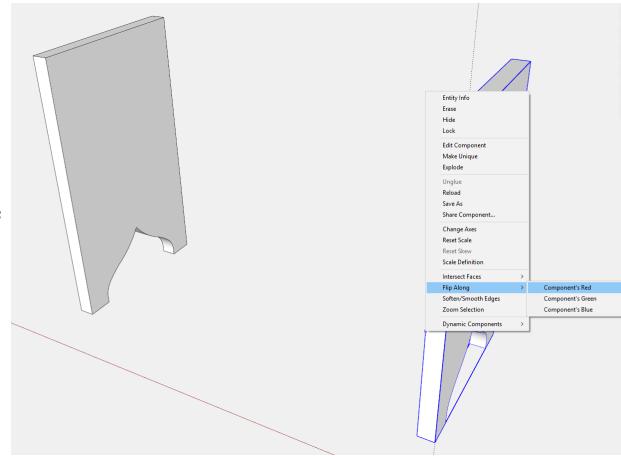


Figure 9. Use the Move Tool to copy the End and move down the red axis to the guideline.

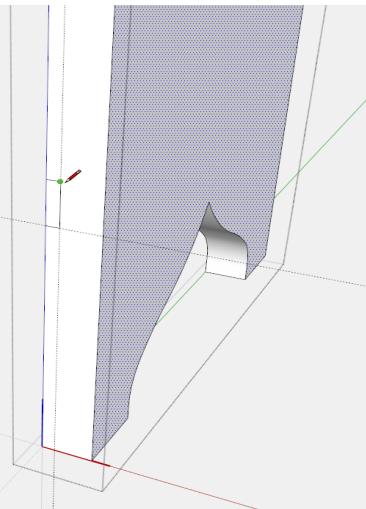


Figure 10. Place guidelines then outline the boundary of the groove with the Line Tool

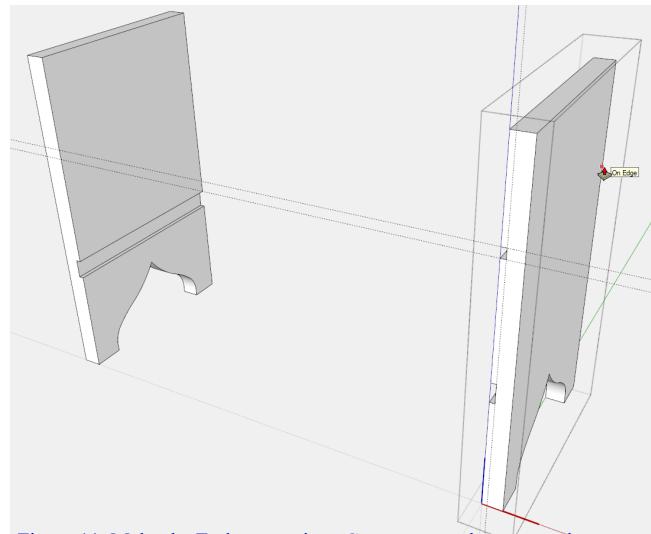


Figure 11. Make the Ends two unique Components, then create the groove in the Right End for the Till Bottom

Ends. Open the End for editing, and using the Line Tool, outline the end boundary of the groove as shown in Figure 10. Choose the Push/Pull Tool and push out the groove the full width of the End. This groove will also automatically occur in the copy of the End on the left.

Since the Right End will have an extra groove on its inside face to accommodate the Till Bottom, it needs to be a unique component. For this reason, explode each copy of the End component, and re-make as Right and Left Ends. Then make the groove in the Right End for the Till Bottom. This is shown in Figure 11.

Video 3—Make the Bottom, Front, and Back

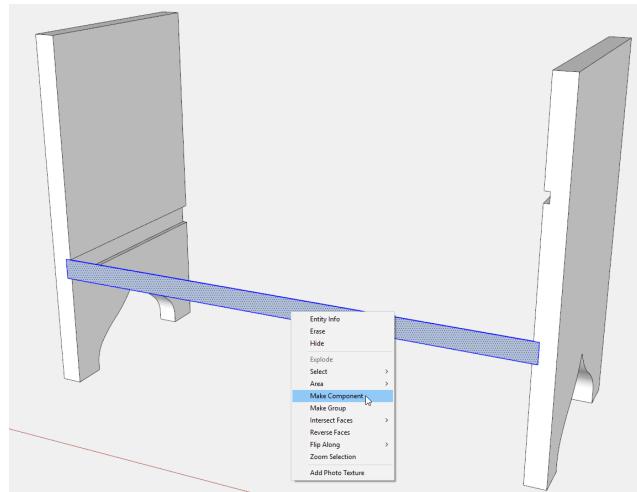


Figure 12. Draw the edge face of the Bottom and make it a component.

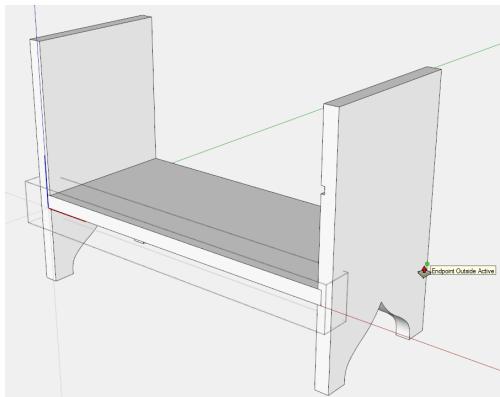


Figure 13. Use the Push/Pull Tool to finish the Bottom component

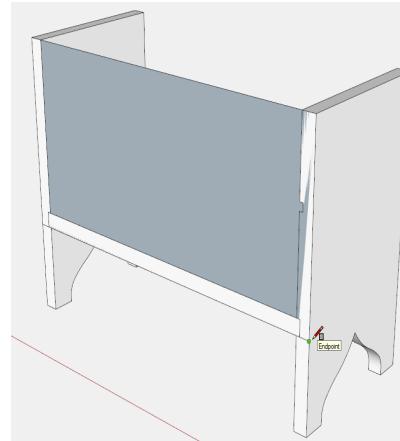


Figure 14. Use the Rectangle Tool to create the face of the Front component.

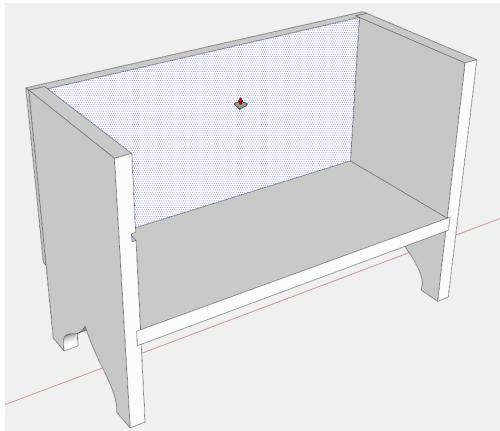


Figure 15. Draw three lines in the inside corner intersections of the Ends, Front, and Bottom. Then Push/Pull 3/16-in. to the inside of the Chest.

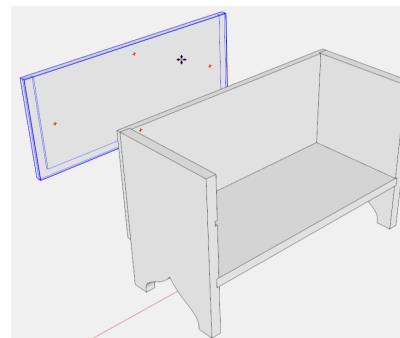


Figure 16. Make a copy of the Front component and move it away from the assembly

components are 1/2-in. thick with a 3/16-in. deep rabbet around the edges for housing the End and Bottom components.

To create the rabbet, orbit around for a rear view of the Chest. See Figure 15. Edit the Front component and draw lines in the intersecting corners of the Bottom and Ends. Then with the Push/Pull Tool, pull out another 3/16-in. thickness to the inside face of the Front. This results in creating the 3/16-in. deep rabbets around the inside face of the Front.

You can verify the surrounding rabbets by making a copy of the Front, and moving it away from the assembly. See Figure 16.

Make a copy of the Front component and move it to the rear of the assembly. Right click on the copy and choose

Step 5 Use the Line or Rectangle Tool to create an edge face for the Bottom. Double click on the rectangle, then right click, and choose Make Component from the menu. Shown in Figure 12. Name the component Bottom.

Note that the following steps in making new components are executed in the context of the overall chest assembly. This is much more efficient and accurate than making components in isolation or free space, and then assembling later.

Edit the Bottom component, and use the Push/Pull Tool to give it a width across the full length of the groove in the Ends. This is shown in Figure 13.

Step 6 Use the Rectangle Tool to outline the face of the Front. Double click and right click, then pick Make Component from the menu. See Figure 14.

Then, with the Push/Pull Tool, pull out a thickness of 5/16-in. The Front and Back

Flip Along Component's Green to orient into the back of the assembly. Currently, a common component definition is being used for both the Front and Back. Eventually, there will be a need to have independent definitions for the Front and the Back. The front will require unique cuts for the front lock. And the back will have recesses for the hinges. Delaying the separation is efficient since there is much commonality in grooves and rabbets. See Figure 17 for status after six steps.

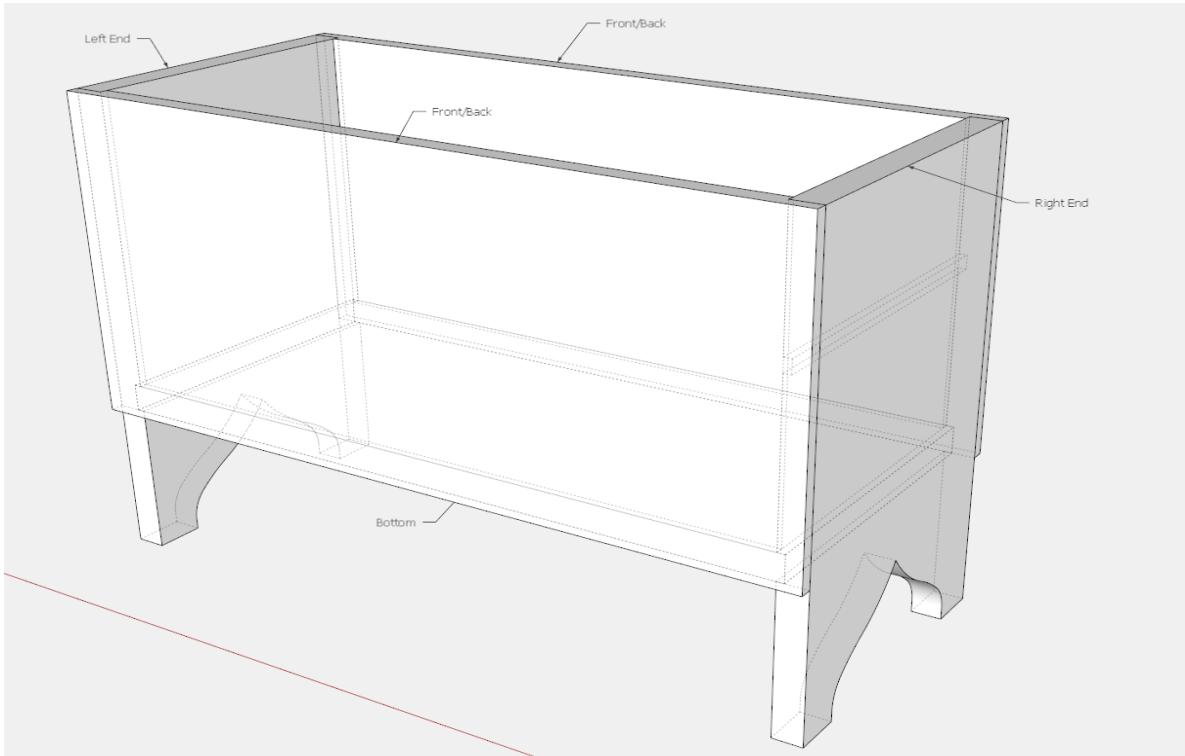


Figure 17. Status of the assembly after six steps. The labels are the names I used for the four components. Note use of Back Edges Style to show the hidden edges

Video 4—Make the Till Components

Step 7 To open access for making the Till components, right click on the Front and Back and choose Hide from the menu. To create the Till Bottom, draw a rectangle for the front edge as it protrudes into the End groove. Then use the Push/Pull Tool to give it length equal to the width of the End. See Figure 18. The Till Front is made in the same way as shown in Figure 19.

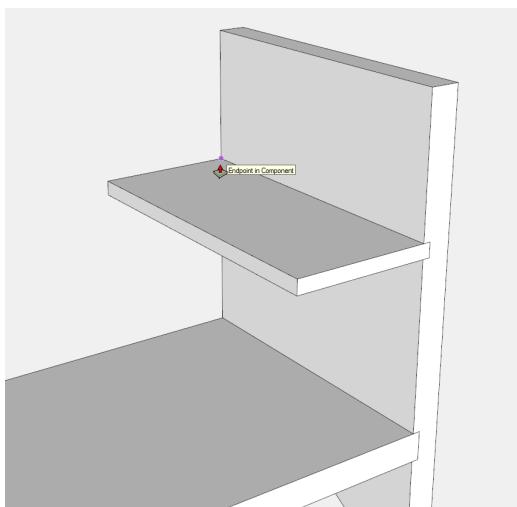


Figure 18. Make the Till Bottom component.

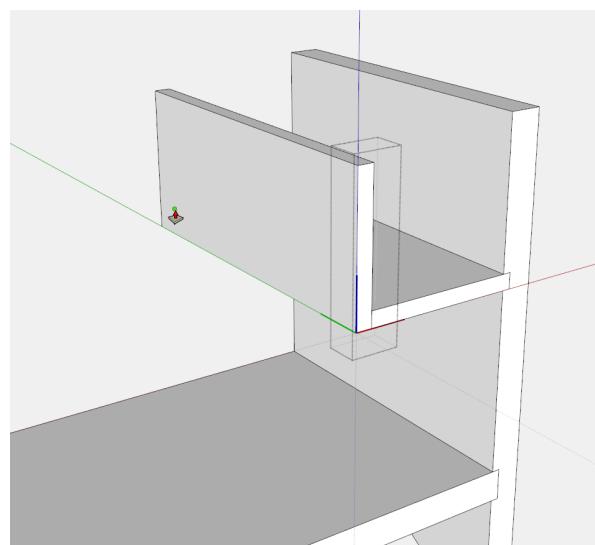


Figure 19. Make the Till Front component.

Use the Rectangle or Line Tool to make the edge face of the Till Top. Using the Arc Tool create the rounded half circle shape on the hinged end of the Till Top. Then use Push/Pull to give it its length toward the back. I prefer having the Till Top slightly shortened to provide a 1/16-in. gap between the inside faces of the Chest Front and Back. Also, I prefer a 1/8-in. lip extension of the top over the front face of the Till Front. That lip is helpful in lifting the Till lid. These extra tweaks in length and width are easily made with the Push/Pull Tool.

The Till Top pivots on 1/4-in. dia. dowels at each end. Use the Circle Tool to create a 1/4-in. dia. circle. See Figure 21. Using the Push/Pull Tool, drive the circle back to create a 7/16-in. deep socket. Then click the Push/Pull Tool on the bottom of the socket, tap the Ctrl key and pull out a 7/8-in. long dowel.

I like a centerline on the dowel as shown in Figure 22. This will help locate the socket in the Front and Back components.

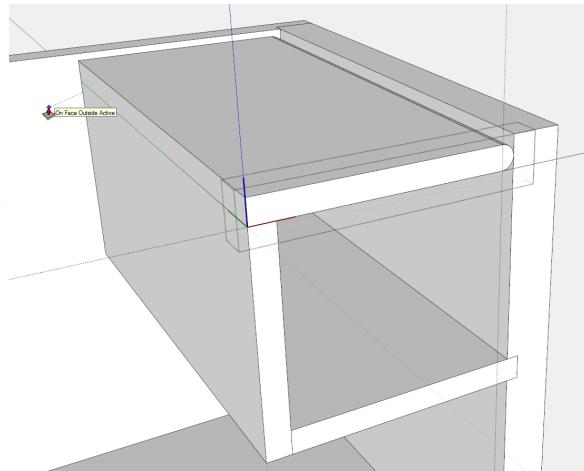


Figure 20. Make the Till Top or Lid

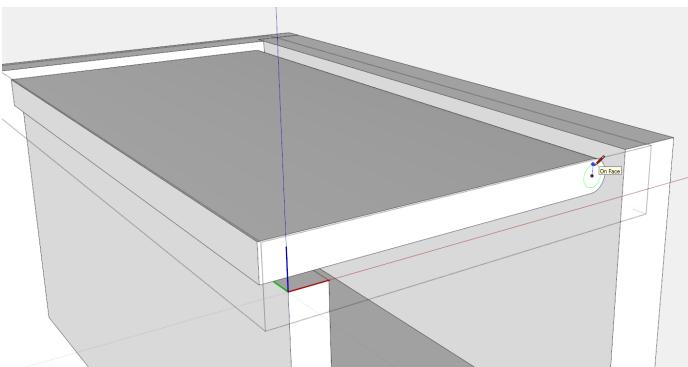


Figure 21. Create the 1/4-in. dia. socket for a 7/8-in. long dowel at each end of the Till Top.

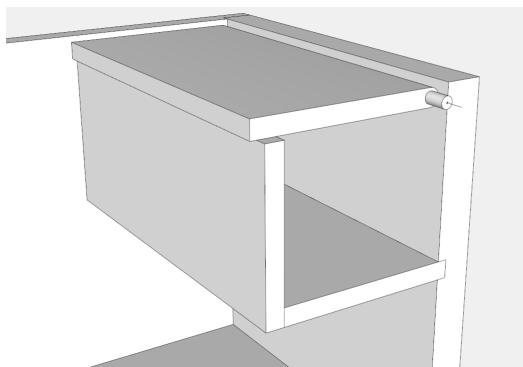


Figure 22. Create the 7/8-in. long dowel and its centerline

Video 5—Make the Grooves and Dadoes for Capturing the Till Components

Step 8 The Front and Back captures the Till Front and Bottom with a 3/16-in. shallow dado and groove. With the Front still hidden, select the Back for editing and then click to select the inside face of the Back. This is shown in Figure 23.

Right click on the face and choose Intersect Faces with Model from the pop-up menu. This function will create lines where the Till Front and Bottom protrude through the face of the Back.

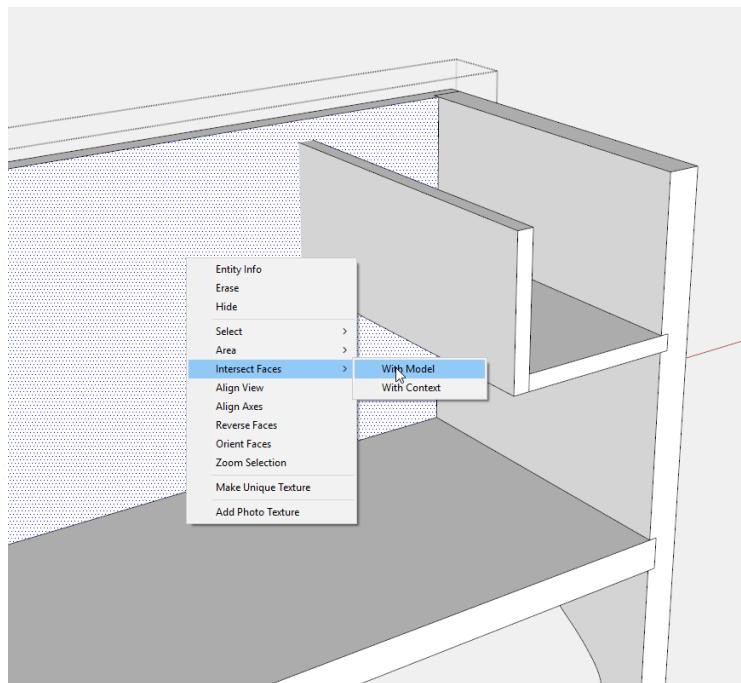


Figure 23. Use Intersect faces to show location of the dado and groove

Make a copy of the Back component and move it away from the assembly. You'll see the boundary lines of the groove and dado etched into the face of the Back by using Intersect with Model. Using the Push/Pull Tool, route the depth of the groove and dado to 3/16-in.

By now you may have noticed that the sequence of steps in building the SketchUp model is quite aligned with the process in the shop. I often find this parallel while designing and building new pieces. For this Chest, I would start construction by making the Ends followed by the Bottom, the Front and Back, and so on.

I find this reassuring, as SketchUp becomes much more than a way to produce a design. SketchUp provides a tool for rehearsing the process of shop construction.

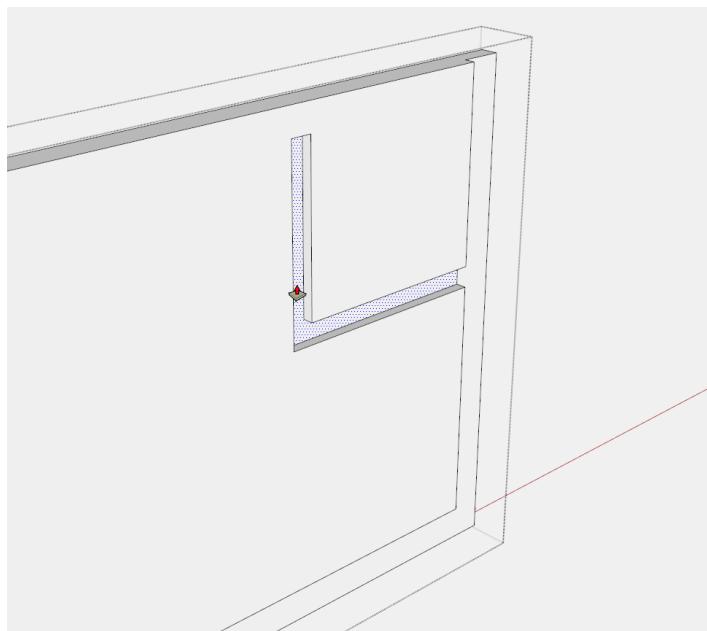


Figure 24. With the Push/Pull Tool, route the dado and groove to a depth of 3/16-in.

Step 9 To create the socket for the dowel in the Front and Back, turn on X-ray Style, and zoom into the top corner of the Chest where the dowel hinge is located. See Figure 25. Open the Front component for editing and with the Line Tool trace over the dowel centerline. This will precisely locate the center of the socket in the Front and Back components. It helps to tap the Left Arrow key to force the line on the Green axis.

Make a copy of the Back component and move away from the assembly. See Figure 26. Using the centerline as reference, connect the Circle Tool at center and draw a 1/4-in. dia. circle. Then use the Push/Pull Tool to create a 7/16-in. deep socket.

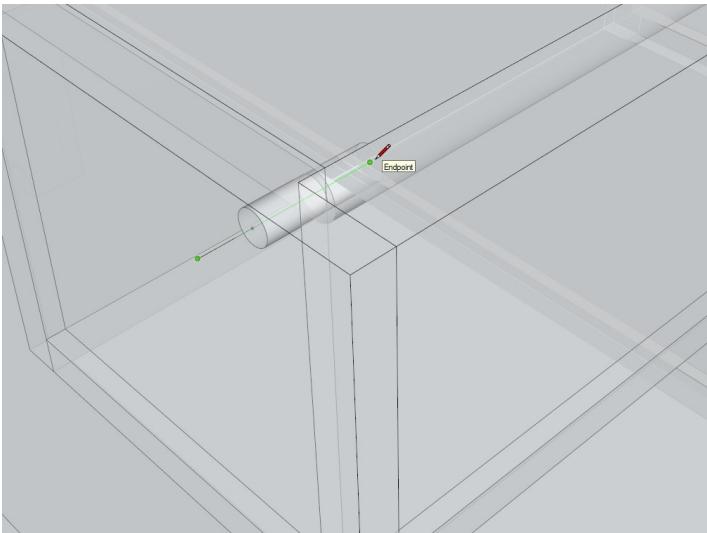


Figure 25. With the Front component open for edit, trace over the dowel centerline

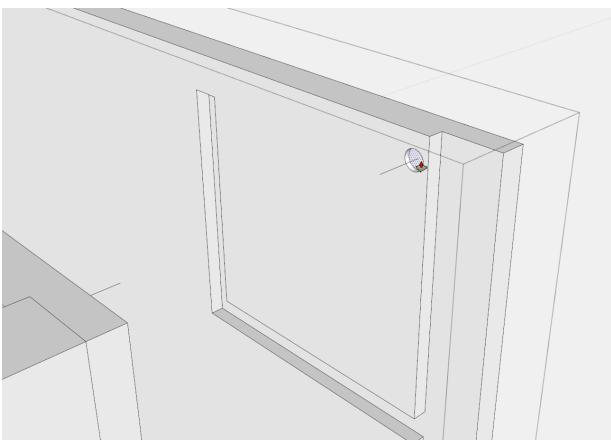


Figure 26. On copy of the Back, Make circle and Push/Pull socket

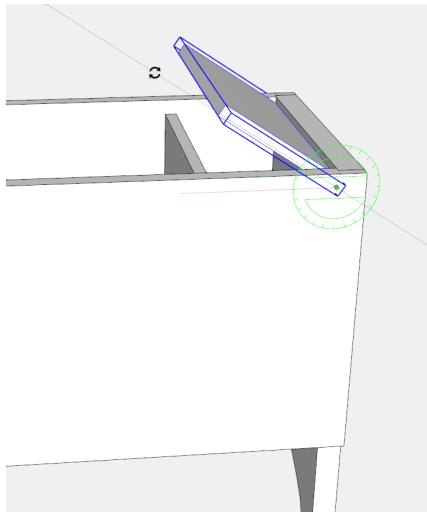


Figure 27. Rotate the Till Top
See Figure 29.

Now that the Till Top is installed with its dowel pivot joints, test the rotation by choosing the Rotate Tool. With the Till Top selected, click the Rotate Tool on the pivot point (where the centerline intersects with the face of the Front). Click to start the rotation, then move the mouse to rotate the Top. See Figure 27.

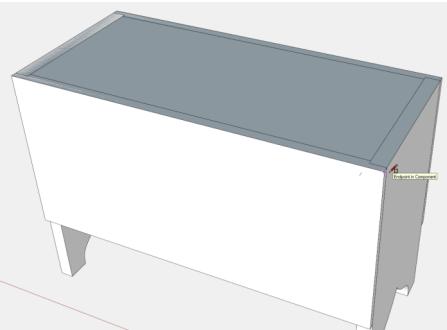


Figure 28. With the Rectangle Tool, create the covering face

Step 10 The final component is the hinged Chest Top. Use the Rectangle Tool to create a face across the top of the assembly as shown in Figure 28. Double click on the face and make the rectangle a component called Top.

Use the Push/Pull Tool to create the 3/4-in. thickness, and also to extend the ends and front edge, for a 1/2-in. overhang.

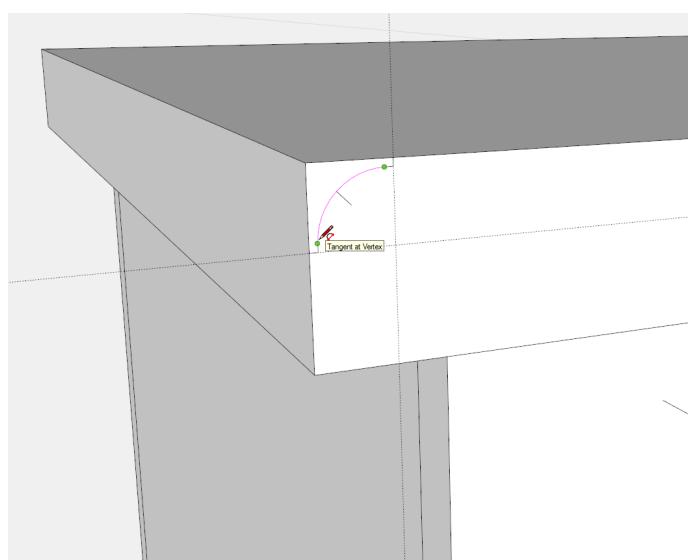


Figure 30. Create the thumbnail profile with Arc and Line Tools

While pressing the Shift key, click the Select Tool, on the three top edges—that is the top front edge, and the two top end edges. Then choose the Follow Me Tool and click it on the profile on the back edge. The Follow Me Tool immediately routes the thumbnail shape on all three of the selected edges. See Figure 31.

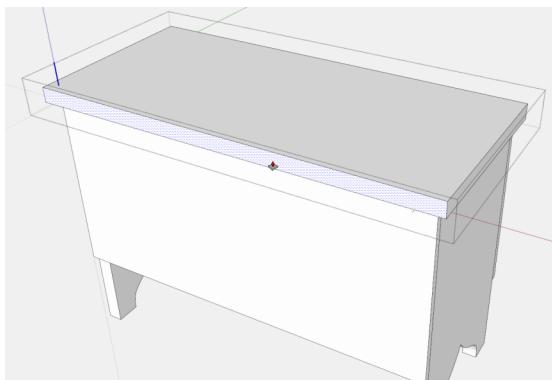


Figure 29. Push/Pull the thickness and the overhang

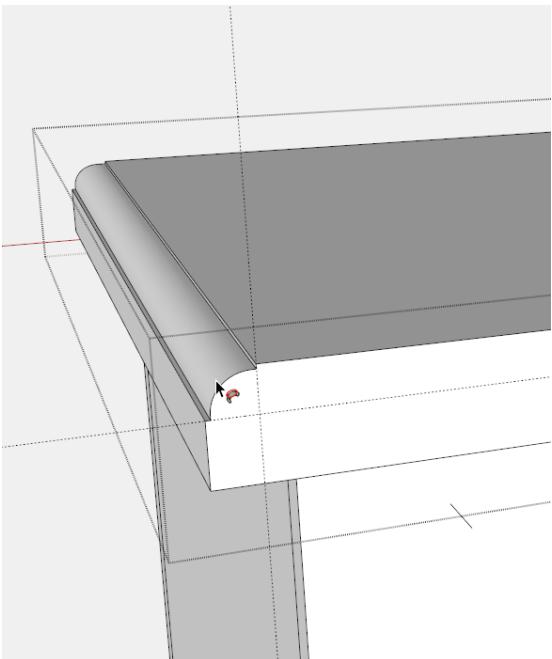


Figure 31. Route the molded edge with the Follow Me Tool

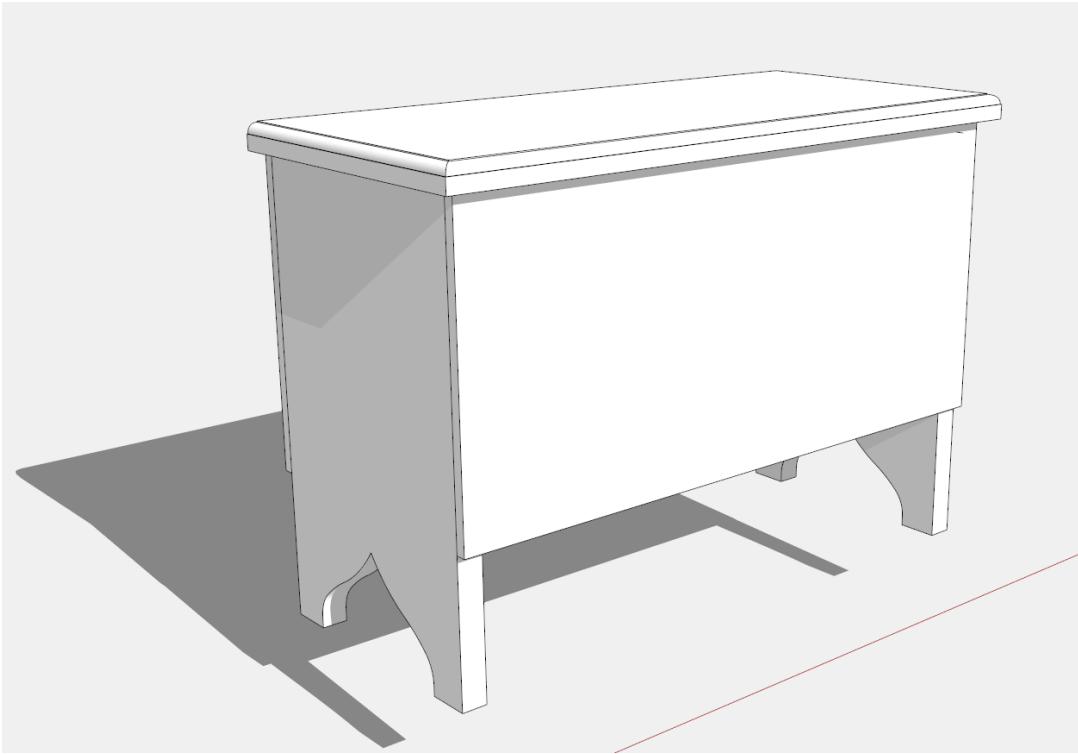


Figure 32. Final model with all components. Although I'm ending this article at this stage of design, I would add to the model all hardware—hinges, and key lock, and all fasteners-such as screw and nail locations. I do not model the actual screws or nails.

Additional Steps Figure 32 shows the final model with all components and joinery. In my own design work, I will do additional work to detail the hardware. This Chest requires butt hinges for the Top, and a chest lock in the Front. I generally include in my models all hardware and associated cut-outs, holes, rabbets, recesses, etc. I find the work on hardware in the model avoids surprises in the shop—such as interferences and size problems. It also gives me exact dimensional information for the hole centers and other cut-outs.

I would also identify locations of fasteners such as, nails and wood screws. The spacing and layout of these details is much easier in SketchUp, and avoids tedious measurements in the shop. Often these spaced fasteners are shown on full-size templates that provide quick mark-up of the components in the shop.

The Drawing Output After creating the model, the production of drawings is straightforward. I create multiple Scenes for various orthographic, exploded and perspective views of the model, and its individual components. Full size orthographic views (used as templates in the shop) are produced with a few mouse clicks. Hidden line and X-ray styles are available to enhance readability and understanding of complex joinery.

Kettell produced an astonishingly compact one-page drawing. My drawing product is thirteen pages in PDF format, but in justification, includes all dimensions, a page for each component, hinges & key lock, full size templates, location of fasteners, and joint details.

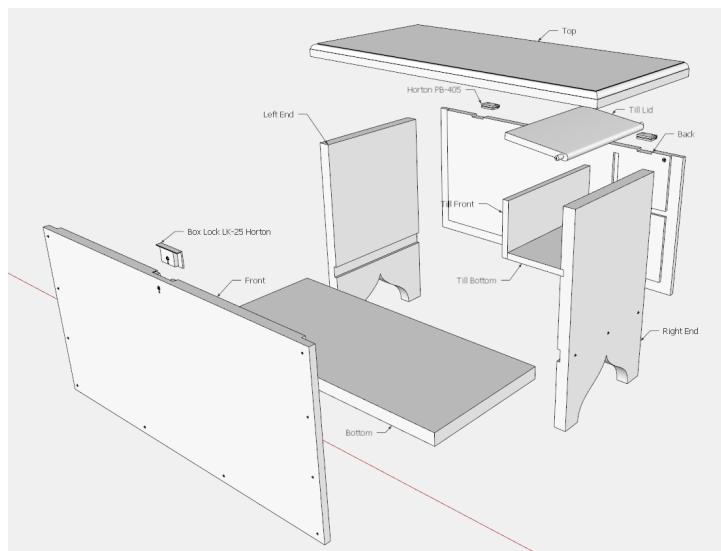


Figure 33. An Exploded View of the Chest