

Easy-to-Build Pencil Box

 **ROCKLER**[®]
WOODWORKING AND HARDWARE

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Rare-earth magnets keep the lid and the drawer from flying open unexpectedly



What you'll find inside:

- **Elevation drawings**
- **Complete materials list**
- **Step-by-step plans**

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A while back, I built my son and daughter small pencil boxes out of some beautiful butternut a friend had given me. The boxes were light and simple, made from 1/4" stock with 1/4" box joints and sliding tops. My daughter's has seen gentle use, mostly at home, but my son's has traveled back and forth to school every day. During its many trips from backpack to desk, it has had at least two injurious encounters with the floor. In addition, it has been crammed so full of pencils, markers, erasers, a pencil sharpener, a flash drive and who knows what else that sliding the lid closed is a bit like trying to put toothpaste back in the tube. Time for a new pencil box.

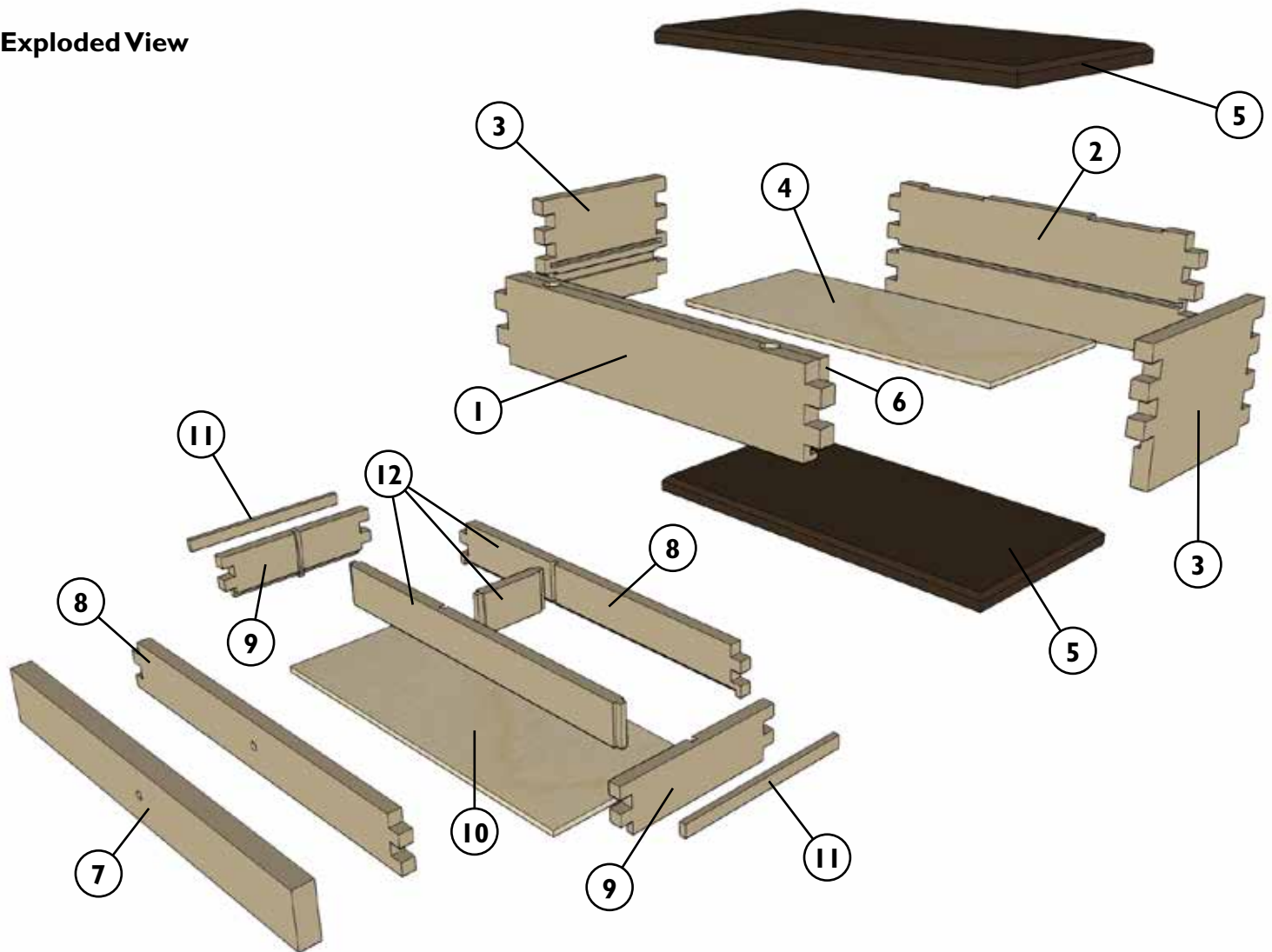
The new model needed to be a bit larger, with several compartments to keep things somewhat organized, and beefier to stand up to daily use by an energetic seventh-grader. Harder, thicker stock – 3/8" thick quartersawn white oak and walnut – and larger, 3/8" box joints would deliver strength. A large main compartment and a subdivided drawer made from 1/4" thick stock would provide ample space. But I also needed simple, durable ways of keeping the drawer from sliding accidentally out of the box and the lid from flying open at inopportune moments. Rare-earth magnets and matching washers turned out to be just the thing. –S.R.

Materials list

Pieces	Material	Qty.	T x W x L	Required Machining
1. Box front	Oak	1	3/8"* x 1 7/8" x 9 1/16"	Cut 3/8" box joints on ends. Cut 1/8" wide x 3/16" deep groove 1 5/8" down from top.
2. Box back	Oak	1	3/8"* x 3" x 9 1/16"	Cut 3/8" box joints on ends. Cut 1/8" wide x 3/16" deep groove 1 5/8" down from top.
3. Box sides	Oak	2	3/8"* x 3" x 4 5/16"	Cut 3/8" box joints on ends. Cut 1/4" wide x 1/8" deep groove 1-15/16" down from top. Cut 1/8" wide x 3/16" deep stopped groove 1 5/8" down from top (stop 3/16" from edges).
4. Box floor	Birch plywood	1	1/8" x 3 3/4" x 8 1/2"	
5. Lid/base	Walnut	2	3/8"* x 4 3/4" x 9 1/2"	Rout 1/8" x 1/8" chamfer on all edges of one face.
6. Support strip	Oak	1	1/4" x 1/2" x 8 1/4"	Rout 1/8" x 1/8" chamfer on one long edge.
7. Drawer face	Oak	1	3/8"* x 1 1/8" x 9 1/16"	
8. Drawer front/back	Oak	2	1/4" x 1" x 8 1/4"	Cut 3/16" wide x 1/8" deep stopped rabbet on bottom edge. Machine 1/4" fingers of box joints on ends.
9. Drawer sides	Oak	1	1/4" x 1" x 3 1/16"	Rout a 3/4" wide x 1/4" deep rabbet along back edge of inside face.
10. Drawer bottom	Birch plywood	1	1/8" x 3 1/8" x 7 7/8"	Cut to fit opening on assembled drawer frame.
11. Drawer runner	Oak	2	1/8" x 1/4" x 3 3/8"	Cut to fit into rabbets in assembled drawer frame.
12. Drawer dividers	Oak	Var.		Cut as desired from 1/4" x 7/8" stock.
13. Brass-plated small-box stop hinge (not shown)		1 pr.		Rockler item #21141
14. 3/8" x 1/10" rare-earth magnets (not shown)		1 pk.		Rockler item #32907
15. 1/2" dia. x 3/32" thick washers (not shown)		1 pk.		Rockler item #38348
16. 1/2" brass knob (not shown)		1		Rockler item #37663
17. Self-adhesive velvet (not shown)		1	12" W x 24" L	Blue – Rockler item #10497 Red – #10471 Black – #34656 Green – #10489 Beige – #27123 Rose – #26722
18. #6 x 1-1/2" screws (ns)		1 pk.		Rockler item #28654
19. #4 x 1/4" FH screws (ns)		4		
20. #4 or #6 x 1/2" screws (ns)		2		

* 3/8" thick stock was planed from 1/2" thick stock

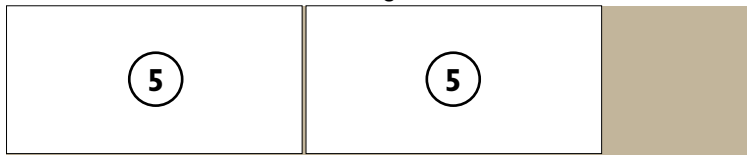
Exploded View



Lumber Diagram

1/2" x 5" x 24" walnut (Item #33815)

Note: Plane to 3/8" thick before cutting



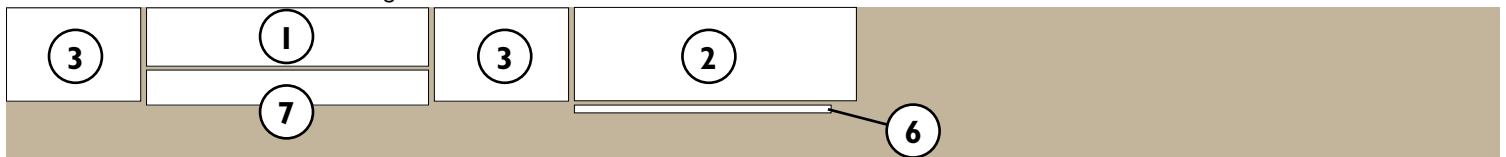
1/4" x 3" x 24" quartersawn white oak (Item #31789)

Note: Excess stock can be used to cut drawer dividers (12), if desired



1/2" x 5" x 48" quartersawn white oak (Item #32258)

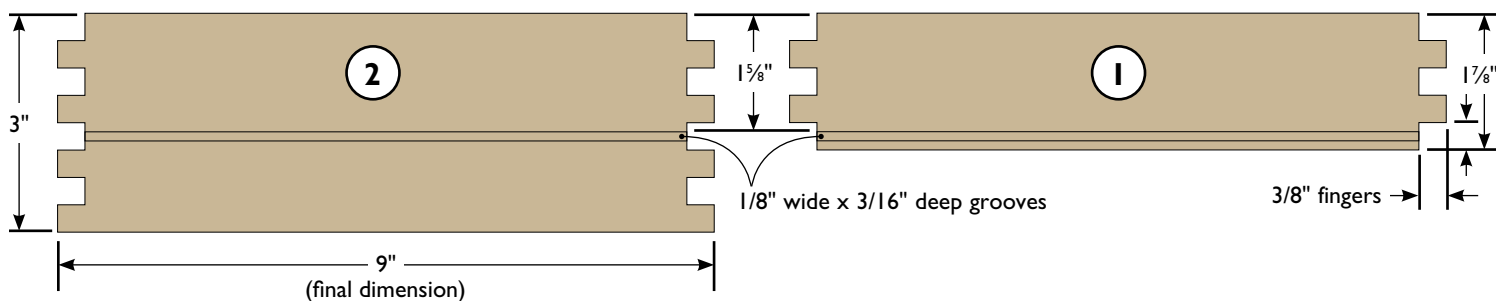
Note: Plane to 3/8" thick before cutting



Cut the pieces in order

I wanted the grain to be continuous on the front face and wrap around the box, so I was careful to cut the pieces as shown in the Lumber Diagram, making the crosscuts first and then the rip cuts. (Making crosscuts first is important because of the need to cut the drawer face away from the box front. You want a slightly deeper piece to make up for the material removed when sawing the two pieces apart.) Keep track of the pieces so they don't get out of order during machining and ruin the grain continuity. Cut all other pieces to size.

Box Components (inside faces)



At this point, also use a 45° chamfer router bit in a table-mounted router to machine a 1/8" x 1/8" chamfer on all edges of one face of the lid and base. (Machine the ends first, using a backer board to minimize tear-out. Then machine the long-grain edges. Any tear-out on the ends will be removed on the long-grain cuts.)

Machine the box joints for the box

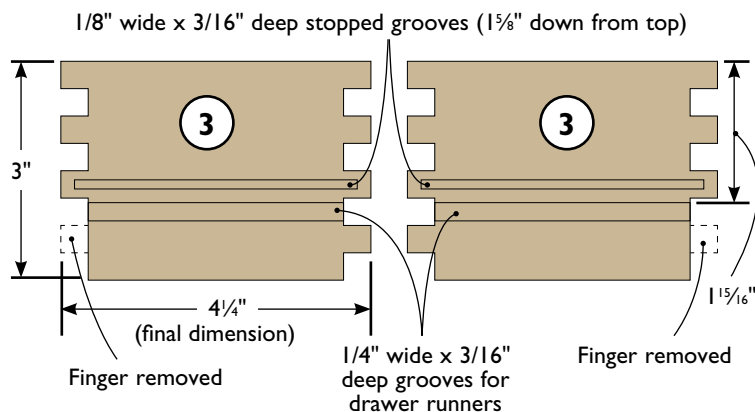
Box joints can be cut with a jig at the table saw or with a router. I used Rockler's Router Table Box Joint Jig to cut the 3/8" box joints at my router table.

Whichever method you use, it's important to lay out, label and cut the joints at each corner in the right order. For the jig I used, I needed to lay out the pieces, inside faces up, and label each piece, each corner and the top and bottom of each piece at each corner. This ensured that I cut the mating ends of the boards together so the joints would be even and tight. **Fig. 1.**

It's worth noting at this point that the listed dimensions for the pieces are 1/16" longer than their final dimensions. That way, I was able to set the router bit height about 1/32" higher than the 3/8" thickness of the stock to ensure that the ends of the finger joints stood a little proud of the surface at each corner and could be sanded down for a flush joint.



Fig. 1



On the front edge of the side pieces, I cut the joints as I did at the back and then routed away the extra finger where the drawer front will go when everything is assembled. See **Box Components.**

Rout the grooves in the box pieces

All four box pieces need 1/8" wide by 3/16" deep grooves to accept the plywood floor for the main compartment. (In the side pieces, the grooves need to stop 3/16" short of the ends to keep from blowing through and ruining the fingers.) To make sure that the grooves ended up aligning all the way around the box, I referenced from the top of the pieces and set the fence 1 5/8" back from the bit.

To cut the stopped grooves in the box sides, I needed to mark the bit's leading and trailing edges on the fence. (I used these marks, along with marks on the workpieces, to start and stop the cuts in the right place.) I placed a squared piece of wood against the fence and brought it up to the bit, rotating the bit so the cutting edge made contact. (You could use a rafter or combination square, too; just be careful not to damage the bit's cutting edge against metal.) I marked the location on the fence and used a square to extend it vertically so I'd be able to see it. Then I repeated the process on the other side of the bit.

On the outside faces of the sides, near the top edges (which run against the fence), I marked lines indicating where the grooves were to start and stop. I set the router bit cutting height to 1/8" and made a test cut in scrap to verify all settings.

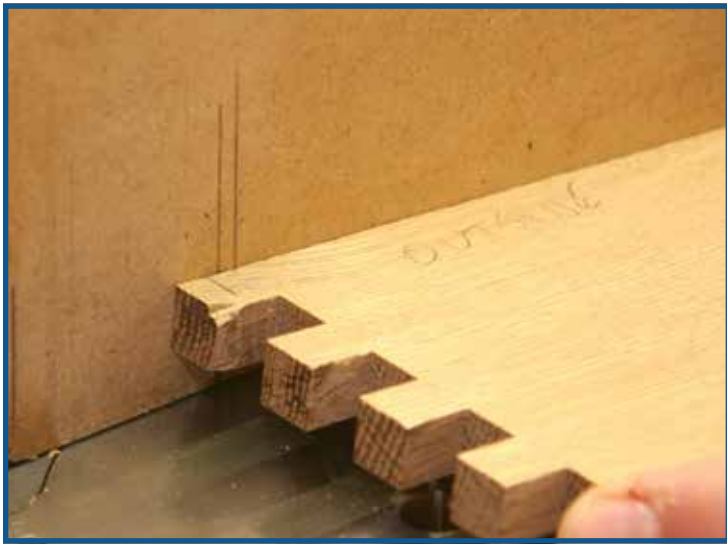


Fig. 2

To make the final cuts, I positioned each workpiece on the router table, top against the fence and inside face down, and lifted the leading edge to keep it from contacting the bit. **Fig. 2.** Continuing to hold the workpiece against the fence, I lowered the leading end onto the bit and lined up the leading mark on the workpiece with the forward mark on the fence, then advanced the workpiece until the trailing mark on the workpiece lined up with the trailing mark on the fence. **Figs. 2-3.** I turned off the router and let the bit stop spinning before lifting the workpiece away.

Routing the 1/8" grooves in the box front and back was simply a matter of positioning each workpiece on the table, top against the fence and inside face down, and pushing it past the bit.



Fig. 3

Grooves also are required in the box sides to accept the drawer runners. I made these at the router table, using a 1/4" spiral upcut bit with the fence set back 1⁵/₁₆". Nothing tricky here – just position the workpiece on the router table, top against the fence and inside face down, and push through the bit.

Glue and clamp the box

I did a dry fit of the box pieces, along with the plywood box floor, to make sure all the joints would come together tightly. Then I applied glue to the box joint fingers (but not to the grooves or the box floor) and clamped the assembly together with a strap clamp. Rockler's 3/8" Box Joint Cauls helped pull everything together tightly.

Fig. 5.

Cut the box joints for the drawer

As with the parts for the box, I cut the drawer front, back and sides 1/16" longer than final dimensions so the ends



Fig. 4



Fig. 5

of the finger joints would stand proud of the surface for sanding flush. I used a 1/4" spiral upcut bit set to a cutting height of 9/32" and machined the joints with Rockler's Router Table Box Joint Jig. (I made test cuts in scrap wood to get the settings right.)

The pieces also need rabbets to accept the drawer bottom — stopped rabbets in the front and back, through rabbets in the sides. See **Drawer Components**. I made these by using a 1/4" spiral upcut bit in my router table. I set the cutting height to 1/8" and buried the router bit in a sacrificial fence so that it would cut to a depth matching the thickness of the plywood bottom (a little less than 1/8"). To rout the stopped rabbets in the front and back, I used a technique similar to the one described earlier for routing stopped grooves in the box sides. This time, however, instead of lowering the workpiece onto the bit, I held it flat to the table and swung it in from the side — again using marks I made on the pieces and the router table fence to start and stop the cuts in the right places.

Optional: Add drawer dividers

I wanted the option of subdividing the drawer space into smaller compartments, so I machined some dividers from leftover 1/4" stock from the drawer pieces. First, I ripped the pieces to about 7/8" wide, and then I did a dry fit of the drawer box to make sure the joints fit well and to determine where I wanted the dividers (as well as how long they needed to be). I did this before gluing up the drawer box because the drawer sides and back required machining to accommodate the dividers.

Once cut to length, the divider pieces needed 1/8" tenons on their ends, and the long divider, drawer back and drawer sides needed matching dados. I marked the locations for the dados during the dry fit and cut them at the table saw, using my shop-built crosscut sled and a full-kerf blade set 1/8" high. I marked the dado locations on the opposite side of the pieces and lined up those marks with the kerf opening on the crosscut sled to make the cuts. I matched and taped the drawer sides together (top edge to top edge) so I could cut the dados in both pieces on the same cut, ensuring that the dados would align perfectly. **Figs. 6-7.**

Then I moved to the router table, which was still set up with the 1/4" bit buried partly in the sacrificial fence. I lowered the bit to about 1/16" and made test cuts on scrap, using a push block and flipping the pieces to rout a centered tenon, until the tenon fit snugly in the dados. Then I made the final cuts on the ends of the dividers and did another dry fit to make sure everything came together.

Glue and clamp the drawer box

I applied glue to the fingers and clamped the drawer box.

Drawer Components (inside faces)

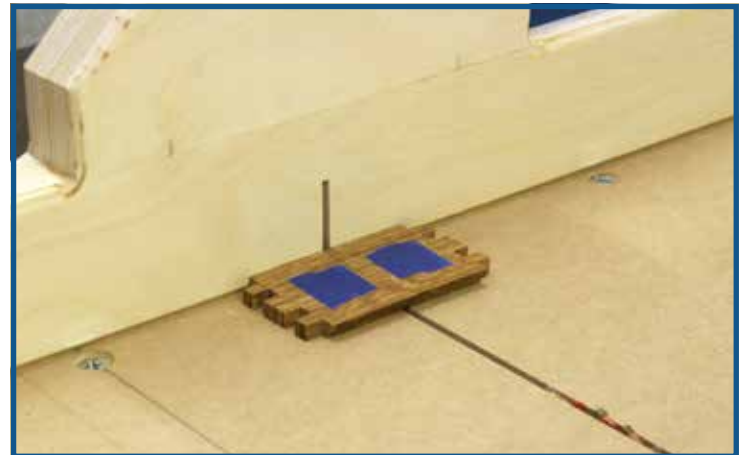
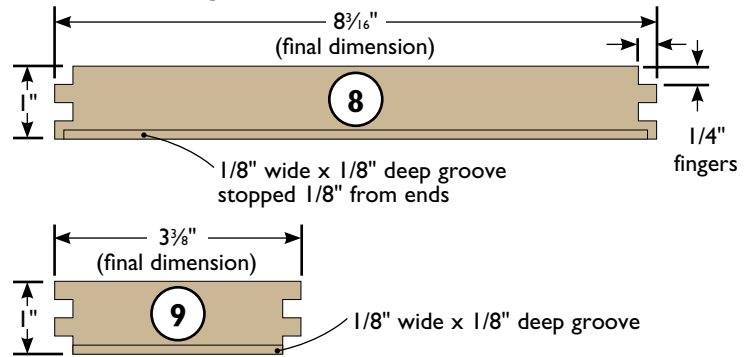


Fig. 6



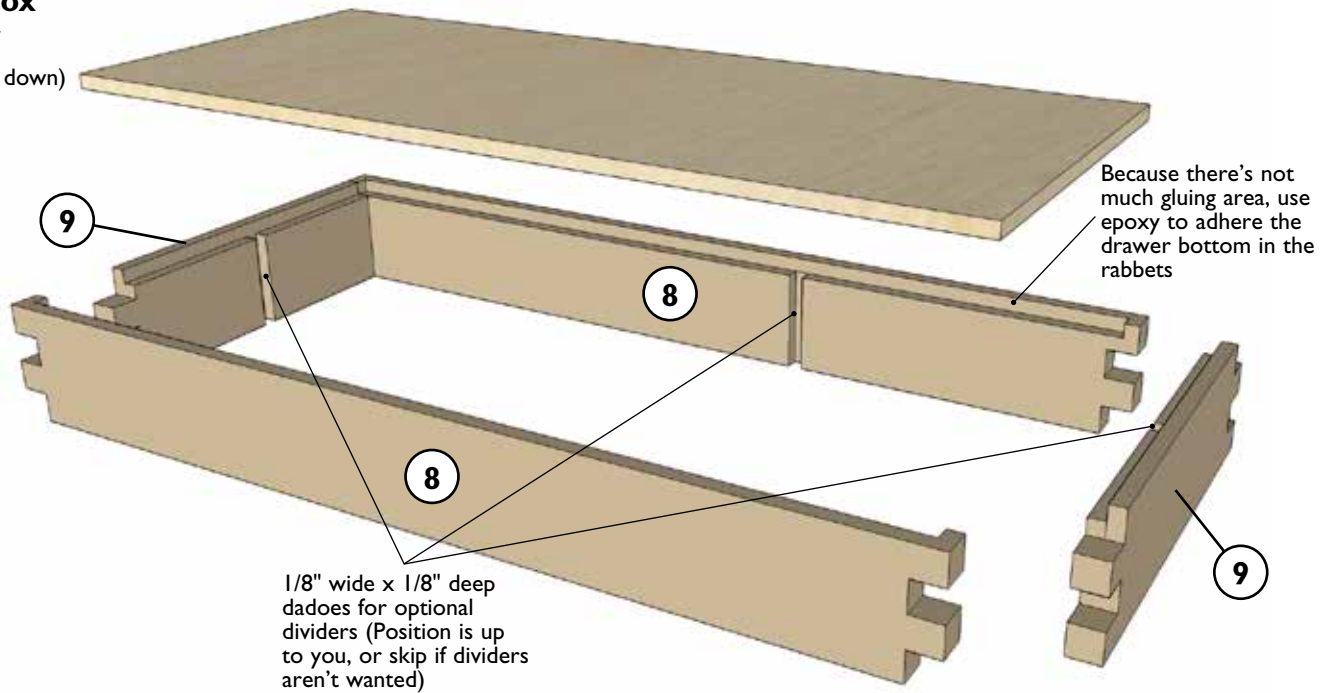
Fig. 7

I didn't glue in the bottom at this point, so I took extra care to make sure the assembly was square before the glue cured.

Once the glue had cured, I used a chisel to square the rounded edges left by the router bit in the stopped rabbets. Then I measured the opening and cut the drawer bottom to match these dimensions.

Drawer Box Assembly

(shown upside down)



Because of the limited glue surface for adhering the bottom to the drawer box, I decided to use a fast-setting epoxy. I spread a bead in the rabbets and then pressed the bottom into the opening. See **Drawer Box Assembly**. I cut an angled tip on a straw and used that to scoop most of the excess epoxy from the inside, especially from the dadoes for the dividers. I was less concerned about the bottom, which ultimately would be covered by self-adhesive velvet. With the drawer upside down near the edge of my worktable, quick-grip clamps provided light pressure on the underside of the bottom to ensure a good bond.

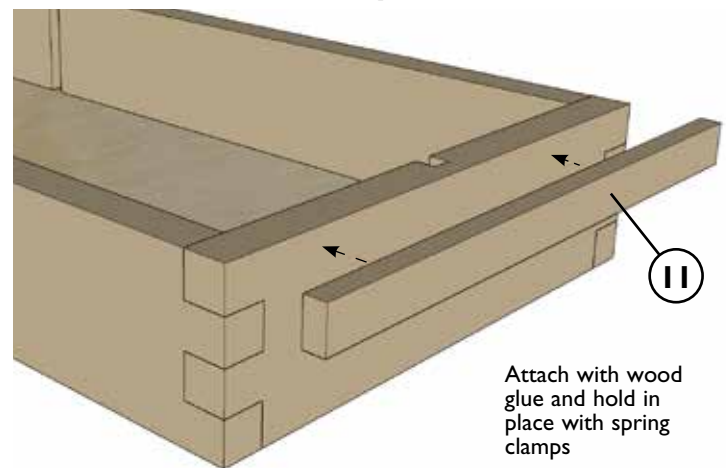
Sand both box and drawer

Once the epoxy had cured, I sanded both boxes so that the finger joints were flush to the surface and then continued sanding up through 220 grit. To get rid of any leftover pencil marks without sanding, I followed a video tip from Chris Marshall on woodworkersjournal.com and wiped down those areas with denatured alcohol (acetone works, too).

Add runners to drawer and support strip to box

Once the drawer box had been sanded, I cut two 3/16" thick x 1/4" wide runners to match the depth of the drawer box and tested them to make sure they would slide in the grooves in the box sides. Then I applied a bead of glue on each, positioned them on the sides of the drawer box and held them in place with spring clamps, making sure that they were flush with the top of the drawer box. See **Drawer Runner Assembly**.

Drawer Runner Assembly (One on each side)



The inside front of the main box also needed a 1/4" thick x 1/2" wide support strip to provide enough material for recessing the rare-earth magnets used in lieu of a latch. I cut it to length and routed a 45° chamfer on the bottom edge that would face the center of the box to prevent scraping of hands when reaching inside. As with the drawer runners, I applied glue to the cleat and positioned it tightly against the front. I made sure it was aligned with the top edge of the front and held it in place with spring clamps.

Once the glue cured, I tested how well the drawer slid into the box and sanded the runners and grooves as needed until it slid smoothly. I also sanded any glue residue from the top of the support strip.

Drill for the magnets

I used 3/8" diameter magnets and corresponding 1/2" washers to hold both the lid and the drawer closed. Mounting them was a matter of deciding on the locations on the back of the drawer and on the main box and drilling shallow 3/8" diameter holes with a Forstner bit to hold the magnets, checking the depth with the magnets themselves; the washers were surface-mounted with #4 x 1/4" flathead screws. See **Lid Magnets, Figs. 8-9.**

The number of magnets and their positioning is up to you. I used two on the back of the drawer box and two to hold the lid. I marked for and mounted the washers on the mating surfaces, drilling shallow 1/16" pilot holes for the #4 x 1/4" screws.

Mount drawer face to drawer

Cut the piece for the drawer face to final width and length, double-checking the specified measurement against your actual box. Locate the center of the drawer face by drawing diagonal lines from corner to corner. Drill a 5/32" diameter hole at that location.

Insert the drawer into the box (the base hasn't yet been attached) and position the drawer face against the front so that there's an even space at the top and the bottom. You want at least 1/32" of space at the top and bottom of the drawer face to allow for seasonal wood movement (admittedly, likely to be very little in this narrow a piece) and easy movement of the drawer. When you have the position right, press something with a sharp tip through the hole in the drawer face to mark the center of the hole location on the front of the drawer box. With a small piece of scrap clamped against the inside wall of the drawer front to serve as a backer, drill a 3/16" hole at that location. (The extra 1/32" provides room for fine-tuning the drawer face's position.)

Now measure and mark for two additional holes to accommodate #4 or #6 x 1/2" panhead screws that will be driven from inside the drawer box to help secure the drawer face. The exact positioning of these holes is up to you; I drilled mine about 1/4" in from the outside edge of the runners. Again, clamp a backer to the inside of the drawer front to minimize tear-out.

Reposition the drawer face against the drawer front and use the bolt and 1/2" brass knob to secure it temporarily. Adjust it so the reveal around the drawer face will be even, and tighten the brass knob. Then, from the inside of the drawer box, drive the screws partway through the drawer front so that the tips mark the location on the inside of the drawer face. Remove the drawer face and drill shallow pilot holes to make it easier to drive the screws. Reposition the drawer face, check the alignment and attach it permanently with screws.

Lid Magnets

(Position as desired, centering the mounting holes front to back 5/16" in from the front edge)

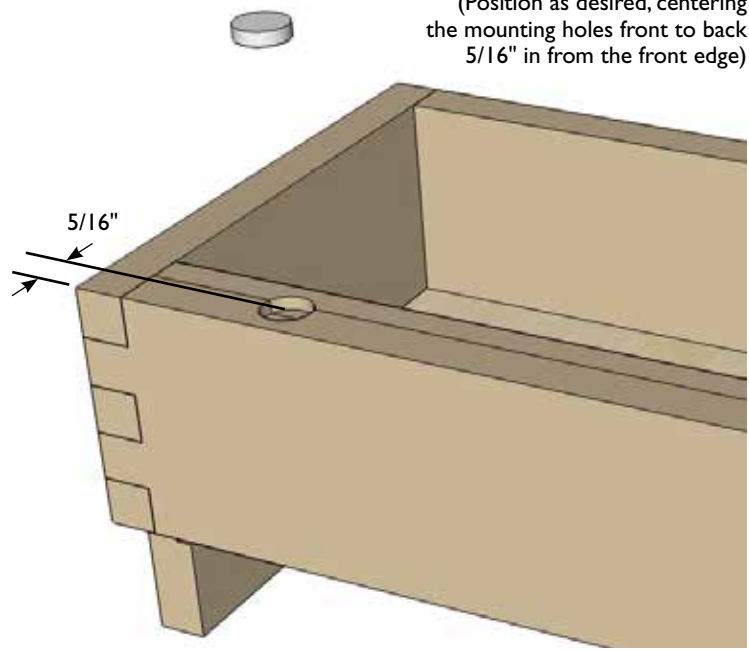


Fig. 8



Fig. 9

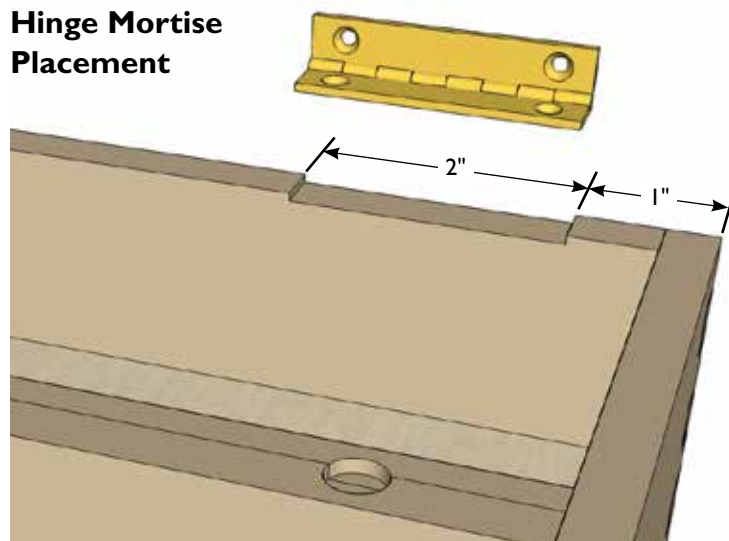
Mortise the box for the hinges

I used 2" long brass small-box hinges that incorporate a feature that stops the lid from opening more than about 105°. Because the lid is a flat piece with no lip, I decided to surface mount that leaf of each hinge. But because I was also surface-mounting the washers for the magnets on the lid and I wanted an even gap between the lid and box, I needed to cut shallow mortises in the back of the box for the hinge. See **Hinge Mortise Placement**.

The best way I could think of to do this was with a 3/4" straight bit at my router table. I made a couple of movable L-shaped stop blocks that would allow me to push the box straight in and then move the box side-to-side to cut the mortise. It took some fiddling, a few practice cuts in scrap and a little final fitting with a chisel, but it worked. See **Router Table Setup for Hinge Mortises**, Figs. 10-12.

To mount the hinges to the box, I positioned each in its mortise and drilled one screw hole with a #4 self-

Hinge Mortise Placement



centering bit. I used a screwdriver to install a screw in that hole, checked the alignment of the hinge and drilled the second hole with the self-centering bit. Then I drove the other screw by hand.

Router Table Setup for Hinge Mortises

(Reverse this setup for cutting the mortise on the other side)

Position fence back far enough that the full diameter of the bit is engaged

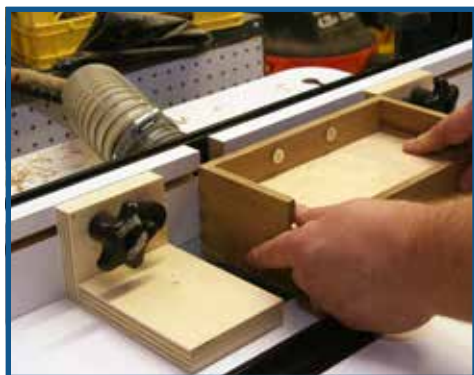
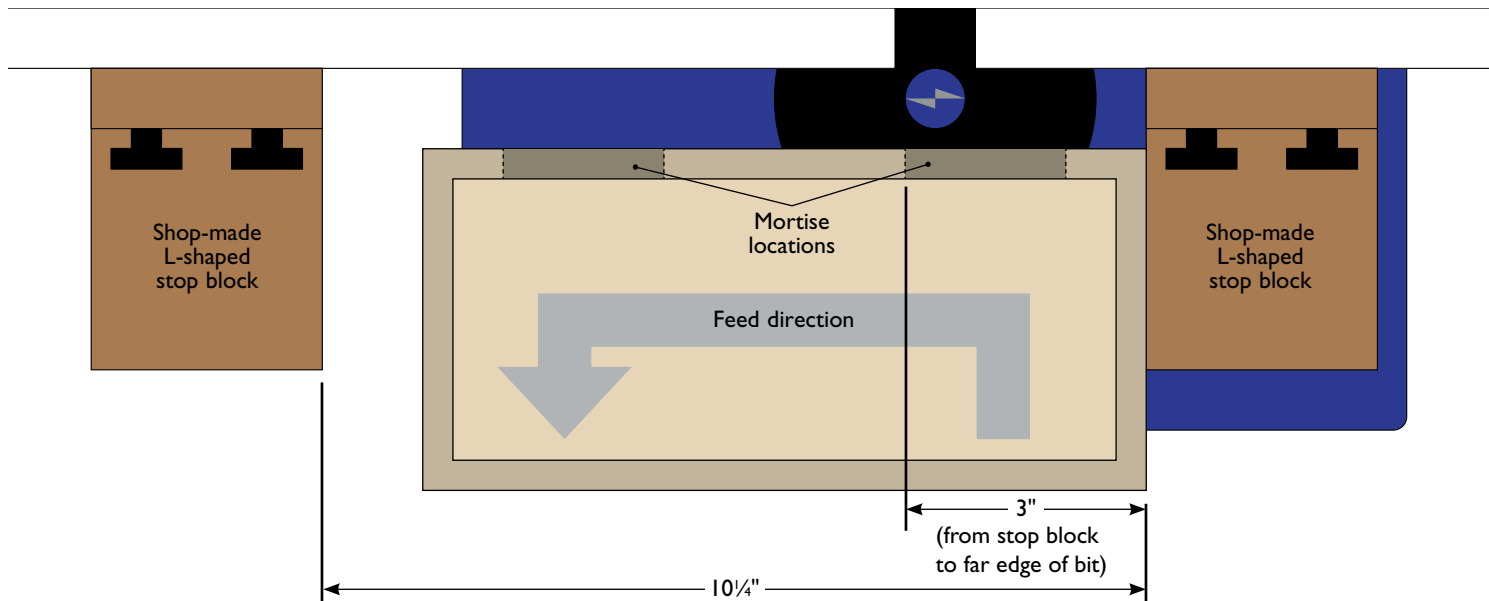


Fig. 10

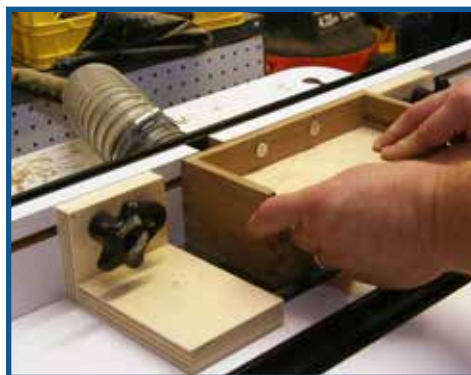


Fig. 11

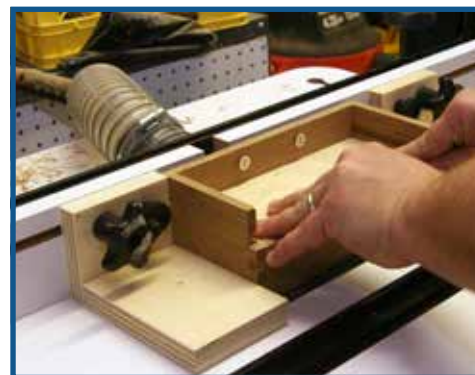


Fig. 12



Fig. 13

Attach the lid and the base

The base is screwed to the sides and the back of the main box. To determine the screw locations, I positioned the box on top of the base, making sure that the reveal was roughly equal all the way around, and traced the outline of the box, including where the sides stopped. Then I used a short rule to measure $3/16''$ in from my lines and mark three locations along the back and two locations on each side for screws. I drilled through holes from the top face of the base, then flipped it over to drill countersinks for #6 x $1\frac{1}{2}''$ screws. I also elongated the holes for the front screw on each side to allow for seasonal wood movement of the base. **Fig. 13.**

Once those holes were drilled, I positioned the main box back on the base, edges against my lines, and carefully flipped both so I could mark for pilot holes in the back and sides of the box. I drilled those pilot holes at the drill press and then attached base to box with #6 x $1\frac{1}{2}''$ screws.

To attach the lid to the hinges already mounted on the box, I positioned the lid so that the reveal would match that of the base on the sides and the front (a Rockler Clamp-It Assembly Square made this easier). Then I traced around the hinge barrel on the underside of the lid. I measured the distance from the back of the hinge to the center of the screw holes and transferred that measurement by drawing a layout line on the lid. Then I held the lid up to the hinge leaves (in the open position), aligning the center of the screw holes in the leaves with the layout lines, and marked the screw locations. I drilled shallow $1/16''$ diameter pilot holes at those locations.

It's important to note here that the screws that came with

the hinges were long enough to potentially poke through the top face of the lid, so I nipped off $1/16''$ or so before installing them.

Finishing

The wood was so beautiful that I didn't want to obscure it at all, so I opted for a water-based satin polyurethane. With its low odor and fast dry times, it was a pleasure to use. I just had to raise the grain beforehand with some distilled water and then knock it down with 400-grit sandpaper (to offset my tendency to sand a little heavily).

Before I applied the finish, however, I removed all hardware from the box (with the exception of the screws holding the drawer face to the drawer) and unscrewed the base. Once the finish dried, I reinstalled the hardware, reattached the base and applied fast-setting epoxy to hold the rare-earth magnets. I also cut self-adhesive velvet to line the bottom of the drawer and the main compartment to minimize the noise. I chose blue, but several other colors are available.

Attention Rockler Plan User

Before starting, please read the plan completely. Check Rockler.com for updates that may not be included on this copy. If you have further questions, please contact our Technical Support Department, 1-800-260-9663 or support@rockler.com



Notes

