



Hidden magnets hold the lid on this crossgrain box but pop it off when the lid is rotated to repelling polarity.

Keeping the Lid on with

HIDDEN MAGNETS

John Kelsey

People love the way hidden magnets hold the lid on this box. Corresponding magnets embedded in the lid and box body secure the lid in “proper” grain alignment. A partial turn releases the grip, but you can’t reverse the lid’s position because the opposing magnets pop it right off.

While the magnets are totally embedded in the wood and out of sight, the canny observer will spot glue lines, though they are not where people seem to expect. This method of blank prep—using three disks with careful figure matching, blank flattening, and good gluing—gets very close to hiding all the evidence.

The project will challenge your layout and lathe skills because there is the risk of cutting into the embedded magnets. So you need to install them accurately and know where they are. You can’t see them inside the wood, but you can determine their locations by sticking extra magnets to the outside.

Craft strategy

Turning this box in crossgrain orientation (with the grain running perpendicular to the lathe bed) works well because long-grain surfaces are better for gluing than endgrain. You can minimize glue lines by careful preparation as well as by design—that’s why my box has a bead just under the lid. Glue up the box blank from three sections: lid, join, and bowl, with the magnets pre-embedded in the join section (*Figure 1*).

When glued together, the blank should be about 3" (8cm) thick. The example shown, finished to 4¼" (11cm) diameter and 3½" (8cm) tall, started as two pieces of 8/4 stock bandsawn to 4½" (12cm) diameter, one for the bowl and the other parted to make the lid and join sections (*Photo 1*). It helps if the wood has been thoroughly dried, but it’s not critical because the lid fit isn’t critical either—the magnets work better if it’s a bit loose. And since they

require about ⅜" (9.5mm) of wall thickness, the box is destined to be chunky, not something thin and delicate.

The join section gets bored identically on both sides for four or eight strong rare-earth magnets—shiny little ¼" (6mm) cylinders glued in place with cyanoacrylate (CA) glue. You’ll find many suppliers online; just search for “rare earth magnets.” Installing all the magnets in the join piece and gluing all three sections into a solid cylindrical blank gives the best grain and figure match. Then part the join section between the embedded magnets and complete the box in the usual way—that is, shape and finish the inside of the lid, fit the bowl to it, hollow and finish the bowl, and only then turn and finish the outside shape.

Hockey pucks

Begin by bandsawing two crossgrain disks to a diameter that fits your expanded scroll chuck and turn them into smooth, flat pucks. One disk is for the lid and join sections, and the other is for the box body. Label the disks accordingly, and draw a sharp witness triangle on the edges so later you can reassemble them in the same configuration (*Photo 2*). From the top disk, part off the join section (*Photo 3*) at a minimum of 1⅝" (29mm) thickness, and preferably 1¼" (32mm) for more breathing room. I use a narrow parting tool, which needs a bit of clearance but reliably wastes a bare ⅛" (3mm) of thickness.

After parting, a sharp scraper will leave a fairly flat surface on the disks, but a straightedge reveals the hills and valleys (*Photos 4, 5*). To finish flattening the parts, use a sanding board (a flat

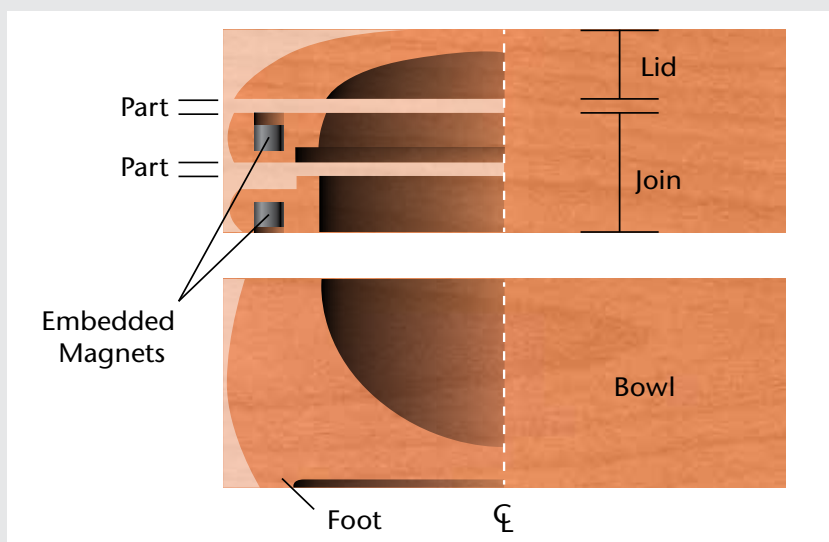
3-Part blank from 2 disks



The box blank is assembled from two matching, quartersawn disks of 8/4 stock. This box is made in crossgrain orientation, with the grain running perpendicular to the bed ways.

Figure 1. One disk makes the box bowl, the other contains the lid and join pieces. The magnets lurk in holes bored in the join piece, which is glued to the lid and body, then parted so the magnets can do their job.

Illustration: Robin Springett



board with abrasive adhered to it) at the lathe (*Photo 6*). Flatten the bottom of the lid piece, both sides of the join section, and the top of the bowl piece. Flatten all four gluing surfaces with care, as it's easy to lose too much wood in the process. It helps to pre-excavate the mating faces so there are no center nubs. If the join piece ends up under $1\frac{1}{8}$ " thick, you might save the day by installing magnets in the bowl section and covering them with a thinner join piece.

Join section

You can install four single magnets in the join section, two for the body and two for the lid, or, for more pull, pairs of magnets, as shown in the photos. To lay out the position of the magnet holes, draw a diameter across the disk face and a circle $\frac{3}{8}$ " from the edge of the disk. Extend the diameter onto the edges of the disk, and do the same layout on the opposite side. Locate the centers of the $\frac{1}{4}$ " magnet holes on the circle and equidistant from the centerline. This leaves $\frac{1}{4}$ " of wood for shaping the outside of the box at the join (*Figure 2*). Finally, punch with an awl to locate the drill centers (*Photo 7*). Repeat the exact layout on the opposite side of the blank.

Bore for the magnets with a $\frac{1}{4}$ " flat-bottom bit (*Photo 8*). As shown in *Figure 2*, bore exactly $\frac{3}{8}$ " deep on the lid side and $\frac{7}{32}$ " (7mm) on the bowl side. The holes should line up from one side of the disk to the other, so transferring the layout accurately is important. Measure their depth and take care to get it right.

Magnet management

These little ultra-strong magnets jump around and stick to each other, as well as to any nearby iron. To avoid confusing the polarity, stack the magnets and mark the same pole on all of them. Mark the top face of the top magnet, slide it off, and park it on a steel ruler. Mark the next, and

so on (*Photo 9*). I use a permanent marker, but you could just scratch an X.

Install the magnets on one side of the join disk first. This makes it easy to get the polarity right on the other side because they'll be attracted to the first set and will be drawn into place. To make a lid that grabs either way around, install the magnets the same way up on the first side of the disk and opposite on the other (opposite polarities attract); for a lid that pops off when it's reversed, install them oppositely so the polarities will match and repel in the rotated position (*Figure 3*). It's easy to get confused, so before committing to glue, park the magnets flanking the join section itself, stacked ►

Part join section from lid



Before parting the join section from the box lid, draw a witness triangle, or reference lines, for future reassembly. A thin parting tool minimizes kerf waste and thus disruption of grain flow. Part the join piece so it is $1\frac{1}{4}$ " thick.

Flatten the parts



Flatten the disks for sound glue joints; the pieces will be glued back together after you embed the magnets. I use a sharp scraper for flattening—for the smoothest cut, lock your elbows to your ribs and sway on the balls of your feet. Sight a straightedge against the light to see hills and valleys.



Hollow the center so there is no nub, and flatten the disk on the lathe using abrasive spray-glued or taped to a flat board.

Mark and bore magnet holes in join section

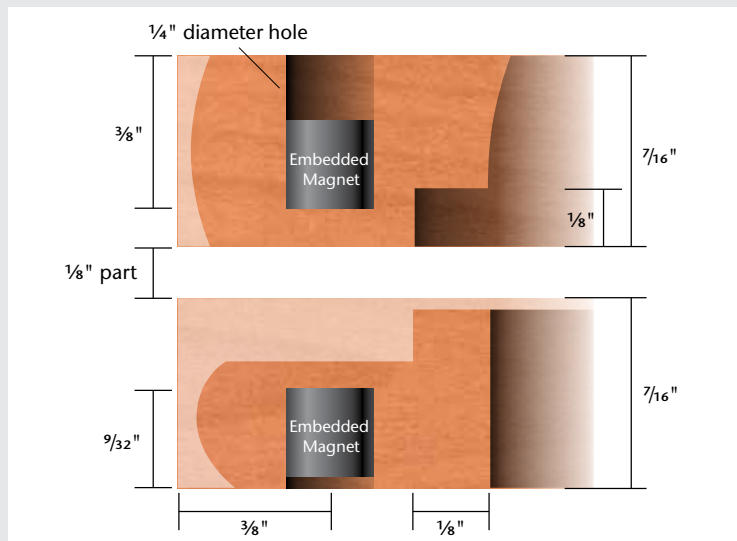


Figure 2. Join details, showing critical dimensions for magnets, tenon, and recess. Tenon atop bowl fits rebate in lid.

Illustration: Robin Springett



Draw a diameter across the join section. Then lay out the magnet centers and center-punch for drilling. Transfer the layout to the opposite side of the join piece for perfectly aligned holes.



Drill $\frac{3}{8}$ " deep on the lid side of the join section and $\frac{9}{32}$ " on the bowl side.

Magnet management

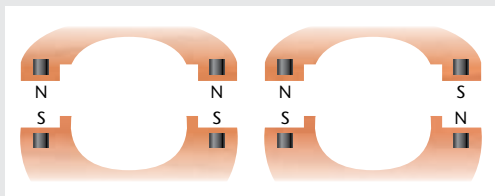


Figure 3. Magnet polarity. The same polarity on the lid side will maintain attraction when rotated 180° (left). Opposite polarity will repel when rotated (right) and push the lid off.

Illustration: Robin Springett



To help keep track of polarity, mark the same pole of all the magnets. Park them in pairs on a steel ruler.



Glue in the magnets one at a time. Drip CA glue into a hole, check polarity, and insert the magnet. Hold it down with a sharp stick, and hit with accelerator.

the way you want them to end up, and far enough apart to not jump together.

Keep the magnets under control by gluing them one at a time. Squeeze a drop of CA glue into the hole, slide the magnet into place, and use a sharp stick or a bamboo skewer to press it down while you apply a tiny squirt of CA accelerator (*Photo 10*). Verify the polarity of the next magnet, and repeat. After you have finished that, keep the disk flat by carefully hand-sanding any drools of CA glue.

Other polarity layouts will work, and some have interesting effects; I found it worthwhile to make a test rig with twenty-four sets of holes.

Making the box

Realign the witness marks to reassemble the three sections into a single cylinder of wood. Using regular wood glue, assemble and clamp the pieces together, with a pressure assist from the lathe's tailstock (*Photo 11*). Wet glue is slippery and there is not much extra wood, so go for low aggravation

and glue up the blank in two stages, not all at once.

After the glue has set, remount the blank and true it up. I like to make the surfaces really smooth and clean now and keep them that way, sharpening my tools often. This minimizes torn grain and tedious sanding later. And from here on, I use a strip of rubbery plastic to protect the work from the chuck jaws (visible in *Photo 13*).

Part the blank in the center of the join piece (*Photo 12*) and flatten carefully, leaving at least $\frac{7}{16}$ " (11mm) of the disk and better yet $\frac{1}{2}$ " (13mm) on either side for the magnets plus a tenon with matching rebate. If you have allowed for some extra wood in the join section, leave more of it on the box body when parting, rather than on the lid, as it will give you a second chance when fine-tuning the fit.

Now you have blanks for a box lid and body with matching magnets embedded in each. Turn the box as you normally would. But before each step, use extra magnets on the outside of the

wood to confirm and mark the location of the hidden magnets inside (*Photo 13*). It is regrettably easy to cut too close—you'll hear the click and see the shine.

I apply finish as I go with a brushing lacquer, the first coat being applied and the excess wiped off immediately after sanding (*Photo 14*).

Final thoughts

When I started making these boxes, I lost about half the blanks by turning into the embedded magnets—highly maddening. Magnet placement was imprecise, as were my lid-to-bowl joints. So I dropped back to making simple, flat boxes without magnets. I made more than thirty before returning to magnetic boxes, which required me to kick up my blank-prep and turning skills. With care and attention to detail, I've taken care of hostess and holiday gifts for yet another year. ■

John Kelsey is a member of the Lancaster Area Woodturners, an AAW chapter.

Assemble disks into a box blank

Glue the three sections together, using clamps along with the tailstock ram. It's less risky to glue two sections first, then the third, to avoid slippage during glue-up. Note that the walnut disk is a clamping pad and not part of the box blank.



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JOURNAL ARCHIVE CONNECTION

To learn more about the steps in basic turned-box construction, see Alan Lacer's 2005 AW article, "Critical Dimensions: Conquering the Challenges of the Lidded Box" (vol 20, no 2, page 32). AAW members can access all past journal articles online at woodturner.org.



Turn the box



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True up the assembled blank and turn the box as you normally would. Part the lid from the body between the magnets in the middle of the join section, leaving about $\frac{1}{2}$ " of wood on either side.



13

At each step, use extra magnets to confirm the location of the hidden magnets, so you don't turn into them.



14

Sand and finish each surface as you go.