



# SHOP PROJECTS

From the editors of *Popular Woodworking*  
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# Cabinetmaker's Tool Chest

Store all the tools you need in easy reach.

BY ROBERT W. LANG

*If I were to make three lists*—the tools I want, the tools I own and the tools I need—the last would be the shortest. When I decided to build a wall cabinet for my hand tools, I put my most-used tools close at hand and at eye level, along with plenty of drawer storage for tools I don't need so often.

I spent time sorting through my tools and experimenting. I cut some pieces of ¼"-thick foam core (plywood or cardboard would work as well) to pin down the size and shape of the cabinet and the layout of the tools. My goal was to store as much as possible in a compact and organized space.

LEAD PHOTOS BY AL PARRISH; STEP PHOTOS & ILLUSTRATIONS BY THE AUTHOR



If you're thinking of building a tool chest similar to this, I suggest that you alter my design and adapt it to your tools, your shop and the way you work. The results will be more useful to you, and you'll be happier. Plan the cabinet around groups of tools; put the most-used ones where they will be near at hand.

I let function lead the way, with a single door for hanging storage. The stiles were turned 90° to provide depth. I wanted to hang a framing square in a corner of the door, and a bit of experimentation led to an overall height of 30" and a width of 22¼". A survey of the tools destined to hang in the door led to an overall depth of the door at 2½" and I settled on a case depth of 11¾".

My initial thought was drawers at the bottom of the case with hanging and shelf storage above. I didn't want the drawers too tall and I settled on varying heights from 1½" to 2¾" with one taller narrow drawer. A mock-up of the plane ramp left room at the top and rather than redo my layout, I sketched in three 2"-high drawers at the top.

I thought that looked pretty good, found a few people to agree with me and carried the horizontal division of the drawers down to the lower drawers. I wanted some wider drawers, and made those two-thirds of the space. Alternating the arrangement from side to side kept things interesting and the regular division meant fewer sizes to deal with.

## FROM THE OUTSIDE IN

The outer case is solid wood, connected with through-dovetails, as is the door frame. I laid out the dovetails to leave a half-tail where the case and door meet and half-pins at the wall and the outer edges of the door.

After sawing the pins by hand I lowered the end of the board in my vise to place it even with the top of a piece of scrap on top of a box. Then I used a trim router with a straight bit to remove the waste between the pins, stopping short of the saw cuts. The small amount of

material that remained was cleaned out with a chisel.

With the pins complete, I marked and cut the tails then made the first of many trial assemblies. With a complex case like this, I lay out the joinery from existing parts when I can. With the outer case together, I marked the locations of the dados that capture the shelves and web frames.

I used a router with a straight bit and a right-angle guide to rout the dados. Because the dados are different widths, I set up a few different routers so I wouldn't need to change or repeat my tool setups. There are times when you really do need four routers.

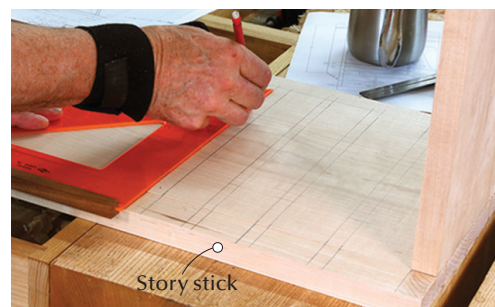
There is a solid shelf below the top drawers and another solid shelf above the lower drawers. The two shelves are connected with a solid vertical divider that sits back 1" from the front edge. The dados for the vertical divider stop back from the front by 1½", and the front of the divider is notched at each end to cover the ends of the dados. After fitting the two shelves and the vertical divider, I reassembled the case, then cut and fit the front rails of the web frames.

Next I laid out and cut the dados for all the vertical dividers between the drawers. These dividers have a short piece at the front glued cross-grain to a longer piece that runs front to back. These pieces are trapped in dados and have nowhere to go, even if the cross-grain joint should someday fail.

The last set of dados are for the small shelf that sits above the plane ramp. These stop about ½" from the front edge of the shelf, which is notched beyond the ends of the dados.

With all the visible pieces in place, I made the secondary parts to complete the web frames. I made the back rails the same length as the fronts, and ran a groove down all the inside edges. I then cut stub tenons on the ends of the pieces that connect the rails front to back.

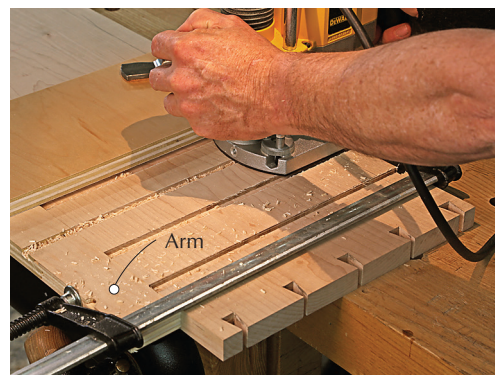
The web frames are glued together and dry-fit to the case to make sure all parts fit tight and square. This dress rehearsal also showed where I needed to



With the case dry-fit, dados for interior partitions are laid out from a story stick.



A trim router with a straight bit makes quick work of clearing waste between the pins, and it leaves a flat baseline.



This T-square jig indexes off the router cut in the arm. Line up that cut to your layout lines, then rout the workpiece.



Dados for the vertical dividers are also laid out with the carcass together, before the web frames that support the drawers are assembled.





## Supplies

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Good openings will ensure good-fitting drawers. Check and adjust each opening with a dry assembly.



Assemble the frame of the door before laying out the groove locations for the panels.



It's easiest to make stopped grooves by bringing the tool to the work. Plunge first close to the ends, then make the cut in between. A mortise chisel makes short work of squaring the ends of the grooves.

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## Cabinetmaker's Tool Chest

NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL
		T	W	L	
CARCASE					
☐	2 Case sides	1 <sup>3</sup> / <sub>16</sub>	11 <sup>3</sup> / <sub>4</sub>	30	maple
☐	2 Case top/bottom	1 <sup>3</sup> / <sub>16</sub>	11 <sup>3</sup> / <sub>4</sub>	22 <sup>1</sup> / <sub>4</sub>	maple
☐	1 Shelf above drawers	5⁄8	10 <sup>3</sup> / <sub>4</sub>	21	maple
☐	1 Vertical divider	5⁄8	9 <sup>3</sup> / <sub>4</sub>	16 <sup>3</sup> / <sub>4</sub>	maple
☐	1 Shelf below drawers	1⁄2	10 <sup>3</sup> / <sub>4</sub>	21	maple
☐	1 Block plane shelf	1⁄2	5	10 <sup>3</sup> / <sub>8</sub>	maple
☐	2 Low frame fronts	1⁄2	2	21	maple
☐	1 Mid frame front	3⁄8	2	13 <sup>3</sup> / <sub>8</sub>	maple
☐	3 Vert drawer dividers	3⁄8	2 <sup>1</sup> / <sub>4</sub>	10 <sup>3</sup> / <sub>4</sub>	maple
☐	1 Vert drawer divider	3⁄8	2 <sup>5</sup> / <sub>8</sub>	10 <sup>3</sup> / <sub>4</sub>	maple
☐	1 Vert drawer divider	3⁄8	3 <sup>3</sup> / <sub>4</sub>	10 <sup>3</sup> / <sub>4</sub>	maple
☐	1 Plane ramp	1⁄2	10	17 <sup>7</sup> / <sub>16</sub>	Baltic birch ply
☐	1 Case back	1⁄2	21 <sup>1</sup> / <sub>8</sub>	28 <sup>3</sup> / <sub>8</sub>	Baltic birch ply
☐	2 Low frame backs	1⁄2	2	21	poplar
☐	7 Frame rails	1⁄2	2	7 <sup>3</sup> / <sub>4</sub>	poplar
☐	1 Mid frame back	3⁄8	2	13 <sup>15</sup> / <sub>16</sub>	poplar
☐	2 Mid frame rails	1⁄2	2	7 <sup>3</sup> / <sub>4</sub>	poplar
☐	2 French cleats	1⁄2	4 <sup>1</sup> / <sub>2</sub>	21 <sup>5</sup> / <sub>8</sub>	Baltic birch ply
DOOR					
☐	2 Outer stiles	1 <sup>3</sup> / <sub>16</sub>	2 <sup>1</sup> / <sub>2</sub>	30	maple
☐	2 Rails	1 <sup>3</sup> / <sub>16</sub>	2 <sup>1</sup> / <sub>2</sub>	22 <sup>1</sup> / <sub>4</sub>	maple
☐	1 Middle stile	1 <sup>3</sup> / <sub>8</sub>	1 <sup>3</sup> / <sub>8</sub>	30	maple
☐	2 Panels	3⁄4	10 <sup>3</sup> / <sub>16</sub>	28 <sup>3</sup> / <sub>8</sub>	maple
DRAWER FRONTS					
☐	4 Fronts	1 <sup>3</sup> / <sub>16</sub>	2	6 <sup>5</sup> / <sub>8</sub>	walnut
☐	1 Front	1 <sup>3</sup> / <sub>16</sub>	2	13 <sup>3</sup> / <sub>8</sub>	walnut
☐	1 Front	1 <sup>3</sup> / <sub>16</sub>	1 <sup>1</sup> / <sub>2</sub>	13 <sup>3</sup> / <sub>8</sub>	walnut
☐	1 Front	1 <sup>3</sup> / <sub>16</sub>	1 <sup>3</sup> / <sub>8</sub>	13 <sup>3</sup> / <sub>8</sub>	walnut
☐	1 Front	1 <sup>3</sup> / <sub>16</sub>	2 <sup>3</sup> / <sub>8</sub>	6 <sup>5</sup> / <sub>8</sub>	walnut
☐	1 Front	1 <sup>3</sup> / <sub>16</sub>	2 <sup>3</sup> / <sub>8</sub>	13 <sup>3</sup> / <sub>8</sub>	walnut
☐	1 Front	1 <sup>3</sup> / <sub>16</sub>	3 <sup>1</sup> / <sub>2</sub>	6 <sup>5</sup> / <sub>8</sub>	walnut
☐	14 Pulls	3⁄8	1 <sup>1</sup> / <sub>16</sub>	1 <sup>1</sup> / <sub>4</sub>	maple

**DRAWER SIDES & BACKS** ¾"-thick, drawer bottoms ¼"-thick plywood

clamp during the final assembly. Then the case came back apart to clean up all the visible surfaces.

The back of the case is a piece of ½"-thick plywood that sits in 1"-deep rabbets in the sides. I skipped the rabbets in the top and bottom to avoid cutting into the dovetails at the corners. There is plenty of material in the area to screw the back to, and the top and bottom of the back are hidden behind drawers.

I clamped a straightedge to my layout line at the back of the sides and cut

the rabbets with a large straight bit. A bearing above the cutter rode along the straightedge. I stopped short at the beginning and end of the cut and cleaned up the corners with a chisel.

### NOT YOUR AVERAGE DOOR

I made the door before I glued the carcase together, just in case I needed to adjust one or the other to ensure they fit together nicely. The outer corners of the door are simple through-dovetails. The extra stile in the middle of the door

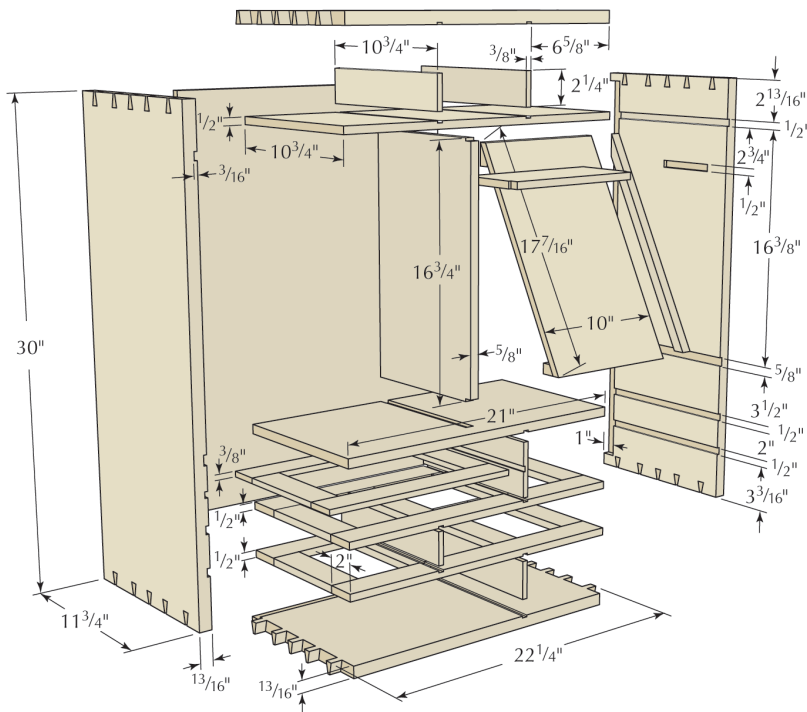


makes it a beefier structure and allows for two solid-wood panels.

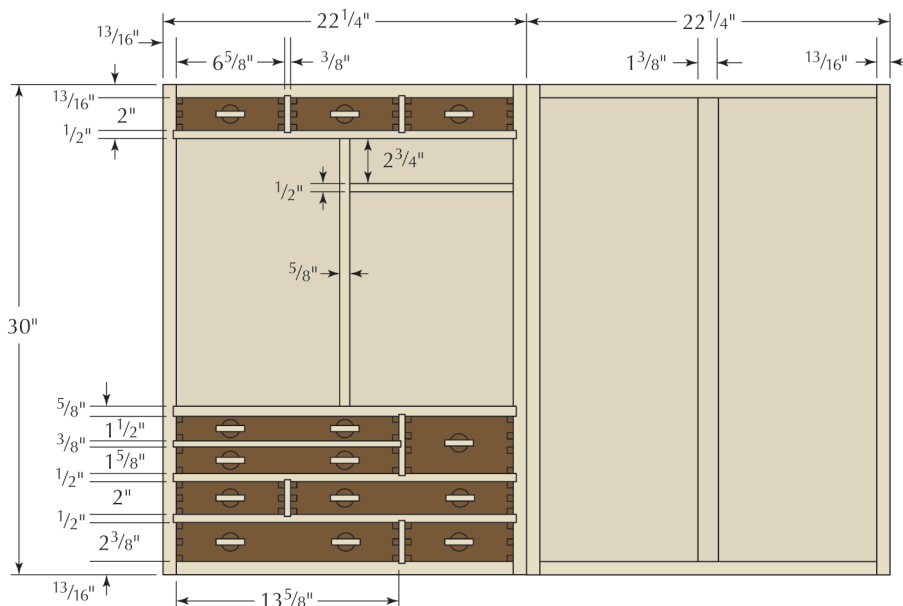
A single dovetail at each end of the central stile holds it to the rails. This tail is lapped back to the edge of the groove that holds the panels, about 1" from the

front edge. I dry-fit the five frame parts, then marked the location of the groove with these pieces together.

The panels are  $\frac{3}{4}$ " thick, with a cove cut from both sides to leave a  $\frac{1}{4}$ "-wide tongue. The cove is a  $\frac{1}{2}$ " radius and I



**EXPLODED VIEW**



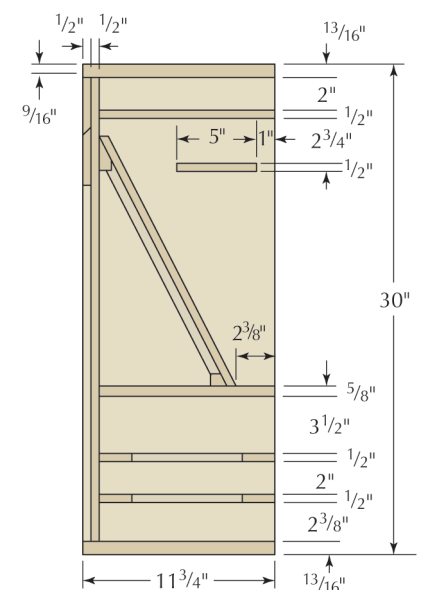
**FRONT**



*There is a logical sequence to the final carcass assembly; with this many parts, it is worth a couple of practice runs to make sure everything fits.*



*Liquid hide glue has a longer open time than yellow or white glue. That gives me time to make sure the corners are square and the joints are tight.*



**SECTION**





set the front by eye until the cut looked pleasant, then lowered the cutter to make a smaller cut at the back. I then put a  $\frac{1}{4}$ "-diameter spiral-upcut bit in a small plunge router and cut the grooves in my door frames.

The door is sturdy and easy to put together as long as the panels can slide easily in the grooves. The center stile is fit to the top and bottom rails, the panels are slid into place, then the stiles go on either end.

## MOMENT OF TRUTH

If all of the carcass pieces have successfully gone together in the dry-fit, final assembly can be done in one go. I made a couple of practice runs to be sure of the sequence and that I had the right number and type of clamps ready.

I laid one side down on my bench, with the dados facing up. Then I brushed liquid hide glue (for its long open time) into the dados and on the end-grain surfaces of the dovetails. (Letting the glue wick into the end grain gives much better glue joints.)

Assembly is from the center out. I fit the large vertical divider into the two solid shelves, then placed the shelves into their dados. The small shelf above the planes also goes in at this time.

Then I placed the web frames, along with the small vertical dividers. There should be enough play between the frames and the shelves so that the dividers can drop into their dados.

Sliding the dividers in from the front would be silly unless the fit were too loose. If the fit is right they will get stuck before they get halfway back. With the dividers and frames all in place, I brushed more glue on the dovetails and added the top and bottom.

Before adding the second side, I brushed glue on the joining surfaces of the shelves and frames. Adding the second side is tricky, but not bad if the parts fit. I started the dovetails at the top and bottom, then lined up the shelves and frames and tapped them into the dados. When all the joints were started I drove them home with a mallet.

If the dovetails fit, they shouldn't need to be clamped, but I needed clamps front and back at most of the dado joints. As I clamped I checked to be sure that both the entire assembly and each corner was square. The final step was to cut and fit the plane ramp from  $\frac{1}{2}$ "-thick plywood. It attaches to  $\frac{3}{4}$ " x  $\frac{3}{4}$ " cleats nailed to the side of the case and the vertical divider.

## A FITTING STRATEGY

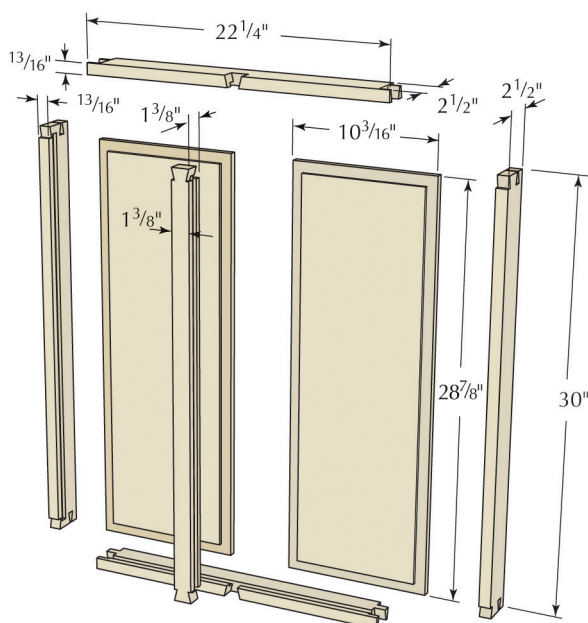
I have two methods to ensure nice-fitting drawers. The first is to fuss over the openings and try to get them as perfect as possible. The second is to fit the parts of the drawers to the openings before assembling the drawer boxes.

I start with the drawer fronts. After marking a rough layout with chalk, I cut the fronts slightly larger than the openings. I carefully trim each front until it just fits in the opening. I want a slight gap when I'm done, but at this point I aim for a snug fit.

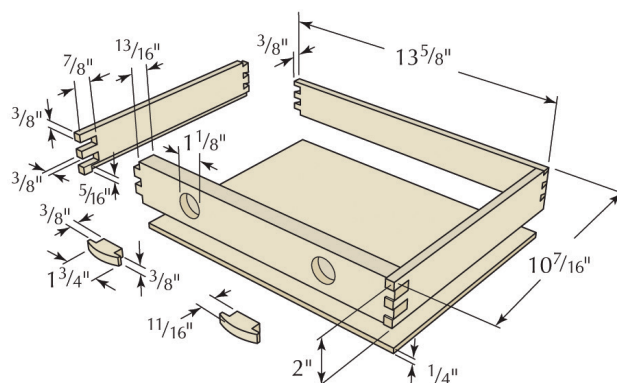
I fit each side to easily slide into an opening. If there are any variations in the openings, I plane the edges of the drawer sides to compensate. My goal is a gap of  $\frac{1}{32}$ " at the top of the sides. This means the sides can vary, so I mark each one with its location.

My theory is this: If the fronts and sides fit nicely, the assembled drawer should fit with minimal fuss, as long as the joints between them are correct. I chose to use Greene & Greene-style finger joints, but the principle applies no matter how the pieces are joined.

I started by laying out the joints on the fronts. Each has a  $\frac{3}{8}$ " x  $\frac{3}{8}$ " notch at the top and bottom corner and except for the two short drawers and the



EXPLODED VIEW—DOOR



EXPLODED VIEW—DRAWER





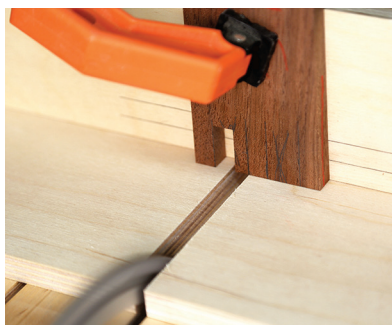
*I make sure that the drawer fronts fit in their respective openings before assembling the drawers.*



*A stop-block on the jig (attached to the table saw miter gauge) is used to make identical cuts on all corners of the drawer fronts.*



*Much like a dovetail joint, the finished fingers of the drawer fronts are used to mark the sides for the matching half of the finger joints.*



*The same jig is used to cut the fingers in the drawer sides. The saw blade is raised to the thickness of the drawer fronts plus  $\frac{1}{16}$ ".*

tall drawer there is a  $\frac{3}{8}$ " x  $\frac{3}{8}$ " notch centered vertically. The tall drawer has notches that line up with the notches in the short drawers next to it.

I made a jig from two pieces of plywood and attached that to the miter gauge of the table saw. I used a Freud box-joint cutter set to make  $\frac{3}{8}$ "-wide cuts and set the height of the blade to  $\frac{3}{8}$ " above the flat part of my jig. I ran the jig over the blade then set the pieces vertically, lining up the layout lines to the edge of the cut.

For the corner cuts I clamped a stop-block to the jig and for the interior cuts I positioned the fronts by eye. These pieces are rather small, so I recommend clamping the work to the jig.

When the notches were all cut in the fronts, I cut a shallow rabbet in the back face behind the pins to make them easy to register on the sides and marked the joint locations with a pencil. (I fudged the sides down from the fronts about  $\frac{1}{32}$ " when marking the joints.) This leaves the desired gap at the bottom of the drawer front after assembly.

I raised the blade by the thickness



*This blank will become a half-dozen pulls. After laying them all out, the Forstner bit makes an angled cut on each side for make a finger-friendly pull.*



*The face of the drawer front is marked directly on the fingers of the drawer side in the dry-assembled drawer.*

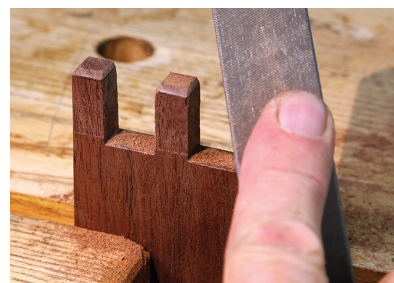
of the drawer fronts plus  $\frac{1}{16}$ " and cut the fingers at the table saw. These joints should fit easily together with hand pressure only. When I had two sides connected to a front, I tested the fit in the corresponding opening. The offset in the joints raises the front, so I planed the top edge of the drawer fronts to leave a slight gap.

I cut the drawer backs to length, matching the distance from side to side of the dry-fit sides and fronts. The drawer bottoms fit in  $\frac{5}{16}$ "-deep rabbets to maximize space in the drawer, so the width of the backs is  $\frac{5}{16}$ " less than the sides. The backs and sides join with through-dovetails.

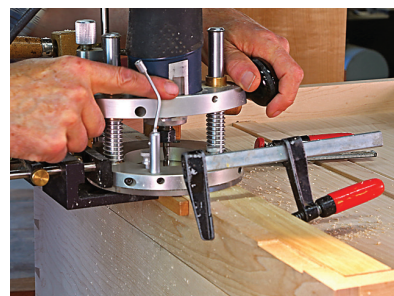
After cutting the back joints, I dry-fit each drawer and made sure it fit in its openings before cutting the rabbets at the router table. The rabbet should be as narrow as possible because the drawers slide on what remains beyond the rabbet. After routing, I cleaned up the corners with a chisel.

## GET A GRIP

Rather than throw money at the draw-



*The edges are rounded over to the pencil line with a file. The file also cleans up the saw marks of the end grain.*



*A scrap clamped inside the door keeps the router base from tipping and the fence defines the back edge of the hinge mortises.*





er pulls, I decided to make my own. I played around with the concept of a shaped wood pull in a shallow hole. After settling on a design that looked and felt good, I needed to come up with a way to efficiently and safely make 14 pulls. I prepared a few pieces of maple  $\frac{3}{8}$ " thick x  $1\frac{1}{16}$ " wide.

I laid out the pulls on the blank stock, leaving a couple of inches extra on each end. I set up at the drill press to hold the blanks at an angle below a  $1\frac{1}{8}$ "-diameter Forstner bit, then lowered the bit to scoop the center of both sides of each pull.

I took the blanks to the table saw (where the  $\frac{3}{8}$ "-wide box-joint cutter setup was still in place) and cut notches at the end of each pull. At the band saw I cut the arcs on the other edge of the blanks then separated the pulls. I refined the edges of the scoops with a gouge, rounded off the curved surfaces, then drilled a  $\frac{3}{8}$ "-deep x  $1\frac{1}{8}$ "-diameter hole in the center of the narrow drawer fronts. The holes in the wide drawer fronts line up with the holes in the short ones.

With the drawer fronts and sides dry-fit together, I marked the location of the drawer fronts on the fingers of the sides. I pulled the sides off and rounded the edges of the fingers back to the pencil lines with a plastic laminate file. After that, I glued the drawers together, cleaned them up and made sure they still fit.

## AND SWING IT

The door is heavy on its own, and the tools inside add even more weight. I decided to go with three  $1\frac{1}{16}$ " x 3" brass butt hinges. I centered the middle hinge vertically, and centered the top and bottom hinges on the top shelf and lowest web frame.

I routed the gains for the hinges  $\frac{1}{16}$ " deep. The hinges were not swaged, so I used a chisel and cut the outer edges of the gains deeper to leave the smallest possible gap when the door is closed.

The lock is a full-mortise piano lock let into the door halfway up. It has two

wings that extend past the strike when the key is turned.

I sprayed shellac for the finish. The first coat was amber to warm the color, followed by two coats of clear. After letting this cure over a weekend, I took the sheen off with an abrasive pad and applied a coat of paste wax.

The back is screwed in place and the cabinet hangs on a French cleat—two  $4\frac{1}{2}$ " wide pieces of plywood with a 45° bevel on one long edge. The cabinet side of the cleat is screwed to the shelf below the top drawers and the vertical divider. The other part of the cleat is screwed to the wall studs.

## A HAPPY HOME

I arranged the tools on the door in logical groups. My framing square is in the upper-left corner with my combination squares nested within the legs. The holders for the small squares have a rabbet in the top edge. That leaves a ledge to keep the stocks in place, and a notch in the end holds the blades. The curved shapes reflect the shapes of the stocks of the squares.

To the right of my squares is a block to hold smaller tools. The front and back are  $\frac{3}{8}$ " thick, separated by  $\frac{1}{2}$ " x  $\frac{1}{2}$ " squares. At the far right, the end

extends above the front and ends in a semi-circle. A screw in the top secures that end to the door stile. At the other end, a screw goes through the block and into the center door stile.

In the lower half of the door is a rack for chisels, placed high enough to clear the drawer pulls. That rack is  $1\frac{1}{4}$ " wide, with 1"-diameter holes drilled on  $1\frac{1}{2}$ " centers. The centers of the holes are  $\frac{3}{8}$ " back from the edge. I made saw cuts to square the ends of the openings so chisels can be put in from the front. Two screws through the outside of the door hold the rack in place. Plugs cover all the screws.

I cut some thin pieces of walnut to the shape of the back of my planes, and fastened them to the face of the plane ramp. I put the smooth and jack planes as far up the ramp as I could to make room for smaller planes below.

On the left side of the case is an open area; saws and hammers fit on walnut holders at the sides and back, leaving room for small power tools or my mug.

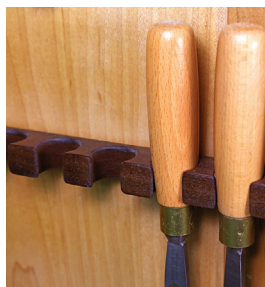
I'm not the most organized person, but I like the tools I use the most hanging near my bench. If I can't find a tool I need, then turn around to find the cabinet empty, I know it is time to stop and clean up a bit. **PW**



ABOVE LEFT This holder for an adjustable square uses the shape of the tool for its overall form. The slot holds the square securely when the door opens and closes.

LEFT Chisels are gripped by the shape of the holes; open faces allow ease of placement.

ABOVE The  $\frac{1}{2}$ " space between the front and back of this rack provides flexible storage for tools I might need in a rush.







# Hardware Hideaway

Store handles, hinges and fasteners in this handsome dust-free organizer.

BY GLEN D. HUEY

## Hardware Hideaway

NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL
		T	W	L	
2	Box sides	½	4½	18	yellow pine
2	Box ends	½	4½	12	yellow pine
1	Box bottom	¼	12	18	plywood
1	Box divider (long)	¼	2	17¾	yellow pine
2	Box dividers (short)	¼	2	11¾	yellow pine
2	Box lids	¾	6¼	18	yellow pine *
1	Lid latch	¼	¾	6	spalted tamarind
2	Tray sides	½	2	17	yellow pine
2	Tray ends	½	2	11	yellow pine
1	Tray bottom	¼	11	17	plywood
1	Tray divider (long)	¼	2	10¾	yellow pine
2	Tray dividers (short)	¼	2	10¾	yellow pine
1	Bin moulding	¾	¾	144	yellow pine

\*Shiplap at center

*While exploring* in an antique store, I found a small, two-level lidded box that would be ideal to store the loads of extra hardware I have stowed in plastic bags. No longer would I need to search endlessly for brads, bails and back plates; everything would be in one place.

The price of the antique, however, was too rich for my wallet, so I took a photo and used the “dollar-bill” method of measuring (a piece of United States paper money is approximately 6" in length). Even if my memory was defective, my notes, measurements and pirated photo could get me close.

### BUILD THE JIG

Both the box and the tray, which fits inside and rests on the lower layer of cubbies, are assembled using box joints (also called finger joints) that I cut at the table saw. Box joints have plenty of glue surface for a strong bond, but are easier than dovetails to whip out by machine. In fact, they are perfect for shop builds. (The same basic process is also a great technique for making dentil moulding.)

Mill the sides and ends of both the box and tray to size and thickness, then set them aside and set up your table saw for making box joints.

First, attach a sacrificial fence to your miter gauge. Install a dado stack set at ½" wide, and raise the depth of cut to ½". Make a single pass of the gauge and fence over the stack to establish the notch for the jig's key—the piece that guides the box-joint making process.

Mill a 12"-long stick of scrap that exactly fits the width and height of the notch (mine is ½" square; I milled it at the planer), then cut a 3"-long piece (the key) to fit and attach into the fence's notch. A couple of brads hold the key in place. With the remaining stick held tight to the right side of the table saw blade (as shown on page 9), free the sacrificial fence from the miter gauge, slide the installed key so it's tight to the right-hand side of the stick, then re-attach the fence to the miter gauge. The jig is ready to go. (As always, you should make a test





cut to confirm that your joints will be tight...or not.)

For the sides of the box, begin with the workpiece positioned tight to the left-hand side of the key. Run the assembly over the dado stack to make the first notch in your workpiece, spaced  $\frac{1}{2}$ " from the edge of the board. Slip the newly cut notch over the key and make another pass. Repeat these steps until you've reached the opposite edge of the board, then flip the board to cut the opposite end. Cut the fingers on the second side, too.

To cut joinery on the ends, begin with the edge of your workpiece set even with the right-hand edge of the fence cut-out; with the first cut, you remove the corner of the board. That corner notch then slips over the key and the balance of the end piece is cut in repetitive passes.

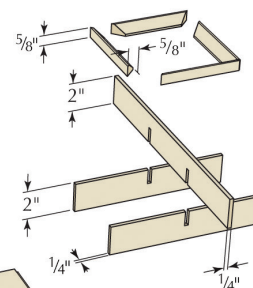
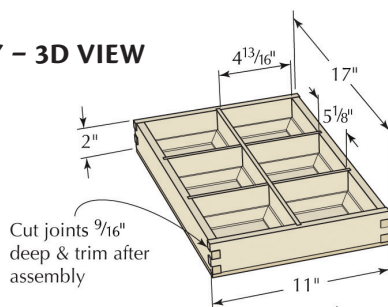
Tray parts are cut the same way, but before any work is done, tweak the blade height to  $\frac{9}{16}$ ". Your first pass raises the cut area, but doesn't affect anything else in the setup. The idea is to slightly reduce the size of the tray to make it easier to lift the unit in and out of the box. Just as before, begin with the tray sides then finish up with the ends.

Dry-assemble the box and tray. Your fit should be tight, but not too tight. If you're working with pine as I am, there is a bit of a "smash factor" you can count on. Be more particular when using hardwoods.

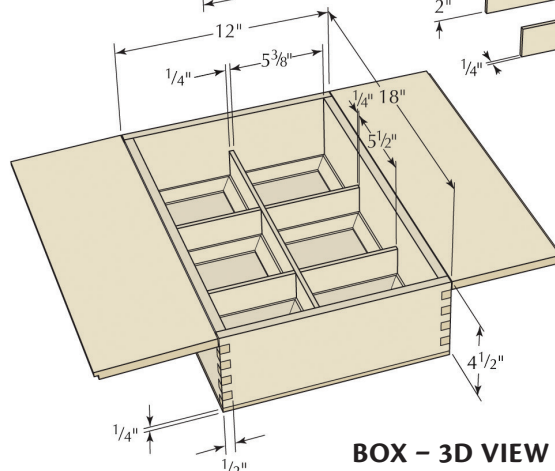
## DADOS ADD STRENGTH

Each side of both the box and the tray has two dados for the  $\frac{1}{4}$ "-thick bin dividers; the dados are almost equally

TRAY – 3D VIEW



TRAY DIVIDER – EXPLODED VIEW



BOX – 3D VIEW

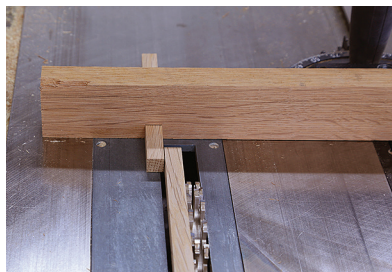
spaced along the lengths (see the illustration above for more information). The ends have a single dado that's cut dead center. I use a shop-made jig to guide my router and  $\frac{1}{4}$ " spiral-upcut router bit to cut the dados (see "Simple & Accurate Router Jig" on page 11).

The layout work is easy. For the sides, measure the length between the joint work, then divide the result by three. Make a mark at the two locations. For the ends, find the centerline of the piece (measure between the joinery) and place a mark. Move  $\frac{1}{8}$ " in both direc-

tions off the marks to lay in the location of the bin dividers.

The dados in the box parts extend up from the bottom edge 2"; those in the tray are routed completely through the parts. Use a backer board to keep from blowing out the grain as the router bit exits the cuts.

After you've cut the dados, use a  $\frac{1}{4}$ "-wide chisel to square the ends of the box dados, then assemble the box and tray. To take full advantage of the box joint's strength, apply glue to all the fingers then slip the sides and ends together. A



Setup for box joints is easy: A sacrificial fence and a milled stick work like magic as you dial in your settings.



The fingers for the box and tray sides begins with the workpiece tight to the left-hand side of the key.



I use the milled stick as a spacer for this step; it takes out any guesswork.





*Router-cut dados help to align the bin dividers and increase the overall strength of the box and tray.*



*It's a good idea to clamp your box and tray, but as you do, make sure the fingers, which are slightly proud of the face of the units, are not captured underneath.*



*Set the parts—short dividers at the ends and longer dividers at the sides—in position on the box or tray as you transfer the layout.*



*Drawing a bead on where to position your egg-crate cuts is straightforward because you can easily see the slot cut in the carrier.*

couple of light mallet taps should set the joints tight—but it doesn't hurt to add a few clamps. Make sure they don't catch the fingers, which are slightly proud of the face of the units.

When the glue is dry, plane or sand the fingers flush to the sides and ends.

## DIVIDE & CONQUER

Mill the dividers to size and thickness, leaving the parts a bit longer than needed. Using the assembled box and tray to measure, square one end of a divider, set the end into a dado then mark and cut the opposite end. (A well-tuned miter saw is perfect for this.) Cut the four pieces for the short dividers, and the two pieces for the longer dividers.

Use an egg-crate joint to assemble the interior of the two units. To mark the location of the cuts, I find it better to use the box or tray itself. Set the part—short dividers at the ends and longer dividers at the sides—in position on the box or tray. Make sure you align the dividers with the back of the dado slot. When positioned, mark both edges of the dado onto the dividers.

The slots for the egg-crate joints are best cut with another table saw jig. This setup is simply a sacrificial fence with a  $\frac{1}{4}$ "-thick carrier attached to its bottom edge. Attach the unit to your miter gauge so the blade cuts the jig about 2" from the end. Raise the blade to just reach the center of the divider—don't forget to account for the carrier thickness. Once set, make a pass over the blade to cut the  $\frac{1}{8}$ "-wide slot. That slot is key when using the jig.

Position your divider on the carrier and against the fence, align the right-most mark at the right edge of the slot—you can easily see the slot cut in the carrier—then make a pass. To complete the egg-crate cut, slide the left-most layout mark to the left side of the carrier slot and make the cut. If your layout marks are accurate, the newly formed slot should slip over the thickness of any divider. If it doesn't, no worries. Set the

divider back on the jig and tweak your slot opening—the edge of the carrier slot easily identifies where to position your divider.

Make the egg-crate slot in each divider. It matters not whether you cut the slots in the top edge, the bottom edge or both. The bin dividers are generic as they fit to the box and tray.

After you've cut and fit your dividers, assemble the pieces in the box and tray. Glue adds little but a mess, so I forego its use here. The box dividers slip in from the bottom; tray parts fit in any direction. As you fit the center pieces in place, you may need to gently bend or twist the shorter dividers to get the egg-crates joined. If you need stronger measures, check the layout and cuts for problems.

The bottoms of the box and tray are  $\frac{1}{4}$ "-thick plywood. Cut the bottoms to fit, add a thin bead of glue around the perimeter, position the plywood then nail the bottom in place—don't attempt to nail the dividers. I use an 18-gauge brad, but a 23-gauge pin works just fine. (Keep the fastener length to a minimum; you don't want to risk bending a brad or pin so it pierces the outside face of your box or tray.)

## NO NASTY CORNERS

Each cubby has a small piece of chamfered moulding wrapping its four sides to make retrieving hardware from the box and tray a snap. The moulding is  $\frac{5}{8}$ "



*Your egg-crate joints should slip together easily with finger pressure only (and glue is overkill).*



x  $\frac{5}{8}$ " and mitered at the corners. The fit is by friction, although you could add glue as you install each piece.

I make the moulding at a router table using a chamfer bit. Begin with a wide workpiece, profile the two edges then cut the pieces at your table saw, aided by a push stick. As your workpiece gets narrow, it's better to profile from opposing faces so you have a wider support surface riding the saw's table.

Mitering the mouldings to fit each cubby could be done by hand, but I favor my chop saw. To make the operation effective, I use double-sided tape to hold a scrap tight at the saw. The scrap holds your cut away from the fence and the saw kerf provides the perfect registration for your cuts.

To work efficiently, you need only to set the saw to 45° to the left. Position one of your chamfered pieces at the chop saw with the  $\frac{5}{8}$ " flats facing up and against the sacrificial fence. Make the first cut.

Measure the length of the piece needed then transfer the length to your moulding; to mark an exact layout at its top edge, position the workpiece to your box or tray. Align your mark directly at the kerf in the fence to make the second cut. I found that I occasionally had to trim the pieces to get a press-in fit, but again, the kerf makes it easy to determine where to place your workpiece. Cut and fit the 48 pieces.



*As the workpiece narrows, it's better to profile the opposing faces of the stock so you have greater support as you rip at the table saw.*

## Simple & Accurate Router Jig

One of the most useful shop-made router jigs I use is for cutting small dados. (This setup is best used on workpieces no wider than 10".) Make a jig for each router and router bit pairing; different combinations require different jigs. My shop is awash with them.

Each jig requires three parts: a base, guide fence and T-square. Each part comes from small pieces or scraps. For the base, I like  $\frac{1}{4}$ " plywood, but I've used Masonite and even pegboard in a pinch. The fence is usually a piece of  $\frac{3}{4}$ "-thick hardwood that's 1" wide, and my T-square material is most often  $\frac{1}{2}$ " thick, but sometimes I use  $\frac{3}{4}$ ".

To begin, load a spiral-upcut bit into your router, then measure the distance from the edge of the router base to the center of the bit; approximate measurements are great, but err to the heavy side. Add 1" to your size. Grab a piece of plywood that's the width needed and a couple of inches longer than your workpiece to use as the base, then attach a guide fence to one edge—I use small brads and glue.

Hold the assembly with the fence to the left-hand side and run the router with its base tight to the fence. Your bit cuts the base and establishes the exact place of the cut each time the jig is used.

Using a square, align the T-square piece at 90° to the just-cut edge, so that its end sits flush or just behind the edge of the base. When set, attach the  $\frac{1}{2}$ "-thick part to the assembly using brads. Be careful—you're driving fasteners through a thin material.

To use the jig, align its right-hand edge even with your layout line, and keep the T-square tight to the workpiece. Clamp the jig and workpiece secure, then set the bit's depth of cut—remember that you need to reach beyond the thickness of the jig's base—and rout the dado. It's easy to align, accurate and works every time.



**1.** Running the router up the assembled jig cuts the jig exactly where the edge of the router bit does its work.

**2.** The usefulness of this jig depends on the T-square piece being set at a perfect 90° to the base.

**3.** Here you see the dado jig in action—you also see a backer that eliminates any blow-out as you cut the tray parts.





*Both ends of the bin mouldings can be cut with your miter saw set at 45° to the left—the first cut has the chamfered edge facing front and down.*



*With your measurement marked on the top edge of the moulding, a good set of eyes is all that's needed to dial in the perfect cut.*



*The challenge for the top is the shiplap center, but if you cut the joint first, the top is easy to trim to size.*



*As the hinges go in, it's possible to slightly reposition the lids—a problem that's easily corrected with a sharp handplane.*

## LID & LATCH

The lid is simply two pieces that are shiplapped at the center. Cut the pieces over-wide, then cut the shiplap (I used a dado stack at the table saw) before you attach the lid to the box with two pair of narrow 2" fixed-pin hinges (available at any hardware store).

Position the two lid pieces on the box and center the joint, then mark and cut the outside edges so the lid fits the box, with a small gap in the middle. (I used two 6" rules as spacers.)

Take your time installing the hardware, and when you've completed the task, use a small plane to even the gap between the lid pieces, if need be. Also, you may need to reduce the width of the hinge leaf attached to the box to facilitate the installation of the tray. I used a file to flush the leaves to the inside of the box.

To hold the box closed, I whipped up a simple wooden latch using a scrap of spalted tamarind, but use whatever you like. Mill the piece to size and length. Drill a slightly oversized hole for a #10 x 7/8" roundhead brass screw in one end of your latch, and cut a slot at the opposite end. Select where you want your latch—I chose the middle of the box—and attach the latch with one of the brass screws. Square the latch to the side of the box, then install the second screw so it fits into the cut-out area of the latch. How much you turn your screws decides how tight the fit. Yes, because they are so noticeable, I clocked these screws.

I decided to allow my box to age naturally, but I used boiled linseed oil on the latch to make sure it stood out. I stripped the zinc coating off the hinges then added a coat of wax.

The box and tray are a great place to store and organize extra pieces of hardware. And this project measures up to my antique-store find, which cost way more than the dollar I used to get sized up on the downlow. **PW**

# Grinder Tool Rest Jig

This simple jig makes it easy to set your rest to specific repeatable angles.

**BY BRUCE D. WEDLOCK**

The many articles on sharpening chisels and plane irons always include some discussion of the desirable bevel angle of the blade. For chisels, it ranges from 20° for paring chisels to 25° for bench chisels to 30° or even 35° for mortise chisels. But how does one accurately set the grinder's tool rest to achieve the desired angle? And how might the curvature of the hollow grind come into play?

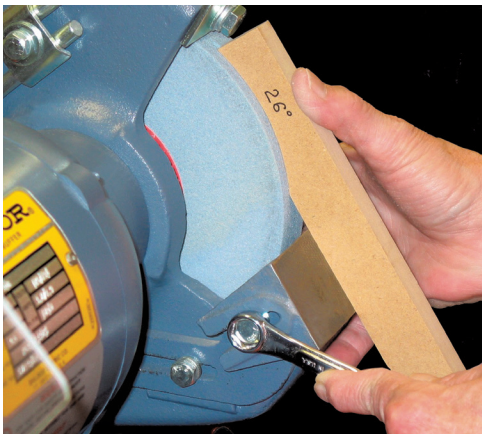
Years of trial and error finally prompted my development of a simple jig to quickly set the grinder's tool rest to a specific bevel angle in an accurate and repeatable manner. The detailed analysis involves substantial geometry and trigonometry.

## JIG CONSTRUCTION

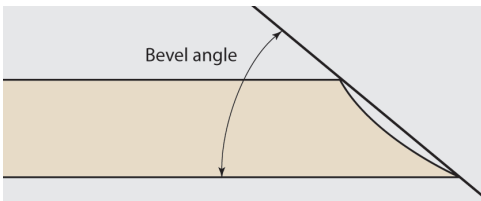
The bevel angle for a hollow grind is defined in the drawing at right. This is the angle at which the honing stone is normally applied to the hollow-ground blade.

The tool rest jig is shown in operation in the opening photograph. The curved portion is firmly held against the grinding wheel and the flat portion is held against the tool rest while it is tightened. This sets the tool rest relative to the wheel to produce the desired hollow-ground bevel angle.

To begin construction you need the diameter of your grinding wheel. If your wheel is new, you can assume it's the diameter on the packaging; if it's been substantially used, you should remove it and



Hold the jig firmly to the wheel and the tool rest, then tighten. The grinder will now grind the tool to the desired bevel angle.



The bevel angle is measured from the base of the blade to the line defined by the top and bottom edges of the hollow grind.

measure its actual diameter. The jig's angular accuracy depends on having a correct fit to the wheel's diameter.

Next, obtain a piece of  $\frac{1}{2}$ " MDF with the dimensions shown in the drawing at right. Draw a line one inch below the top edge. From the midpoint of this line, use a protractor to draw a second line at the desired bevel angle plus  $90^\circ$  as shown.

With a compass set to the wheel's radius, place the compass at the midpoint of the 1" line and strike an arc on your second line. Now place the compass at the intersection of the arc and second line and draw an arc intersecting the original line as shown in the layout illustration at right. This completes the layout.

Carefully rip the jig along the 1" line, leaving the line just visible. Band saw the arc close to the layout, leaving some material, then carefully sand to the arc. Test the arc on your grinding wheel to check for a snug fit as you sand it. You

may need to trim the length of the jig to fit your grinder's wheel guard. You can make small adjustments to the arc's fit by holding it against the grinding wheel and turning the wheel by hand. Finally, mark the bevel angle on the jig. You are now ready to set your tool rest as shown in the opening photograph.

## HONING

Once the blade's bevel is hollow ground, you will need to go through the honing grits to finish the edge. While practice will make you adept at freehand honing, many find an inexpensive honing guide will do a better job. There are many honing guides available, and some come with angle-setting jigs. But what you really want is your honing guide set for the bevel angle ground on your blade. A setting jig may not match this exactly. There are several factors such as blade thickness and taper angle of a chisel that introduce small variations into the exact bevel angle set by the tool rest jig, so the best approach is to set your honing guide to match the bevel angle that your jig produces. This is easily accomplished as shown in the photo at right.

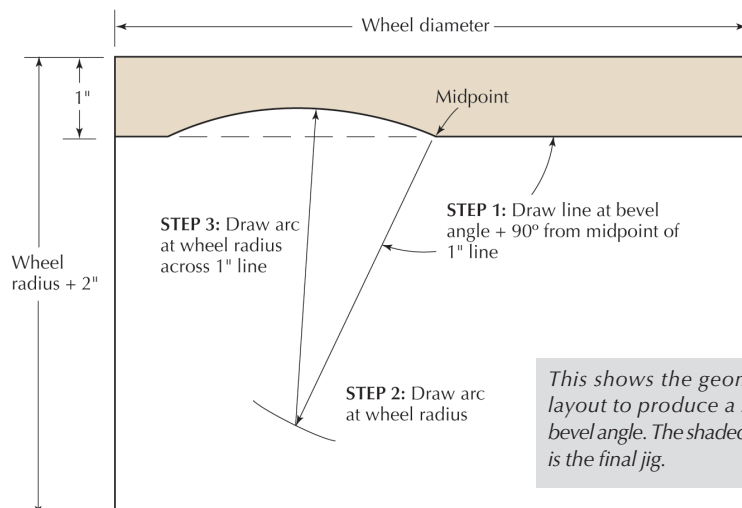
Use a straightedge applied to the edges of the hollow grind and adjust the guide's roller to match that angle. Once this is done, record the blade position in the guide by butting the guide against the edge of a piece of plastic laminate and scribing the blade edge location

with a sharp knife. This distance won't change as the grinding jig always produces the same bevel angle. You now only need to place a ground blade edge on the scribe line to set the honing guide position.

## CONCLUSIONS

A jig to accurately set the tool rest on your grinder will eliminate the guesswork of repeatedly tweaking the bevel angle. There are several factors that come into play when calculating a bevel angle, such as blade thickness and taper. For typical chisels, these combine to an error of less than one degree, so they were neglected in setting the bevel angle for the jig. For a plane blade that has no taper, you should add one degree to your desired bevel angle when laying out the jig to compensate for these factors.

It should go without saying, but to get top results, you need to use a soft grinding wheel such as an #80-grit aluminum oxide white or blue wheel on your grinder. Then true it square and flat with a diamond wheel dresser. Dressing removes glazed surfaces, making the wheel cut faster and cooler. In like manner, be sure your honing stones are flat. Waterstones sharpen fast, but they also wear fast. To get the best results, true them with an appropriate flattening stone. These steps will save you time in the long run and give you razor edges. **PW**



This shows the geometrical layout to produce a specific bevel angle. The shaded portion is the final jig.



# Shop Mallet Selection

It's easy to get a handle on which whacker to choose.

BY GLEN D. HUEY



*Woodworking mallets come in all shapes and sizes, and in many different materials. The secret to choosing the right mallet for the task at hand is to evaluate the head.*

**If you've ever** whacked a carving tool or pounded a joint using your palm or the side of your fist—I know you have because we've all done it—you know the result: a sore hand and unfinished business.

This is why we need mallets. And while a mallet is not supposed to compensate for dull tools or force an ill-fitted joint closed, it is a much-needed woodworking tool. In reality, any device will do in a pinch—I once used an old baluster for drawer dovetailing. But what mallets do we need, and why? Where do you begin?

## HEAD CASE

Mallets generally fit into one of three categories. To determine what fits where, we need only examine the head. Traditional joiner's mallets have large rectangular

lar-shaped heads, the key word being "large." These mallets are typically wooden and have a variety of duties in a woodshop, including assembly and, as the name implies, joinery.

The head of a carver's mallet—most often turned or round in shape—is generally smaller in size. These mallets run the gamut when it comes to size and weight, and of what material it's made. There are really two camps within this category: mallets made with wooden heads and those that have brass (or other metal) as the striking surface. A carver's mallet of the non-brass variety is sometimes used for many of the duties covered by a joiner's mallet, but you seldom see the reverse. And mallets with brass or other metal heads are most often used when carving.

The third group of mallets could be best described as "other." This category is a catch-all for rubber mallets, deadblows and the like.

## SHAPE & SIZE FOR JOINERY

Joiner's mallets generally are two-piece construction with a handle fit into the head, either firmly attached or with the head sliding over a tapered handle. The head is large, wide and almost rectangular in shape. The business ends of the head are end grain, and are cut at an angle to establish better contact with the item being struck. The sides of the head are most often straight and flat, and can be used too. But I don't recommend using mallet sides when you need to apply extra force.

The larger head of a joiner's mallet allows woodworkers to easily strike their project or chisel—the required precision of that strike is lessened due to the wide surface. And the flat surface decreases the chance of a bad strike that could deflect the tool, especially if that tool has a round end.

Joiner's mallets weigh anywhere from 12 ounces to nearly 24 ounces. (Timber framer's mallets, which are similarly shaped, can be as heavy as 32 ounces.) A weight of 16 ounces or more offers plenty of punch for mortising work or



**Joinery's Mallet** *The overall shape of the joiner's mallet is common, but sizes and weights vary dramatically.*

when cleaning the waste out from between dovetails.

If you increase the mass of the head (larger size or added weight), you decrease the amount of force needed to do the work, but you increase the need for stamina and strength to use the tool over long periods of time. Some manufacturers add weight by soaking the mallet in boiled linseed oil. This also preserves the wood and keeps fiber crushing (and mallet degradation) to a minimum.

Beech is a favorite hardwood for many joiner's mallets, but you'll find maple, too. It's best to use tightly grained, dense hardwoods.

## WHAT'S IN A NAME

Round mallets are known as carver's mallets. But is that name suited to the tool? I'm willing to bet that there are more carver's mallets doing joinery work than being used to assist with carving. (I began woodworking using a carver's mallet; it was an old baseball bat that was shaped into a mallet.)

Why not use a carver's mallet for joinery? If you strike the round end of a chisel with a round mallet, you can easily deflect the blow in a direction other than that intended. While using the lighter mallet strikes typical for carving, that is an advantage. When making joints, it's not necessarily a good thing. But if your mallet work is advanced, this is seldom a problem.

If you're using a round-head mal-



**Round Mallet** *A round mallet deployed against a rounded chisel handle can easily deflect the tool and result in a bad strike, which could turn your project to waste.*

let for joinery work, the weight needed to make the tool work its best is on par with that of a joiner's mallet. Unlike a joiner's mallet, however, you're more apt to see many different wood species used for the head of a carver's mallet. (Lignum vitae is a popular species in commercial mallets.) I believe this is because carver's mallets are popular shop-made tools; it's easy to raid your scrap bin for a variety of materials.

In many carver's mallets, the handle-to-head intersection is integral because the mallet is turned from a single piece of stock. Combining two pieces (different species or not) requires the use of a joint. Many shop-made mallets use a simple connection such as a dowel joint. Some commercial carver's mallets use a mechanical fastener buried below the surface.

## BRASS CHANGES TASKS

Whenever I see brass as the head of a carver's mallet (bronze or steel, too), I think carving and light-duty work. I don't think joinery. Brass mallets, in my opinion, are not to be used to whack your chisels when dovetailing or other joinery work. Light taps associated with carving are the perfect use of brass-headed mallets.

Metal striking your chisels mushrooms the handles, which can eventually split them—this is also why regular hammers should be avoided for joinery work. There is one exception: If your



**Wooden Mallet** *Any wooden mallet will give up the ghost over time and need to be replaced. My first mallet has been retired, but it'd still do the job if necessary.*



**Carver's Mallet** *Because carver's mallets are so easy to turn in a home shop, they are often created from a variety of different wood species, including exotics. And different species can be mixed or matched.*



**Metal-Headed Mallets** *These aren't for whacking out a set of dovetails or chopping mortises; these mallets are for swinging gently such as when carving.*





**Rubber Mallets** *Dead-blow and other rubber mallets are designed for minimal rebound and are less likely to mar your workpiece.*



**Unique Mallets** *Mallet makers are determined to make better tools. Here you see urethane-wrapped, infused and leather-faced mallets. Urethane is easier on your tools while the infused mallets are more resistant to wear.*

chisels have metal rings or caps at the ends, striking the tool with a metal mallet is acceptable.

Brass mallets can weigh as much as joiner's mallets and other carver's mallets. Smaller brass-headed mallets—shaped similar to hammers—generally range in weight from 6 ounces to 14 ounces. (You can find examples that weigh considerably more.) In my opinion, these mallets are perfect for light work, including but not limited to driving pegs and setting plugs.

### BUILD A BETTER MOUSETRAP

Toolmakers are seldom content with available products. Mallet manufacturers are no different. This desire to make

better tools has led to a few mallets that incorporate different materials or processes beyond a good soaking in boiled linseed oil.

The most well-known modern change to a carver's mallet is to wrap the business end with urethane. These mallets are quieter in use, but I'm not sold on them as a replacement for a joinery mallet. Why? When I use urethane-headed mallets, I don't feel the transference of force from the mallet to the chisel is a one-to-one ratio. The softer urethane absorbs some of the force, which requires me to do more work to complete the task. Urethane mallets, however, are easier on your tools. If there's other science involved, it's beyond me.

At the other end of the scale are the infused mallets made by Blue Spruce Toolworks. An acrylic-polymer resin fills the wood pores completely to prevent the fibers from crushing when used. The resin also adds weight. The company has three mallets. The round design (in both 14- or 16-ounce) has been available for some time, and there's a 24-ounce joiner's mallet that is just coming to market. I've chopped many dovetails using one of the round mallets and find it exceeds my expectations.

### OTHER SHOP MALLETS

When it comes to assembling projects in my shop (or taking them apart), I prefer a mallet with less punch. A urethane-wrapped mallet works well for this, but I like a dead-blow hammer or a rubber mallet. In my experience, wood mallets, no matter the design, tend to crush the wood or leave dents when striking projects.

Our shop dead-blow is made of urethane (no surface bruising) and has shot loaded inside to keep the mallet from bouncing off the project. Minimal rebound makes better use of the applied force. The same holds true for a rubber mallet, except there is no shot inside. In my home shop, a rubber mallet is the tool I use for assembly or when flushing the edges in a panel glue-up. One of these shock-absorbing mallets should be included in your tool arsenal.

### DRIVE IT HOME

If you're using a carver's mallet for joinery, you owe it to yourself to try a joiner's mallet. When I switched, I discovered that my dovetail work improved. (It could have been the result of better strikes, or it could be as simple as added weight.) If you switch, keep your carver's mallet, too. It works best for finessing work and can be the force behind carving tools. And every shop should have a dedicated mallet for grunt work, so stop bruising your project (and your hands) and get a dead-blow. Brass mallets? Sorry, I don't own one. **PW**



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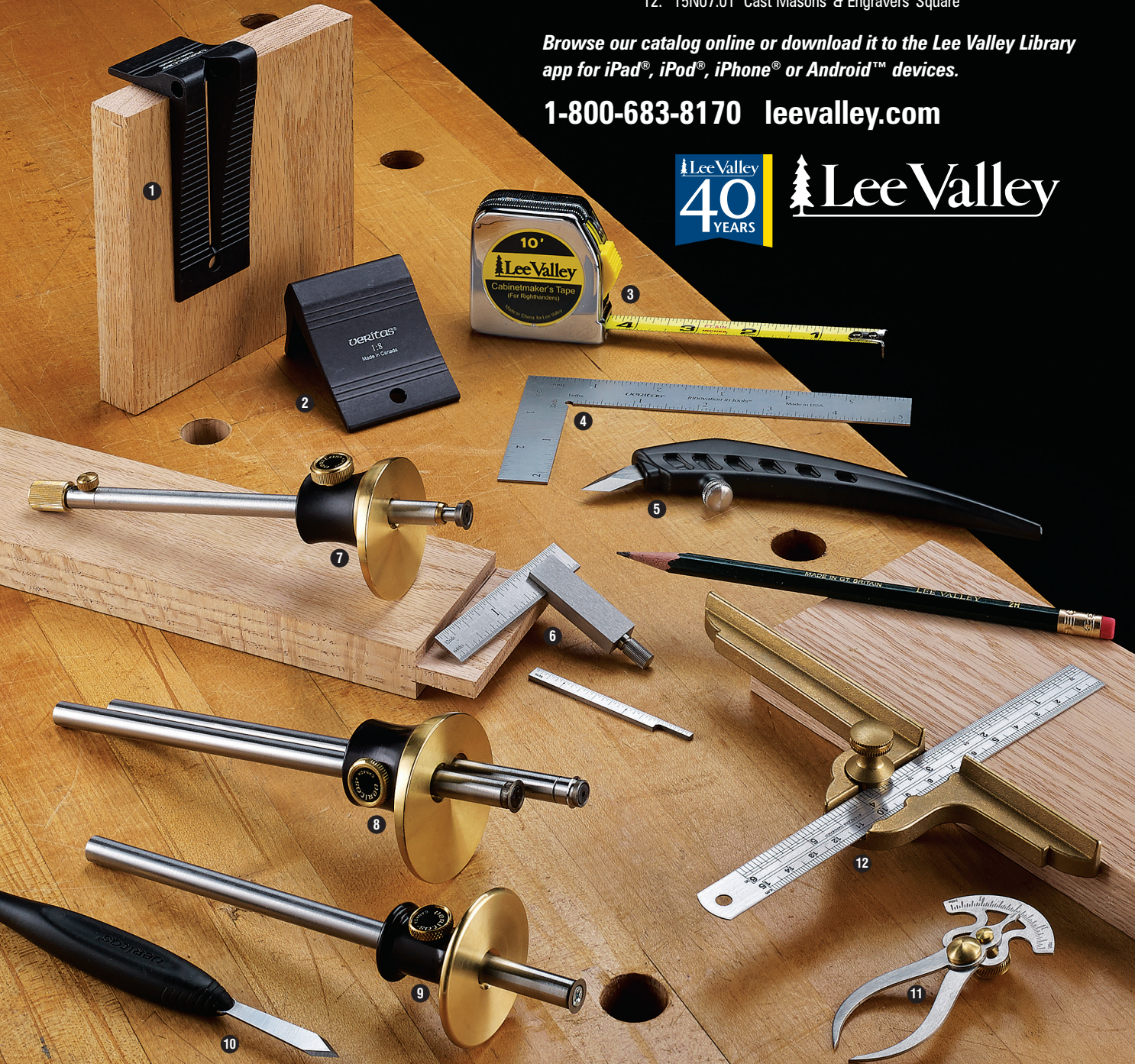
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