Part 1: Build a

Complexity and serenity coexist in this exceptional Chinese piece

BY JOHN CAMERON

Fifteen years ago, I had a 400-year-old Ming Dynasty table sitting in front of me in pieces on my bench. I had been asked to clean it up and tighten some of its joints, but when I learned that the whole thing was unglued and could be taken apart, I carefully disassembled it. Then a light went on: I should grab the opportunity to make a reproduction directly from the real thing. I've since built a handful of copies in various hardwoods, including this one in cherry.

The original table was acquired by an American molasses merchant working in Shanghai in the 1920s who shipped it home. Like many Ming Dynasty pieces, it is clean and simple looking but constructed with a complicated system of joinery, most of it hidden. Making these glueless joints is a tricky business, one that rewards patience and solid sharpening skills. If you have not fashioned such joints before, I suggest making mockups of them before plunging into the real thing.

In this first of two articles I'll describe making the table's top and legs and its unusual apron-to-spandrel joinery. In *FWW* #308, Part 2 will cover the rest of the joinery and assembly.

A NOTE ON THE JOINERY

Furniture made in the Ming Dynasty (1368–1644) exemplifies much of what I aspire to in my own work—clean lines, considered proportions, conscious use of wood graphics. The beautiful bonus in much Ming furniture is the joinery: wonderfully complex, interlocking systems that link the various parts securely while allowing for wood movement and typically requiring no glue. Most surviving Ming furniture was made from oily, waxy tropical hardwoods, which are difficult to glue even with modern adhesives, let alone with the animal glues used at the time. The Chinese furniture maker's solution was brilliant—devising interlocking masterpieces that survive for centuries while avoiding cross-grain gluing and other problems that have helped destroy much historic Western work.

Photos: Jonathan Binzen

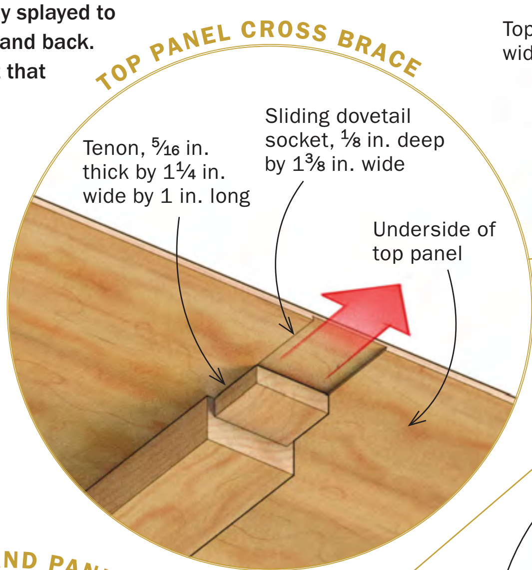
Classic Ming Table

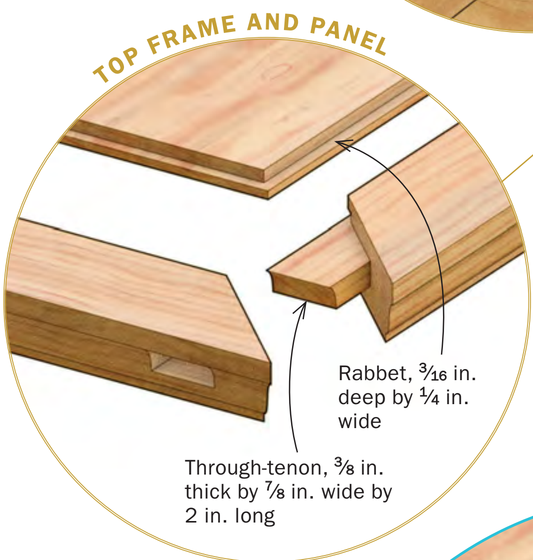
Ming table is a master class in unglued joinery

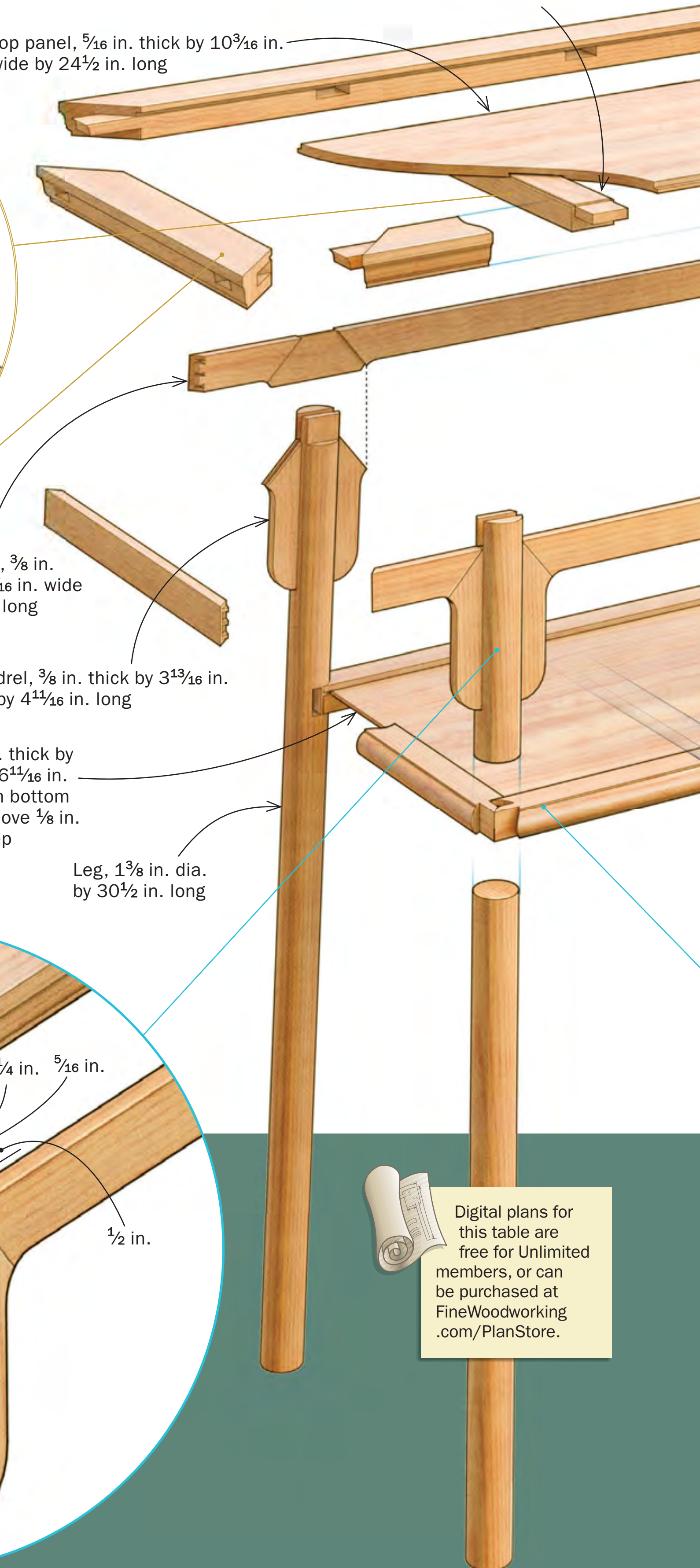
The table's legs are slightly splayed to the sides and raked front and back. The angle is just 1.5°, but that subtle slant, which is vital to the appearance of the piece, affects much of the joinery and adds a distinct level of difficulty to the project.

Part 1

The joinery shown in yellow circles on this drawing is discussed in Part 1 of this two-part article.

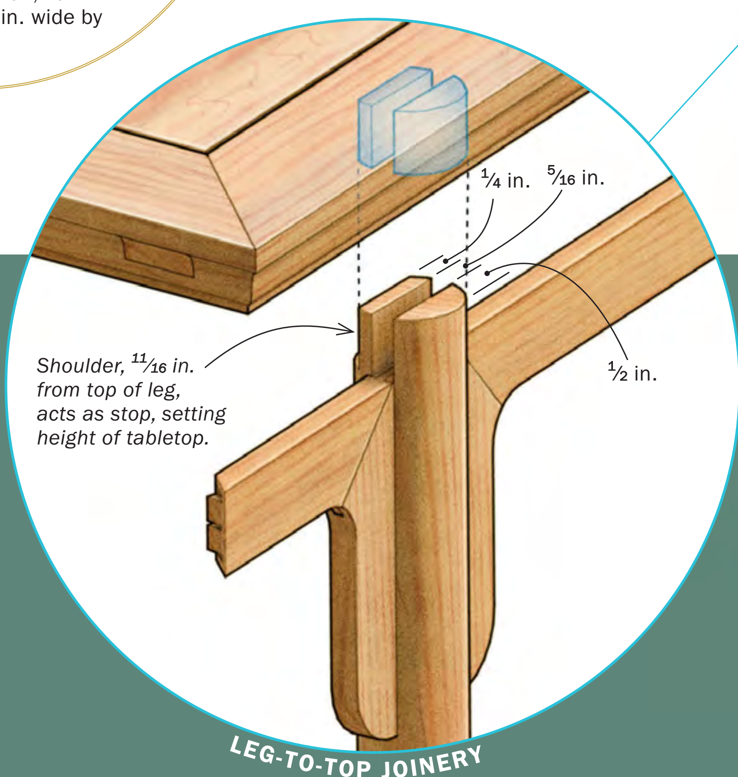






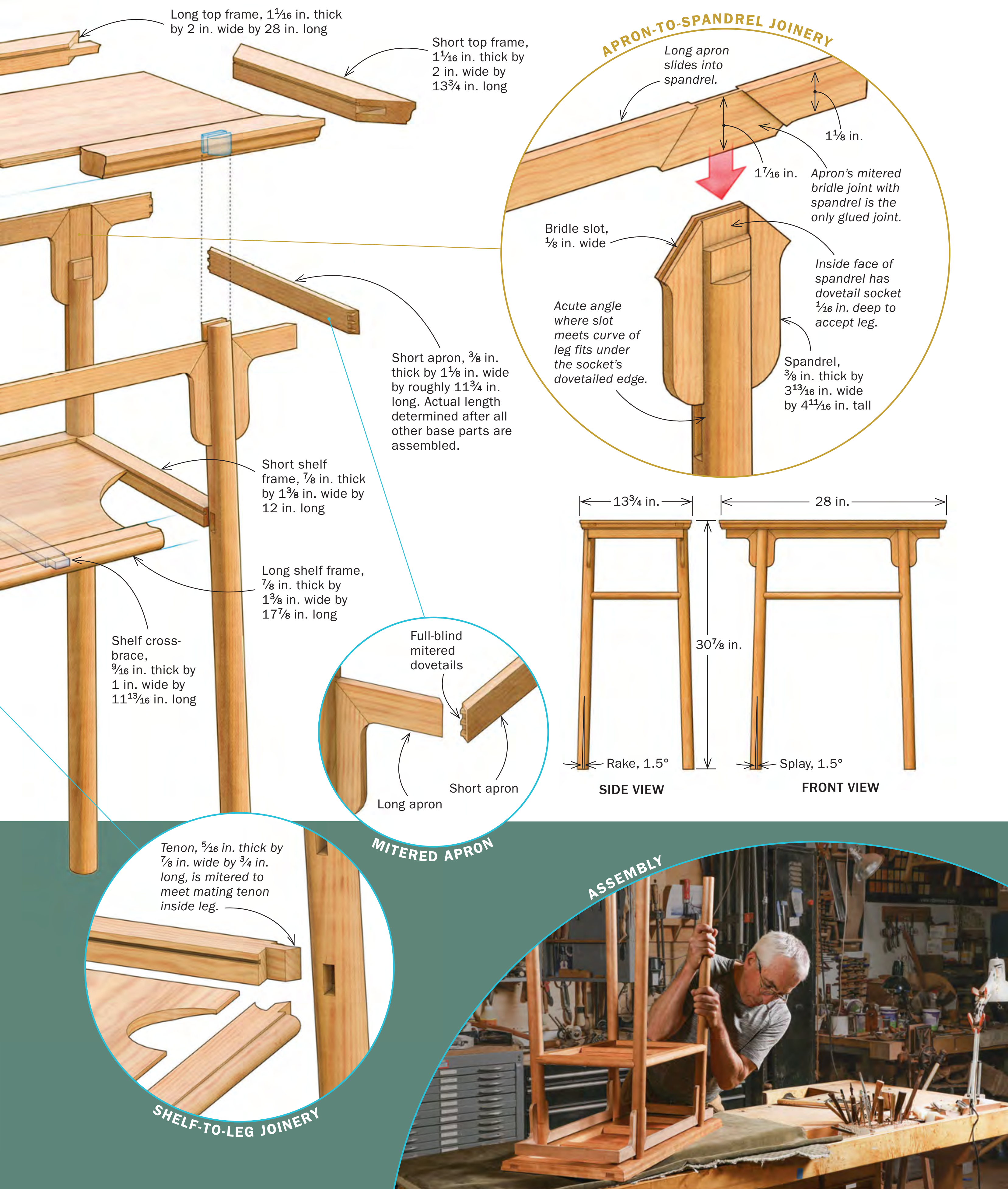
Part 2

The joinery shown here in the blue circles will be covered in Part 2 of the article, in *FWW* #308.



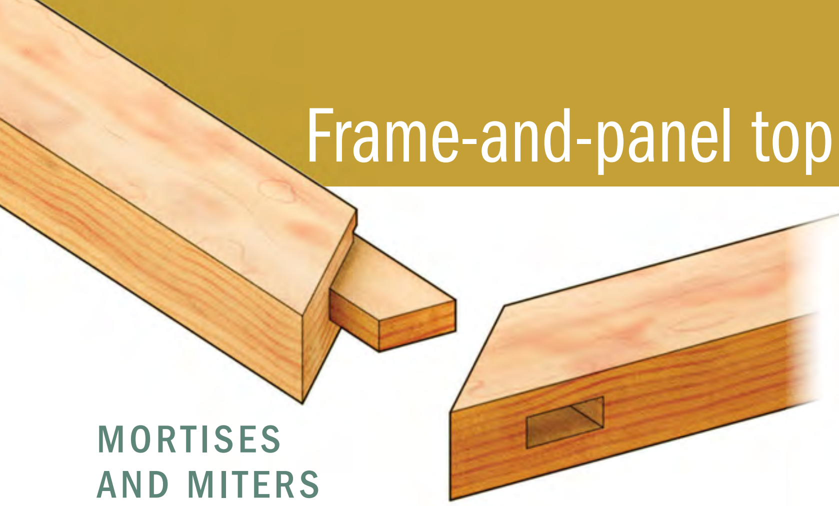
Digital plans for this table are free for Unlimited members, or can be purchased at FineWoodworking.com/PlanStore.

Drawings: John Hartman



Long top frame, $1\frac{1}{16}$ in. thick by 2 in. wide by 28 in. long
Short top frame, $1\frac{1}{16}$ in. thick by 2 in. wide by $13\frac{3}{4}$ in. long
APRON-TO-SPANDREL JOINERY
Long apron slides into spandrel.
$1\frac{1}{8}$ in.
$1\frac{7}{16}$ in.
Apron's mitered bridle joint with spandrel is the only glued joint.
Bridle slot, $\frac{1}{8}$ in. wide
Inside face of spandrel has dovetail socket $\frac{1}{16}$ in. deep to accept leg.
Acute angle where slot meets curve of leg fits under the socket's dovetailed edge.
Spandrel, $\frac{3}{8}$ in. thick by $3\frac{13}{16}$ in. wide by $4\frac{11}{16}$ in. tall
Short apron, $\frac{3}{8}$ in. thick by $1\frac{1}{8}$ in. wide by roughly $11\frac{3}{4}$ in. long. Actual length determined after all other base parts are assembled.
Short shelf frame, $\frac{7}{8}$ in. thick by $1\frac{3}{8}$ in. wide by 12 in. long
Long shelf frame, $\frac{7}{8}$ in. thick by $1\frac{3}{8}$ in. wide by $17\frac{7}{8}$ in. long
Shelf cross-brace, $\frac{9}{16}$ in. thick by 1 in. wide by $11\frac{13}{16}$ in. long
$13\frac{3}{4}$ in.
28 in.
$30\frac{7}{8}$ in.
Rake, 1.5°
Splay, 1.5°
SIDE VIEW
FRONT VIEW
Full-blind mitered dovetails
Long apron
Short apron
MITERED APRON
Tenon, $\frac{5}{16}$ in. thick by $\frac{7}{8}$ in. wide by $\frac{3}{4}$ in. long, is mitered to meet mating tenon inside leg.
SHELF-TO-LEG JOINERY
ASSEMBLY

Frame-and-panel top



MORTISES AND MITERS BY MACHINE

Milling the mortise. *The short members of the top frame get a through-mortise at each end. Cameron, who also does some metalwork, uses a Bridgeport milling machine to rough out the mortises.*

Making the miter. *Once the mortises are milled, Cameron cuts the miters with a sled at the table saw. Afterward, he'll square the ends of the mortises with a chisel.*

Top frame: miters with through-tenons

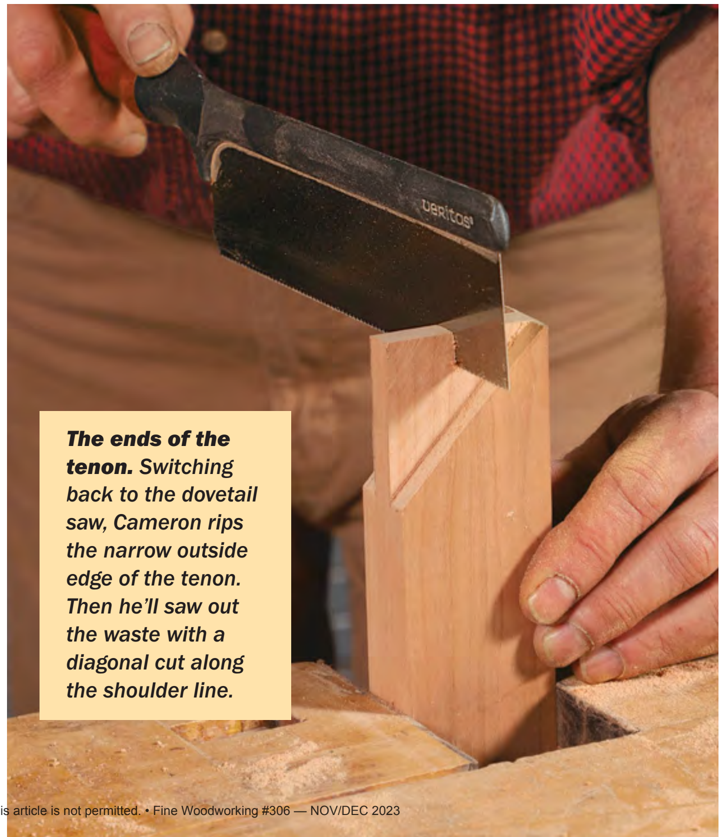
Begin the table by laying out the top's frame joinery. Then cut a through-mortise in the short frame members with the sharpest, most accurate tool you have. For many, it will be a hollow-chisel mortiser or a router; for me it is a small Bridgeport milling machine. I cut the miters on the short frame pieces at the table saw and plane them clean on a shooting board with a miter jig.

Now turn to the long frame members, where the hand joinery begins. With the workpiece clamped at an angle in a vise, cut the cheeks of the tenon; saw close to the lines, but leave a little waste. Then flip the piece on its face and saw along the miter line, leaving a bit of waste that you'll pare to the line later. The inside edge of the tenon is not shouldered, but the outside edge needs to be cut—first ripped, then sawn along the miter. Saw like your grandfather taught you—slowly, letting the saw do the work.

TENONS BY HAND

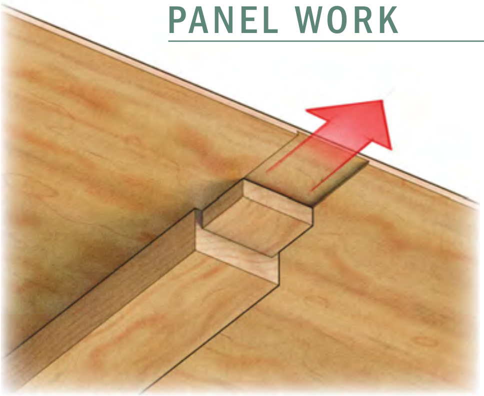
Cheeks first. *Cameron clamps the long frame member at an angle in his vise to cut the tenon cheeks with a dovetail saw.*

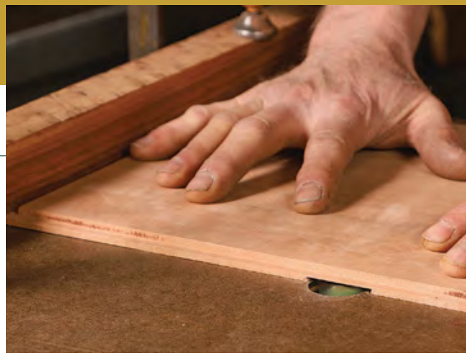
Slanted shoulder. *Next, with a crosscut saw, he cuts along the diagonal shoulder line, leaving a bit of waste that he'll pare away later with a chisel.*



The ends of the tenon. *Switching back to the dovetail saw, Cameron rips the narrow outside edge of the tenon. Then he'll saw out the waste with a diagonal cut along the shoulder line.*

PANEL WORK





Sockets on the underside. *After rabbeting the perimeter of the panel to create a tongue to fit into the frame, Cameron routs a pair of sliding dovetail sockets on the panel's underside to accept the cross braces.*

Shallow tail. *Still at the router table, and with the dovetail bit at the same height, Cameron resets the fence and routs a 1⁄8-in.-deep dovetail along the cross brace.*

Successful test. *Cameron sneaks up on the fit of the cross braces, shifting the router table fence incrementally until the cross braces are snug but slide smoothly.*

Frame fitting. *With the cross braces fitted into their dovetail sockets, test fit the long frame members, being sure the brace tenons seat in their mortises and the panel tongue in its grooves.*

I go next to the router table and, with the workpiece face down, use a straight bit to make a skim cut across the tenon's top cheek. The bit height should be exactly 5⁄16 in. above the table—the distance from the top cheek of the tenon to the top face of the frame. This gives me a surface I can trust as I do the rest of the trimming and fitting with chisels and a shoulder plane. As you trim the tenon look for a fit that requires just hand pressure to assemble (not a mallet), but that is secure, not sloppy.

Fit each joint independently, and then assemble the whole frame and tweak where necessary to achieve tight miters and nicely aligned corners. With the frame still assembled, plane the top surface so the joints are flat and flush. This has the added benefit of providing a reference surface to run against the fence when you cut the grooves for the top panel. Do that next, at the table saw.

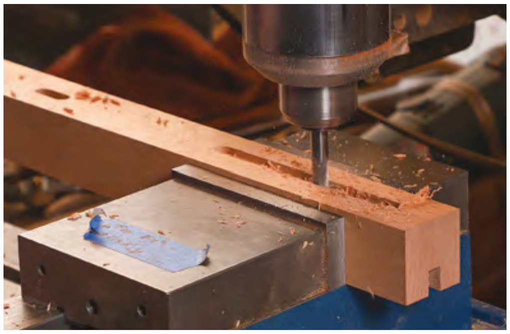
Top panel and braces

Make the top panel and cut a rabbet around its perimeter at the table saw to create the tongue to fit the frame groove. Leave the tongue slightly thick so you can hand fit it with a shoulder plane to achieve a tight slip fit, one without any rattle.

Next come the two cross braces that keep the top flat. They connect to the underside of the panel with shallow sliding dovetails and to the frame with tenons. Start by mortising the long frame members for the cross-brace tenons, then cut and fit the tenons. Assemble the frame without the panel to test the cross braces' fit,

On with the ends. *The short frame members are fitted next to complete the top. (Before fitting the panel, Cameron assembled the frame alone, in order to plane its joints flush and mold its perimeter.)*

Make the leg



Mill the slot with the leg still square. *When Cameron cuts the long slot for the spandrel and apron, he leaves a bridge of waste at the top for stability. He'll remove it once the leg is shaped. He also cuts the mortises now for the shelf tenons.*

Make them round. *After ripping off the corners of the blank at the table saw, Cameron uses a roundover bit at the router table to give the legs their circular shape. He'll follow up with hand tools to finesse the curves.*

then take it apart and reassemble it, this time without the cross braces but including the top panel. This lets you accurately locate the sliding dovetail recesses by transferring the position of the cross-brace mortises to the panel. Rout shallow sliding dovetail sockets across the underside of the top panel and cut mating dovetails along the cross braces. With both cross braces fitted in their dovetail sockets, the whole top assembly can be put together.

Before setting the top aside to work on the table's base, profile the perimeter of the frame. The original table's edge profile, a shallow ogee, is hard to match. Not wanting to grind custom cutters, I used two commercially available router bits—a dish carving bit and a roundover bit—and then faired to the final shape with hand tools. A liberal use of test stock will allow you to do the same. Cut the profile with the top assembled, so the ends of the through-tenons get shaped at the same time. Shim any slight gaps beside the tenons before routing.

Making Ming legs

The slight splay of its legs is essential to the Ming table's elegant stance. But that innocent little 1.5° angle raises the difficulty quotient of almost every joint in the table's base. To make life easier, I fashioned a set of tapered shims and used them to cant the workpiece while I machined or shaped it. I also made a chart showing the splay angle in rise/run format; if my tapered shims were too short for an operation, the rise/run chart told me how thick to make a spacer and how far to place it from the blade.

After milling the leg blanks square and cutting them to final length, you can cut the slots at the top and the mortises for the shelf frame tenons. The slot is straightforward—no need to take splay into account. Cut in from both faces, and leave some waste

A shoulder at the top. *With the leg resting on an L-shaped spacer that generates both the splay and rake angle, Cameron cuts the shoulder on the leg's inside tenon. The ⅜-in.-thick spacer is 14¼ in. from the blade.*

Cheek by hand. *After cutting the shoulder at the table saw, Cameron rips the cheek with his dovetail saw. He'll clean up the cheek with edge tools when he fits the joint.*

Away with the waste. *The last step is to remove the bridge of waste at the top of the slot. After sawing, smooth the inside surfaces with a chisel.*

Apron and spandrel

Spandrel gets a sliding dovetail. *On the inside face of the spandrel, Cameron routs a shallow sliding dovetail socket. The leg will lock into it.*

Mismatched miters. *Because the legs are splayed at 1.5°, the two miters on the spandrel differ. Cameron lays them out with knife lines, cutting one at 44.25°, the other at 45.75°. When the miters are done, he'll crosscut the top of the spandrel 1.5° off 90°.*

The slot in the spandrel. *The top of the spandrel gets slotted, allowing it to slide onto the apron in a bridle joint. Cameron makes the cut at the table saw, clamping sheet goods to the saw as a second fence.*

Double bevel transfer. *Cameron uses a pair of bevel gauges to transfer the miter angles from the spandrel to the apron (top). After removing most of the waste with a handheld router, cutting close to his layout lines, Cameron finishes the apron half of the mitered bridle joint with chisels and shoulder planes (above).*

intact at the top to bridge the slot so the leg remains stable while you shape it. Like the slot, the mortises for the shelf frame are cut with their long sides parallel to the length of the leg. But they enter the leg at a 91.5° angle, so I placed one of my 1.5° wedges on the mortising machine's table while making the cut.

To shape the legs round, I first knocked the corners off at the table saw, then used a roundover bit on the router table. If you do the same, use a fence, not the bearing, to guide the cut, as the bearing can slip into a mortise and you'll cut too deeply. After routing, fair the curves with hand tools and sandpaper.

The top of the leg gets two tenons that fit into rounded mortises in the bottom of the top frame. The inside tenon has a shoulder that acts as a depth stop, and I started with that, cutting it at the table saw with a sled. Now that the leg was rounded, the tapered wedges were more awkward to use, so I used spacers instead, putting one beneath the leg and another between the leg and the sled's fence. I placed ⅜-in.-thick spacers 14¼ in. from the blade.

After cutting the shoulder, I moved to the bench and used a hand saw, chisels, and shoulder plane to finish the tenons and

THE ONLY GLUE JOINT

Glue goes here. *All the table's joints except this one—the mitered bridle joint linking the spandrels to the apron—are assembled dry. For this glue-up, keep pressure on the miters as well as the bridle joint.*

Shape the apron. *Cameron cuts the straight parts of the apron's lower edge at the table saw, making stop cuts for the middle section by carefully tilting the workpiece onto and off of the blade. He moves to the bandsaw to cut the curving sections of the spandrel and apron.*

remove the bridge of waste at the top of the slot. Making the mating mortises for these tenons would need to wait; I would only know the precise distance between the legs after the base was assembled. That will be included in Part 2 of this article.

The spandrels are central

The joinery between the leg, spandrel, and apron needs to be spot on. The joint between the leg and spandrel, a combination of bridle and sliding dovetail, holds the leg solidly at its distinctive angle, providing stability and stance. The leg is let into a dovetailed recess on the inside face of the spandrel. To ensure a tight joint, the leg should be completely shaped and finished before fitting. Any scraping or sanding later would destroy a perfect fit.

Mill the spandrel blanks 1⁄16 in. thicker than the slot in the top of the legs. Then, with a dovetail bit at the router table, cut a 1⁄16-in.-deep dovetailed recess down the middle of the spandrel on its inside face. One slick feature of this joint is that you get the male half of the sliding dovetail for free—the acute angle where the rounded leg meets the slot works just like a dovetail.

With the sliding dovetail recess complete, cut the miters at the top of the spandrel. Because of the leg splay, these are not 45° miters; instead, one is 44.25° and the other is 45.75° These Ming makers were playing no games! Once the miters are cut, crosscut the top of the spandrel at 1.5° on the table-saw sled.

To make this section of the table yet more complicated (and more elegant and secure), the spandrel is fitted to the apron with a mitered bridle joint. I cut the bridle mortise in the top of the spandrel on the table saw using a flat-topped chisel-tip ripping blade with a full 1⁄8-in. kerf. A single pass with this blade yields the correct slot size—one third of the 3⁄8-in.-thick spandrel.

Mitered bridle on the apron

Cutting the apron half of the mitered bridle is a bit trickier. I began by knifing the miter angles onto the apron blank. Then I used a handheld router with a straight bit to mill away most of the waste. When I set the bit depth I erred on the shallow side so I could get to the final fit with a shoulder plane. And I stayed clear of the layout lines while routing. I trimmed to the miter lines with a wide chisel; be very careful on the second side as the part is thin and fragile at that point.

This table is an exercise in glueless joinery, but when I took apart the original, I found one glued joint—the mitered bridle between the apron and spandrel. I decided to glue mine as well. If you choose to glue yours, keep clamp pressure on both the miter and bridle joints when gluing.

With the glue-up complete and the apron and spandrels now one piece, I cut the bottom edge to shape. After laying out the rounded sections with circle templates, I made the straight cuts at the table saw and then cut the curves at the bandsaw. I faired the curves with files and with sandpaper wrapped around a dowel. □

Curved cleanup. *Files and sandpaper combine to fair the curves and smooth the straight sections of the apron and spandrel.*

John Cameron builds furniture in Gloucester, Mass.

Part 2

Cameron finishes the table in the second part of this article (*FWW* #308), describing how to build the shelf, with its tricky coped joinery, finish the leg and apron joinery, and do the final assembly.