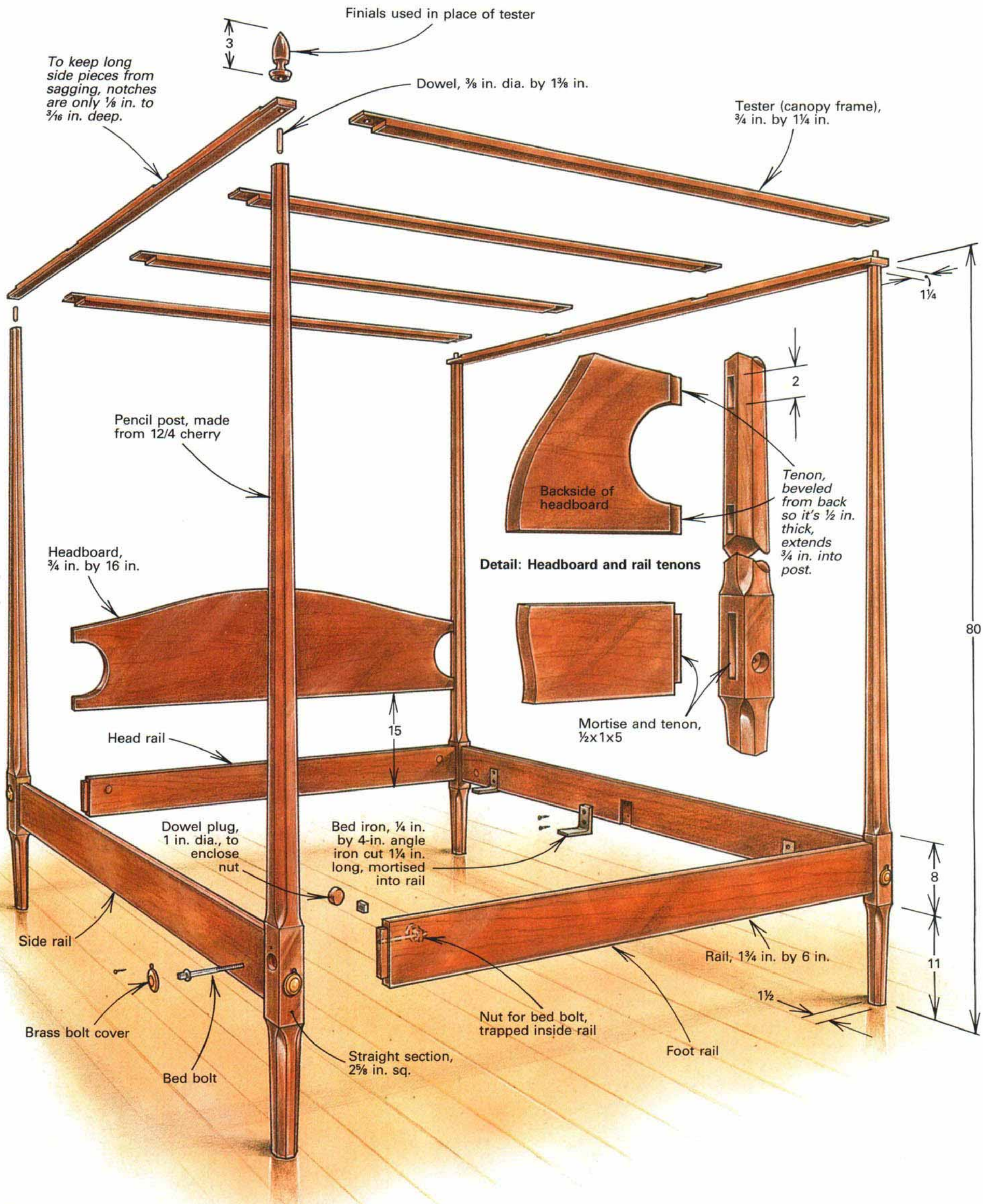
Fig. 1: Pencil-post bed



The Pencil-Post Bed

Jigs for machining tapered octagons

by Christian H. Becksvoort

The pencil-post bed is a classic form that has been in use for centuries, The high posts were originally designed to hold a canopy frame, or tester (pronounced teester), as shown in the photo at right. Before central heating, a canopy was standard equipment and was often accompanied by thick, quilted curtains on all four sides. Drawing the curtains at night created a room within a room designed to conserve warmth and provide privacy. In warm weather, the heavy curtains were replaced by fine lace netting, which offered protection against insects. Today, the testers are covered with either net or lace canopies or left bare, a decorative reminder of earlier times. I usually turn finials for the tops of the posts so the customer has the option of removing the tester entirely and capping the posts with the decorative turnings.

Traditionally, bedding was supported by a rope mattress woven between the bed rails. Early on, the rope also held the bed parts together, but around 1750, builders switched to bed bolts, which could hold the bedstead securely together even when the rope mattress started to sag. The 6-in.-long bed bolts I use extend through the posts and thread into nuts that are trapped within the side rails *and* the head and foot rails. On conventional, low-post beds, the headboard and footboard are usually glued up and knock-down hardware is used for assembling the side rails. However, it would be difficult, if not impossible, to move an assembled headboard with tall pencil posts upstairs, through doors and around tight comers. Therefore, a pencil-post bed must be made to knock down completely into individual members: four posts, two side rails, a head rail and foot rail, a headboard and a six-piece canopy frame and/or four finials. Besides the eight bed bolts that secure the rails, the bed is held together by the mortises and tenons where the rails and headboard join the posts, and the lap joints on the tester.

Before building this or any bed, check and recheck the actual box-spring dimensions, because they are anything but standard; few people today would want a bed that can accept only a woven rope mattress. I build pencil posts only in full- or queen-size, purely for reasons of proportion. The single-size seems too narrow and tall, while the king-size begins to resemble a cube.

A pencil-post bed with traditional tester or canopy frame is shown above. The eight-sided, tapered posts are mortised to receive the four bed rails, which are held in place with bed bolts concealed behind the brass bolt covers. There are no glued joints, so the entire bed can be disassembled for ease of transport.

Pencil posts-The evolution of tall bedposts has been from massive square posts to thinner and tapered posts, then to even more delicate, eight-sided tapers, the shape we now associate with pencil-post beds (though most pencils today are six-sided). In addition, I prefer to taper both the upper portion of the post and the shorter, lower portion below the rails. I used to bevel the corners of the tapers with a handplane or spokeshave to create an octagon. This was time-consuming and presented the risk of tearing out the grain as well as the problem of shaping a smooth transition from the bevels to the square portion where the rails join the posts. To simplify this, I devised the two simple jigs shown in figure 3 on the next page. I use the jigs in conjunction with a tablesaw molding head, but they can be used with a shaper or a table-mounted router and a 45° cutter (you'll need 1 ⅛ in. of cutting surface). The posts are first roughed out on the bandsaw, and the tapers are cleaned up on the jointer. Then, the corners of the tapered portions are beveled into octagons by running them over the molding head, using one jig for the upper portion and the other for the lower portion. Cutting the bevels by machine saves time and virtually eliminates tearout and, because of the cutter's arc, automatically leaves a smooth transition from the bevels to the square portion of the post. This results in a completely shaped post right off the ma-

Fig. 2: Determining dimensions of octagon

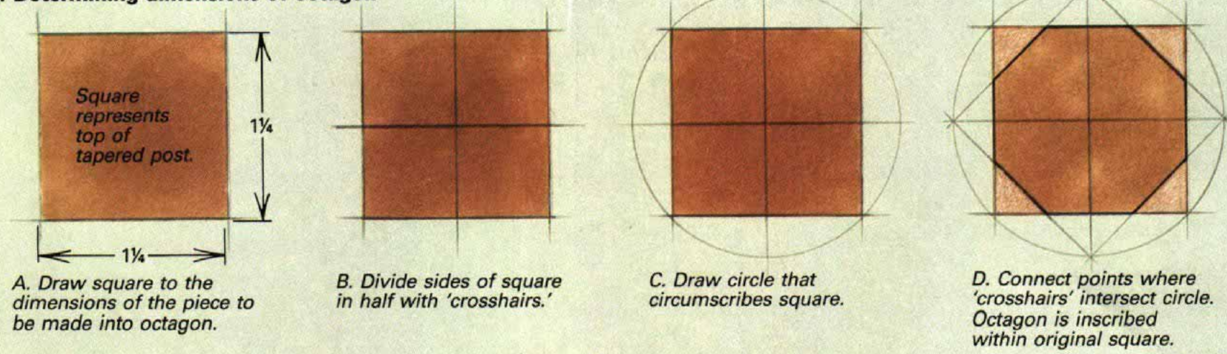
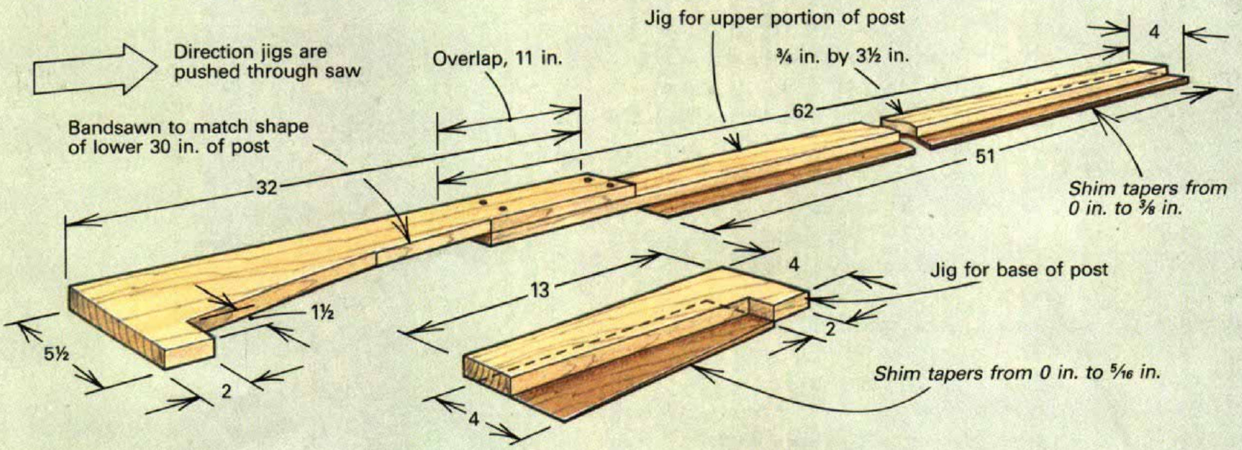
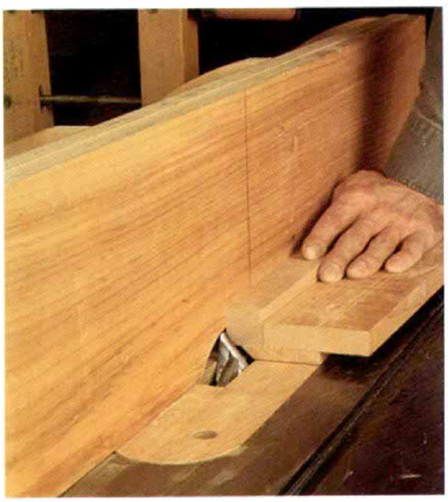


Fig. 3: Jigs for sawing tapered bevels





The photo at left shows the setup for beveling the upper portion of the post. An auxiliary fence and the height of the 45° cutter in the molding head are set to expose 1⅟16 in. of cutting edge. Above, the author bevels the base of the post with the smaller jig. The larger jig pushes the post past the cutter; the smaller jig is pushed with the post; both jigs help to safely hold the post against the fence. The lines on the fence and the post indicate where to stop the cut.

chine, with nothing left to do but sand out the machining marks.

To make the posts, I begin with 12/4 stock up to 12 in. wide by 7 ft. or 8 ft. long. Since 1 don't have a jointer wide enough to true up one face of these planks, I lay out the posts on the rough wood, using a pattern cut from ¼-in.-thick Masonite. My pattern is 80 in. tall, which, adding 3 in. for the finial, gives a total height of just under 7 ft. The untapered portion of my posts, the section that will contain the mortises for the rails, is 8 in. long by 2⅝ in. sq. and begins 11 in. from the bottom of the post. The post tapers from this 2⅝-in.-sq. section to 1¼ in. at the top and 1½ in. at the bottom (see figure 1, p. 32). Because of this taper, you can save a fair amount of wood by reversing the pattern as you lay out the posts side by side.

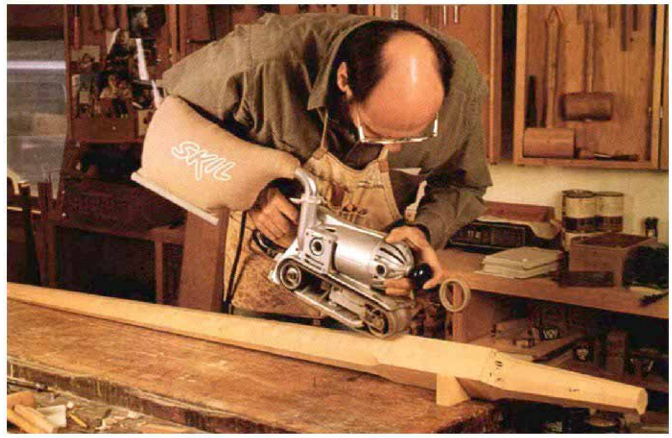
After all four posts are laid out, bandsaw them apart, leaving them slightly oversize. Then, square up two adjacent sides of the 2⅝-in.-sq. by 8-in.-long section on the jointer, working to the pattern line on the side that's laid out. You only need to true up the area around the square sections, because you'll be bandsawing tapers on the rest of the length of the post. Then, bandsaw the top and bottom tapers on the posts, leaving the pattern lines to work to when cleaning up the shape on the jointer later. Crosscut the posts to length on the pattern lines, then lay out the pattern on the adjacent side of the posts that was previously trued on the jointer. Bandsaw away the waste, then take the posts to the tablesaw and clean up the bandsawn sides of the 2⅝-in.-sq. sections by ripping them 2¹¹⁄₁₆ in.

thick. Take the posts to the jointer and clean up the tapers to the pattern lines. One final pass on the jointer will plane off the sawmarks from the square sections and bring them to $2\frac{5}{8}$ in.

To complete the shaping of the posts, you must bevel the corners of the tapers to make them eight-sided. The beveling jigs are designed to cut bevels that increase in width as the post increases in width, so that at any given point, all eight sides are equal in width, forming an equilateral octagon in cross section. Figure 2 on the facing page shows my method for determining the dimensions of the octagonal cross section at the top of the posts. On a piece of paper, draw squares to represent the dimensions of the post's top, bottom and square section, and use this method to determine the octagon's size at each of these points. You will have an octagon with $\frac{17}{32}$-in. sides inscribed within the $1\frac{1}{4}$-in. square representing the tops of your posts and an octagon with $\frac{5}{8}$-in. sides for the $1\frac{1}{2}$-in.-wide bottoms of the posts. Draw these octagons 011 the top and bottom of one of the posts, to use as a reference when setting the fence of the tablesaw and the height of the cutter. The $2\frac{5}{8}$-in.-sq. portion of the post will give you an octagon with $1\frac{1}{16}$-in. sides. This will be the maximum length of the cutting edge that should be exposed when the molding head's height is set.

The jig for beveling the long, upper portion of the posts, shown in figure 3 on the facing page, consists of a cradle glued to a tapered shim that gradually lifts the post's length off the machine table, thereby yielding a tapered bevel cut. The shim is about 4 in. wide and 51 in. long, and tapers up to $\frac{3}{8}$ in. thick. It's glued under the 62-in.-long 1x4 portion of the cradle so about 2 in. of the shim's width overhangs the full length. This overhang will lift and support the post, although part of it will be ripped off with the first pass on the tablesaw. The lower portion of the cradle is bandsawn from a 32-in.-long 1x6, to conform to the shape of the lower 30 in. of the post and to wrap around the bottom end of the post, acting as a push stick. The two parts of the cradle are screwed together, with the shorter portion on top, which raises the push-stick part of the cradle enough to contact the bottom of the post completely. The smaller jig for beveling the bottom of the post is built on the same principle, except in this case, the post pushes the jig instead of the jig pushing the post. This variation makes it easier and safer to control the post for the short, lower portion of the post and vice versa for the longer, upper portion. The shim for the smaller jig is 4 in. by 11 in., tapering from $\frac{5}{16}$ in. to zero. It's glued to a 13-in.-long 1x4, bandsawn to fit the post's taper and to wrap around the post's bottom.

The setup I use, with a tablesaw molding head fitted with shopmade 45° bevel cutters, is shown in the lower, left photo on the facing page. The same basic procedures would apply to a router table or shaper. Our earlier calculations told us that the sides of the octagon at the largest portion of the post are $1\frac{1}{16}$ in. wide. So, we now set the cutter and an auxiliary fence to expose $1\frac{1}{16}$ in. of the cutting edge so we can cut the tapered bevel in one pass. To double-check this, place the post, with the octagons drawn on its ends, on the larger jig so that the tapered, top portion of the post will run along the saw's fence, as shown in the photo. Raise the cutter so that at the peak of its arc it will bevel the corner right up to the side of the octagon. Slide the fence over to the side of the post and lock it in place, with the cutter centered on the octagon's side. With this setup, you can bevel all four upper corners on each post as well as all four lower corners. The jigs themselves compensate for the different tapers of the upper and lower portions of the post. After setting the fence and the cutter height, use a square and a felt pen to mark on the fence the location where the cutter goes into the table. This is the point where the cutter begins its cut. In addition, mark each post at 11 in. and 19 in. up from the bottom. This designates where to stop the cuts, preserving the square section.



With the shaped post supported by a simple V-block, Becksvoort beltsands the machining marks from the tapered bevels of the octagon. A smooth, continuous motion and a light touch with the nose of the belt sander are requirements for sanding the curving transition from bevel to square.

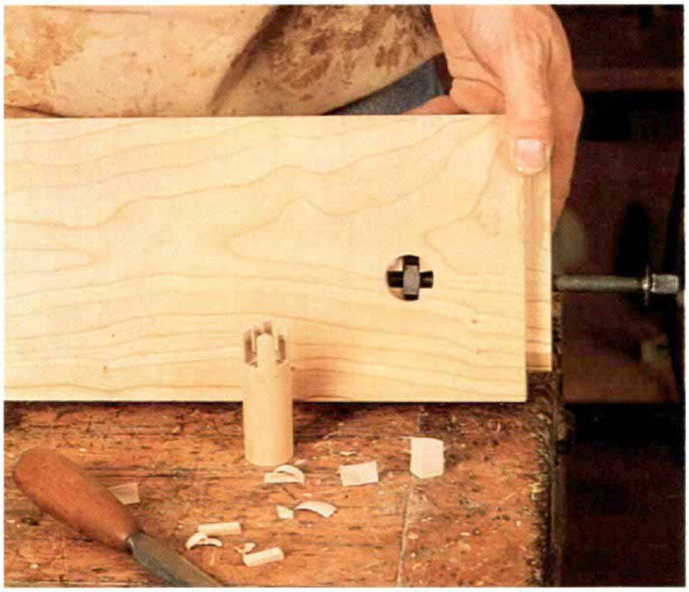
Push the jig and post, with its tapered side running along the fence as shown in the lower, left photo on the facing page, over the spinning molding head. When the line on the post indicating the top of the square section meets the line on the fence, pull the post and jig away from the fence. Repeat this procedure for the other three corners to form a tapered octagon on the top section of the post. Bevel the bottom of the post in the same way with the smaller jig, as shown in the lower, right photo on the facing page. Stop the cut when the line at the bottom of the square portion lines up with the line on the fence. Repeat the cuts until the four corners are beveled. Once all four posts are beveled top and bottom, you've completed the most difficult part of the bed.

I sand the machine marks from the bevels with a belt sander. With experience, a light touch and a confident hand, I've gotten so I can use the front wheel or "nose" of the belt sander to sand the curving transition without making it wavy (see the photo above). If you don't feel comfortable using a belt sander for this, a cabinet scraper and a hand-sanding block will do the trick.

Rails, mortises and bed bolts—Traditionally, the rails on pencil-post beds were nearly square ($2\frac{5}{8}$ in. by 3 in. was common), to resist the inward pull of the rope mattress and the downward weight of the bed's occupants. However, today's beds rely on a box spring that only bears *down* on the rails, so the more familiar, 1-in. or 2-in. by 6-in. board-on-edge serves nicely. I mill my rails from straight 8/4 stock to a finished size of $1\frac{3}{4}$ in. by 6 in. The 6-in. width hides all but 1 in. or so of a standard box spring.

The mortises for the rails are $\frac{1}{2}$x1x5 in. and centered top to bottom and side to side on two adjacent faces of the square section of the posts. This $\frac{1}{2}$-in. depth may seem shallow for bed-rail mortises, but cutting the mortises deeper would only weaken the posts. Besides, the bed bolts hold the tenons tightly in the mortises and help support the downward force on the rails, while the mortises and tenons provide alignment and prevent inward rotation of the rails. In the past, I've done my share of routing, drilling and chiseling mortises, but I now have the luxury of a horizontal mortising machine. However you cut your mortises, be sure they are all the same length and the same distance from the bottom of the posts. Use a square to lay out for the length of the mortises, transferring the lines around the corner of the adjacent faces of the post. Accuracy here will ensure a level mattress support.

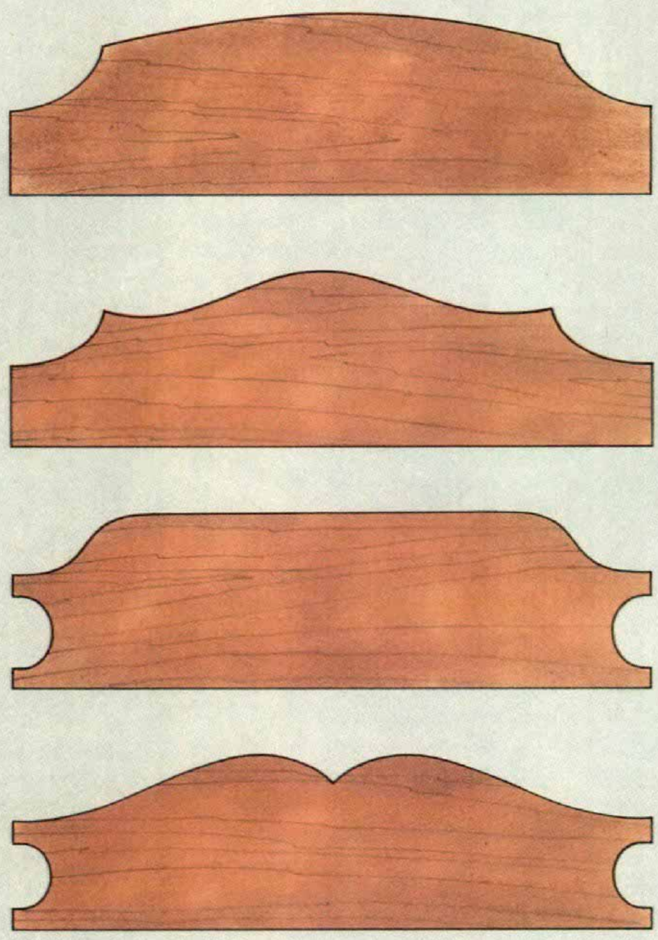
After the mortises in the posts are complete, the two side rails



The nuts for the bed bolts are dropped into a 1-in.-dia. hole that intersects the bolt hole. Pie-shape pieces are bandsawn from a 1-in. dowel, chiseled to fit around the nut and glued in place to keep the nut aligned with the bolt hole. The nut is then trapped in place with a glued-in dowel plug.

Fig. 4: Headboard profiles

The style and design of a pencil-post bed can be altered simply by varying the headboard shape.



and the head and foot rails are crosscut to length to suit the size bed you're building. Double-check the box-spring dimensions, and don't forget to add 1 in. for the ½-in. tenon on each end of the rails. Add an extra ¼ in. to ½ in. so the box spring is easier to install or remove, and take into account the 7/16 in. the rails are set back from the inside corner of the posts. The ½x1x5-in. tenons are cut on the ends of all four rails, using whatever method is comfortable for you: backsaw, tablesaw, router, or even bandsaw or radial-arm saw. Because these joints will be assembled and disassembled, the tenons should slide into the mortises easily but without excess play. To ease assembly, sand or file a 1/16-in. bevel on the tenon corners and around the perimeter of the mortises.

After fitting the tenons to the mortises, you're ready to drill for the bed bolts. To locate the holes in the posts, I made a rectangular plug that fits into the mortise. On this plug, I marked the vertical center of the mortise and then drilled two 7/64-in.-dia. holes through the plug: one ½ in. above center for the head and foot rails; the other ½ in. below center for the side rails. These holes accept a 6d finish nail, which is inserted through the appropriate hole and tapped into the mortise to locate the bolt holes. With the drill press, I drill a ⅛-in.-dia. hole from the mortise through the post to locate the hole on the outside Of the post. Then, I turn the post over, and using a 1-in.-dia. Forstner bit, drill a ¾-in.-deep hole to countersink the bolt head. Finally, I change to a ⅜-in.-dia. twist bit and drill back through the ⅛-in.-dia. hole to the inside of the mortise. I repeat the procedure for the other seven bolt holes.

The bolts will extend through the holes in the post and into holes in the tenon ends of the rails. To align these holes, mount a rail horizontally in a bench vise, find the mating post and mortise for that particular rail end and slide the mortise onto the tenon. Hold the post in place with one hand while you drill a ⅜-in.-dia. hole through the post-bolt holes into the tenon ends. Unless you have an extra-long bit, you'll need to remove the post and extend the hole 4 in. deep into the rail to accommodate the 6-in.-long bed bolts. Repeat this procedure for the remaining tenons. The rails are now ready for nut holes.

To locate where the nut will be trapped in the rail, lay the rail on the bench, with its inside face up, and slide a bolt partially into the tenon hole. Align a straightedge with the centerline of the bolt shaft; with a pencil, mark this centerline on the rail. Measure in about 3 in. from the tenon shoulder, along the bolt's centerline, and use an awl to locate the hole you'll drill for the nut. This should fall about ⅜ in. from the end of the bolt, Traditionally, the nut was dropped into a ⅜x1x1¼-in. slot chiseled into the rail. A plug was then cut and glued into the hole to prevent the nut from falling out. These slots can be chopped by hand or cut with a ⅜-in.-wide hollow chisel or a plunge router and jig. I find it easier to drill a 1¼-in.-deep hole with a 1-in.-dia. Forstner bit. Then, I drop the nut into the hole and screw the bolt through. To hold the nut in place, I bandsaw a ⅜-in. by ⅜-in. cross out of the end of a 1-in. dowel, saw off the four remaining pie-shape pieces and pare them with a chisel until they fit snugly around the bolt and nut, as shown in the photo this page. I glue them into place around the nut, leaving the bolt threaded through the nut until the glue sets, to ensure proper alignment. Then, I plug the hole with a 1-in.-dia. dowel.

Next, I mortise the inside faces of the two side rails to receive the bed irons that support the box spring (see figure 1). You can have a local blacksmith or machinist cut 1¼-in.-long pieces from ¼-in.-thick 4-in. by 4-in. angle iron or bend ¼x1¼x8-in. stock to 90°. You can also purchase them from one of the sources listed at the end of this article. The irons should be drilled and countersunk for #12 flat-head screws. The mounting screws should be 1 in. to 1½ in. long. Each rail should have one iron 10 in. to 12 in. from

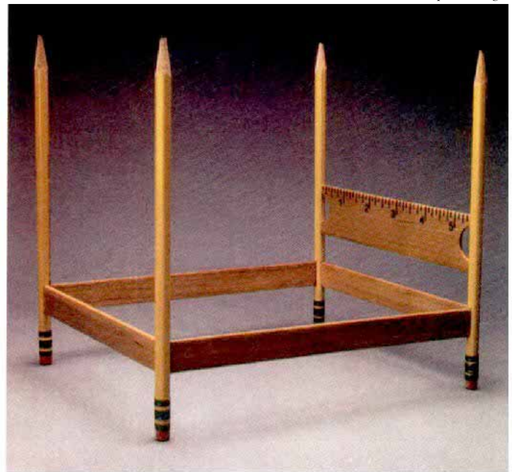
Toying with tradition

Just because the pencil post is a traditional form doesn't mean it has to look traditional. Here are two variations that toy with the pencil-post theme.

A few years ago, I made a "real" pencil-post bed for an architect. The photo (far right) is the model I made from actual pencils. To make a full-size bed, the pencil posts had to be 11 times the actual pencil size. I made four pencils $3\frac{1}{8}$ in. by $82\frac{1}{2}$ in. tall. I used cherry, because Port Orford cedar, the usual pencil wood, is a bit too weak and difficult to obtain in 16/4 stock. The posts were cut to six sides and sharpened with a block plane; the grooves and flutes for the eraser holder were carved in, as was the lettering. I painted the posts to match a pencil's colors. The headboard is a section of ruler, to scale.

A friend of mine, David Stenstrom of Portland, Me., built the pencil-post bed in the photo (right) from maple, then had it sprayed to a high-gloss, candy-apple red. The expected clash of style and color results instead in a stunning piece you can't take your eyes off. —*C.B.*

Photo: Kip Brundage



Don't write-off the diminutive pencil-post bed (right) as just a small pun: Becksvoort made it as a model for a full-scale version. Woodworker David Stenstrom grew tired of his traditional cherry pencil-post bed, so he built another (left) and lacquered it bright red. The form is so simple and the lines so clean that this contemporary treatment doesn't seem at odds with the design of the piece.

each end and one in the middle. I mortise them into the inside face of the rails so the angle is flush with the bottom of the rail.

Headboard and tester—The bedstead is not complete until you've made the headboard. You can choose from a variety of shapes, such as the profiles shown in figure 4 on the facing page, or you can design your own. I prefer a simple curved top with a semicircle cut out of each end. My headboards are 14 in. to 18 in. wide, depending on the bed's size. To determine the length and placement of the headboard, assemble the head rail and two posts. iMeasure up about 15 in. (the combined thickness of box spring and mattress) from the bottom of the rail, and mark this point on both posts. This is the bottom of the headboard. To determine the headboard's length, measure between the posts where the upper tenons will be and add $1\frac{1}{2}$ in. for the two $\frac{3}{4}$-in.-long tenons that extend into the posts. I glue up $\frac{3}{4}$-in. stock to the desired width and bandsaw the headboard to shape. Make the four tenons that anchor the board to the posts about 2 in. wide and bevel them in back so the part of the tenon that extends into the posts is about $\frac{1}{2}$ in. thick. Then, place the bottom of the headboard against the marks on the posts and locate the exact positions of the tenons (mortises-to-be) on the inside facets of the posts. Disassemble the head rail and drill, chisel or rout the mortises. The angle created by the posts' tapers is so minor over the 12-in. distance between tenons that it's easy to compensate for by slightly angling the top and bottom of the mortises with a chisel. The fit should be loose but not sloppy, as this is not a glued joint. Reassemble the entire head unit to check for fit.

Now the posts, rails and headboard can be finish-sanded. If they were shaped and planed with no major tearouts, I begin with 120 grit and sand through 400 or 600.

The tester is made from $\frac{3}{4}$-in.-thick stock, ripped to $1\frac{1}{4}$ in. wide to match the width of the post tops and joined with unglued lap joints. If it was glued together, you'd have a large, flimsy, unwieldy frame to contend with when it was removed for transport or storage. The tester's corners are anchored with dowels in the four post tops.

Determine the size of the tester frame pieces by assembling the bed and measuring from the top of the posts, outside to outside. Make the lap joints in the side frames shallow, $\frac{1}{8}$ in. to $\frac{3}{16}$ in. deep, to help prevent sagging. Cut four crosspieces, one for each end and two middle pieces; lap their ends to fit the laps in the side pieces.

I use a doweling jig to drill the $\frac{3}{8}$-in.-dia. by $\frac{3}{4}$-in.-deep holes into the tops of the posts for the dowels that secure the tester frame. To aid in clamping the doweling jig to the tapered posts, I cut off a chunk from the thick ends of two of the strips bandsawn from the post tops and use them as spacers. I chamfer both ends of $\frac{3}{8}$-in.-dia. by $1\frac{3}{8}$-in.-long dowels and insert them in the post tops. Drill $\frac{3}{8}$-in.-dia. holes through the corner laps of the tester frame to fit over the dowels in the tops of the posts.

As an alternative to the tester, I also turn finials for the posts. Traditional forms include the ball, acorn, urn, tall urn and flame. I've settled on a modified acorn pattern borrowed from a Shaker chair design. Drill a $\frac{3}{8}$-in.-dia., $\frac{3}{4}$-in.-deep hole in the bottom of the finials to fit over the dowels in the post tops.

The bed featured here is made from cherry with an oil finish, but it looks just as nice in American mahogany, walnut or figured maple. After finishing, the bed irons are attached and decorative bolt covers (usually six) are screwed over the bolt holes. □

Christian H. Becksvoort builds custom furniture in New Gloucester, Me., and is a contributing editor to Fine Woodworking.

Sources of supply

Bed bolts and nuts, wrenches, angle irons and bolt covers (both pressed and cast):

Ball & Ball, 463 W Lincoln Hwy., Exton, PA 19341; (215) 363-7330.

Horton Brasses, Box 120F, Cromwell, CT 06416; (203) 635-4400.

Period Furniture Hardware, Box 314, Charles Street Station, Boston, MA 02114; (617) 227-0758.