

The Haunched Mortise and Tenon

How to strengthen the corner joint

by Ian J. Kirby

The most basic of woodworking problems is joining two pieces of wood together at right angles to form a corner. The most common joint for doing this is the mortise and tenon. We are usually in one of two situations: first, where two pieces of similar thickness are being joined, as in the corner of a door frame (fig. 1); and second, where a third piece of wood of dissimilar thickness is involved, as in a typical table or chair joint between apron and leg (fig. 2).

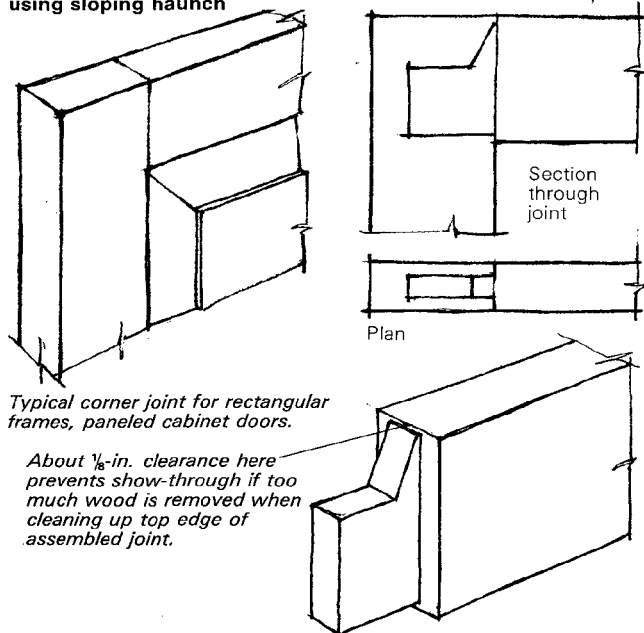
When designing these joints, note that the top edge of the mortised member—the vertical piece in the illustrations—will be in line with the top edge of the tenoned rail. If you want the final appearance to be as shown, then the joint must be stopped somewhere below the top surface. The usual solution is to add a haunch, which may be either square or sloping. Both variations strengthen the joint and increase the gluing area, and the basis for choice is visual. If you want a clean,

uninterrupted line at the top shoulder of the joint, you would use the sloping haunch. If you don't mind the interrupted line or if the joint will be concealed, the square haunch is a little easier to make and a little stronger.

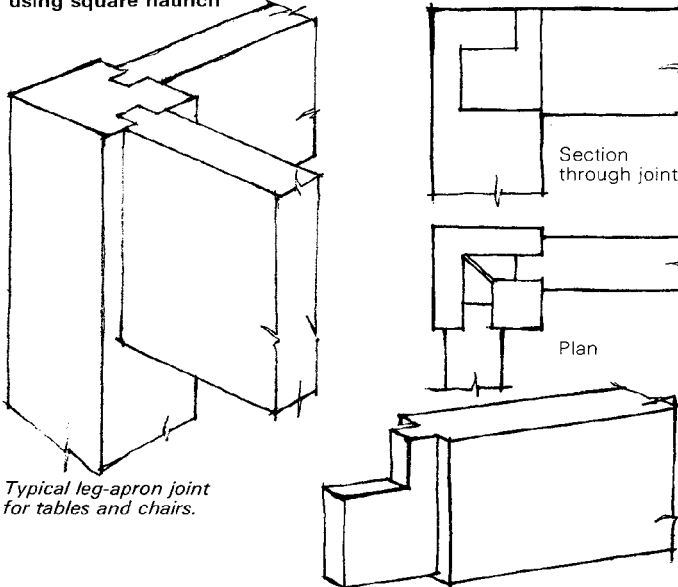
The illustrations show the form of the joints, and the elevations suggest suitable proportions. I must emphasize here that it is the responsibility of the designer to detail all the joint dimensions to achieve the visual effect he wants as well as the mechanical strength the structure requires.

The main reason for the haunch is strength. Resistance to twist is especially improved. If you leave the haunch off altogether (fig. 3), the result is that about a third of the width of the rail is free-floating, with no mechanical bond and no glue bond where it needs it the most. If you go to the other extreme and make a bridle joint, you sacrifice mechanical resistance to downward loading. Although glue is strong in shear

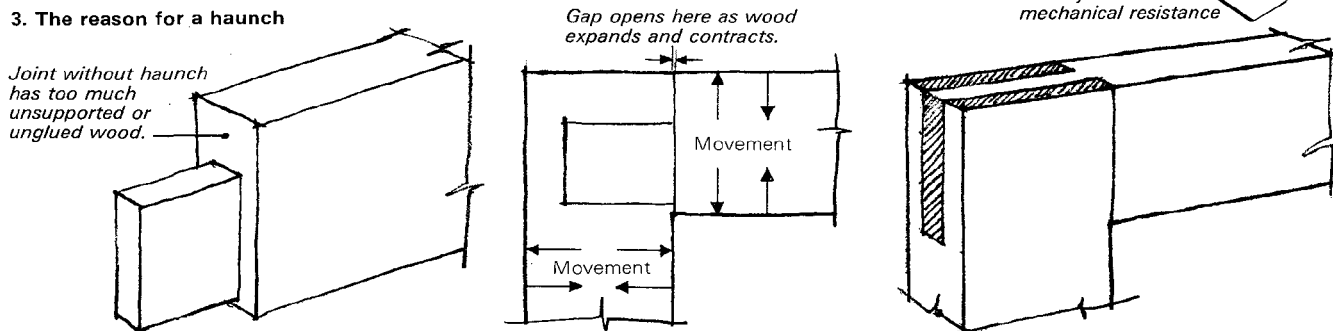
1. Mortise and tenon between pieces of equal thickness, using sloping haunch



2. Mortise and tenon between pieces of unequal thickness, using square haunch



3. The reason for a haunch



and the joint has a great deal of gluing area, the two parts meet at right angles. This puts considerable strain on the glue line when the wood shrinks and expands, and the condition is aggravated by the large amount of exposed end *grain*. In addition to the forces the object will encounter in use, you must consider seasonal shrinkage and expansion. These can exert far greater forces than ordinary usage will, although they do not occur or show themselves for some time. The most common fault in this regard is a gap appearing at the top edge shoulder line.

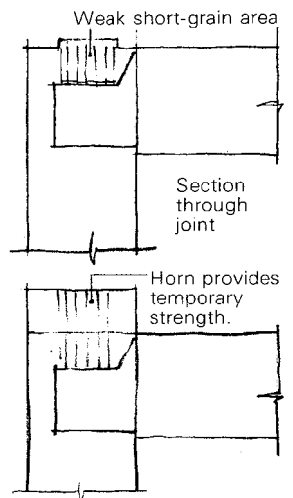
There is a peculiarity of manufacture common to both the sloping and square versions of the haunched joint. When cutting the wood to length, an extra $\frac{3}{4}$ in. should be left on the end of each piece where a mortise will be made. The wood should be knifed quite deeply all around at the true length where the top edge of the tenoned piece will be aligned. The extra $\frac{3}{4}$ in. of wood is left there until the joint is made and the glue is cured, whereupon it is sawn off. The extra wood, called a horn (fig. 4a), has the effect of making the mortise be more in the center of the piece of wood than right at the end. While the joint is being made, it helps prevent the wood tissue from splitting beyond the joint. While the joint is being glued and clamped together, provided it fits well, the piston-and-cylinder action can very easily crack the wood in the area of the haunch. It is also possible, especially on a blind joint, for a piece of short grain to pop right out along-

side the haunch. The horn prevents these unhappy events. Since glue seals the piston-and-cylinder, the viscosity of the glue is also a factor. The thicker it is, the more slowly you should clamp the joint together—the excess glue has to go somewhere, and it needs a little time to flow out of the joint. Imagine the dilemma in the days of hot animal glue: As the glue cools, it becomes more viscous and starts to set, so clamping slowly doesn't work. Part of the solution then was the horn, and it still is.

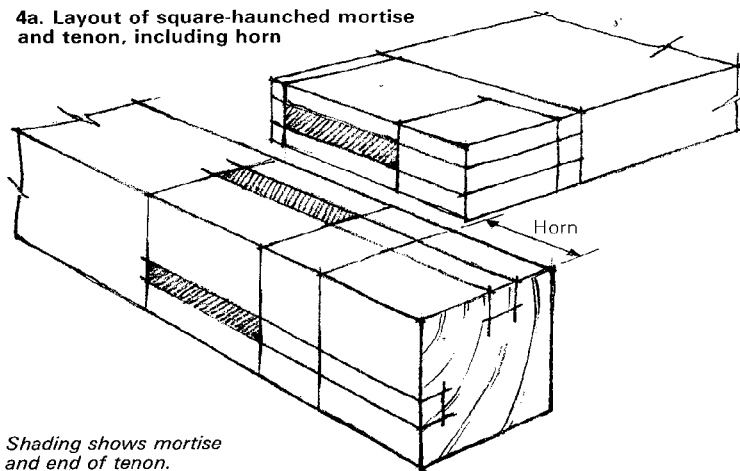
The square-haunched mortise and tenon is marked out as shown (figs. 4b, 4c). A longer haunch would seem to give more gluing area, but it might also allow the mortise cheeks to curl away from the tenon. A haunch shorter than square gives too little gluing area. The tenon is sawn in the usual way, being sure to leave the shoulder lines for last.

The mortise is chopped as usual, but only in the full-depth part of the joint. Remove the waste to accommodate the

Short grain on mortise member is quite weak until joint is glued—top of joint may be pushed out if no horn is left.

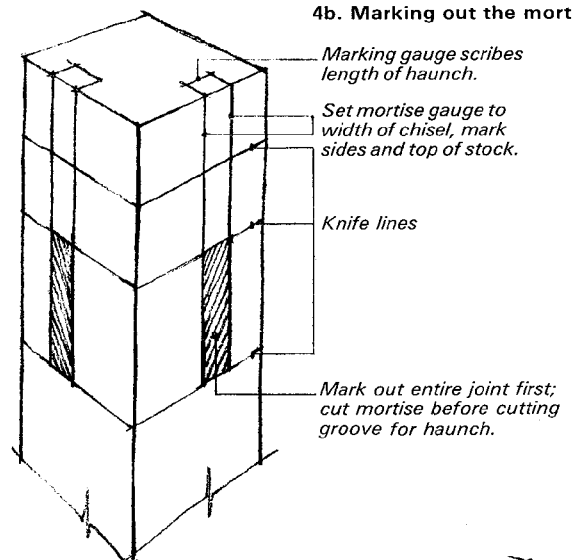


4a. Layout of square-haunched mortise and tenon, including horn

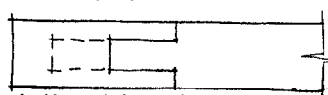


Shading shows mortise and end of tenon.

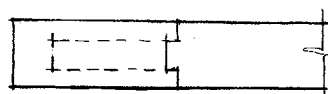
4b. Marking out the mortise



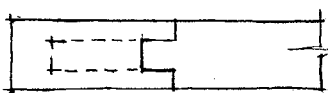
Haunch proportions



A. Haunch is too long—cheeks are liable to curl.

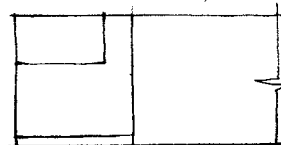


B. Haunch is too short—not enough glue area, but better than A.

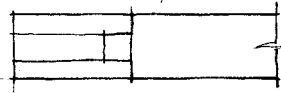


C. Correct—haunch is square in plan.

Elevation of tenon layout



Plan of tenon layout



4c. Marking out the tenon

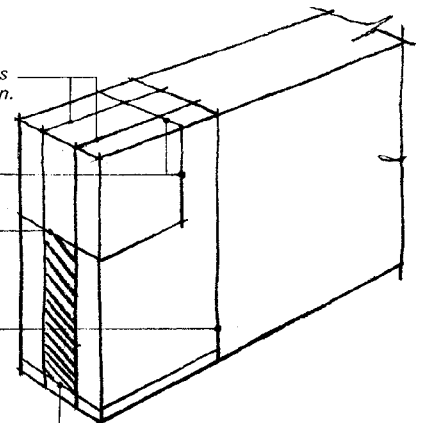
1st cut — Mortise-gauge lines for cheeks of tenon.

4th cut — Knife across for length of haunch.

3rd cut — Marking-gauge lines for top edge of tenon.

5th cut — Knife shoulder line deeply.

2nd cut — Marking-gauge lines for bottom edge of tenon.



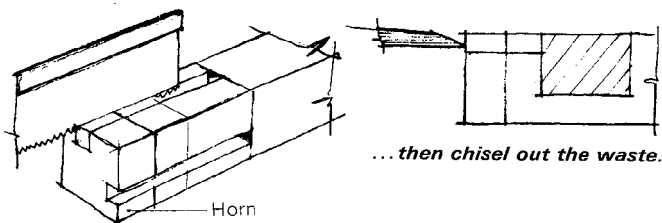
haunch by placing the workpiece in the vise at a slight angle and cut down the insides of the haunch lines with the tenon saw (fig. 5). Only a few inches of the saw can be used, but the method is fast and efficient. Sight across the back of the saw to make sure it is parallel to the top edge of the wood, and be sure that sharpening has not moved the saw's teeth out of parallel with its back. Once the sides of the haunch groove are sawn, remove the waste with the mortise chisel. Place it about halfway down the haunch groove on the end grain and give it a smart tap. Watch out for grain direction, in case it is running down into the joint and liable to result in more waste removed at the joint end than at the horn end. With care, it is not difficult to keep the haunch groove clean and parallel. Two points: The groove has to be cut in the horn, which seems a waste of time, but that's how it is. Second, don't try to chop the haunch groove the same way as the mortise. It is difficult this way to keep the bottom clean and parallel.

The sloping haunch joint is marked out in the same way as the square haunch (fig. 6). At its root, the haunch is usually as long as the tenon is wide—if the joint were sectioned here, it would look in plan the same as the square haunch. Saw the tenon cheeks and ends in the usual way, then saw the slope before sawing the shoulders. A common error is to saw the main tenon and shoulders before the sloping haunch, thereby removing the layout lines.

The full-depth portion of the mortise is chopped as usual. Then place the wood in the vise and cut the slope with the mortise chisel. There is no measurement one can make to get the slope right the first time. The normal method is to cut the slope short, check the depth at its root and remove the necessary amount. It is very easy to draw the joint showing the slope of the haunch coming right to the top of the shoulder line. But it should stop short, leaving about $\frac{1}{8}$ in. of vertical shoulder before the slope begins. This allows for over-enthusiasm when planing the top edge clean. □

Ian Kirby is director of Hoosuck Design and Woodworking in North Adams, Mass. This is the third in a series of articles on the mortise-and-tenon joint; the previous installments appeared in March '79 and May '79.

5. Saw down the walls of the haunch...



6. Layout of mortise and tenon with sloping haunch

