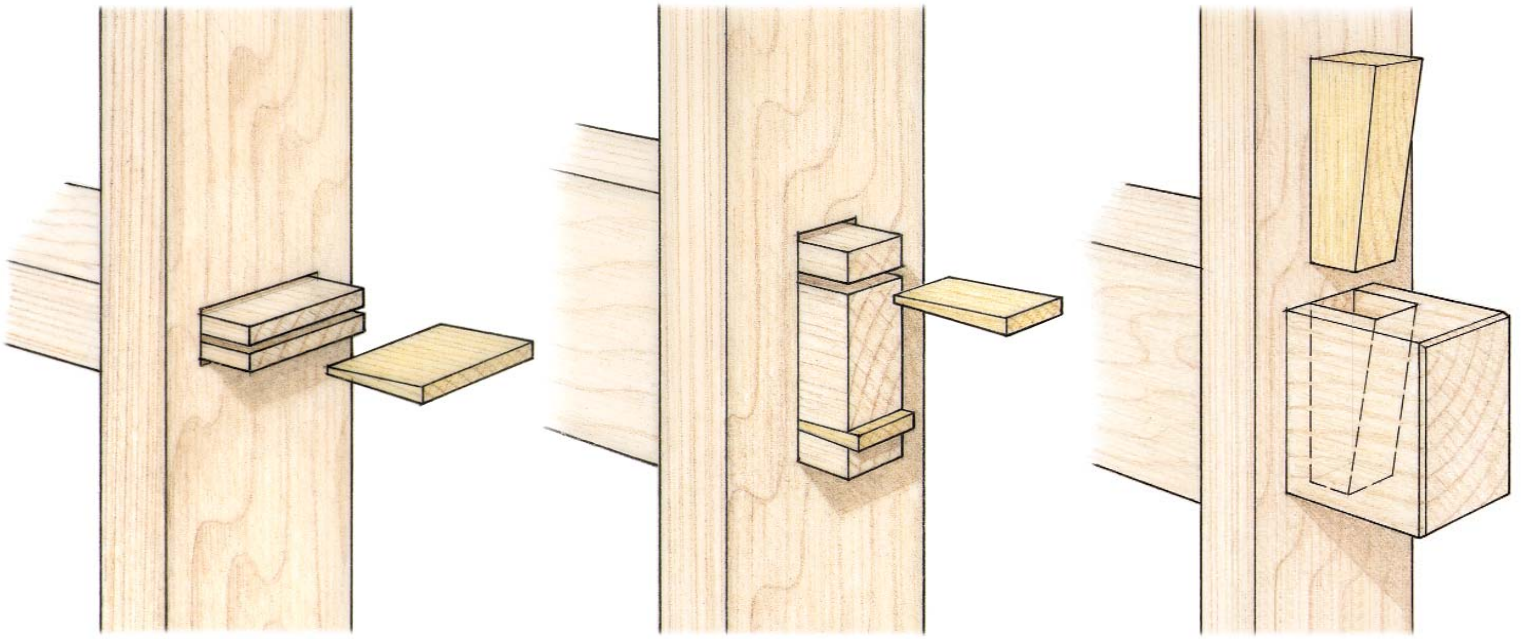


SINGLE FIXED WEDGE | DOUBLE FIXED WEDGES | SINGLE LOOSE WEDGE

The Mighty Wedge

Fixed or loose, wedged joinery adds strength and style

BY JOHN NESSET

Since antiquity, wedges have served as an important means of joining wood. Low-tech but effective, they remain a useful and attractive element of joinery, evoking a rustic past when life (we like to think) was simpler and more straightforward. Like dovetails and other exposed joinery, wedges convey a sense of solid, honest craftsmanship, even to the uninitiated.

A whole book might not be enough to detail every application for the mighty wedge, but I'll cover the two major types in their basic single and double forms. From there, furniture makers can derive other variations.

Wedges fall into two general categories: fixed and loose. Both types are driven into through-tenons to reinforce the joint. Fixed wedges generally are driven into the end grain of a tenon with glue added for reinforcement, then trimmed flush. They are appropriate where the wedge risks working loose.

Loose wedges are driven into a mortise that goes crossways through a protruding tenon. Loose wedges are not glued or fastened, so they must be oriented so that gravity and/or friction will keep them in place. They are used for two reasons: to create a knockdown joint and for decorative effect.

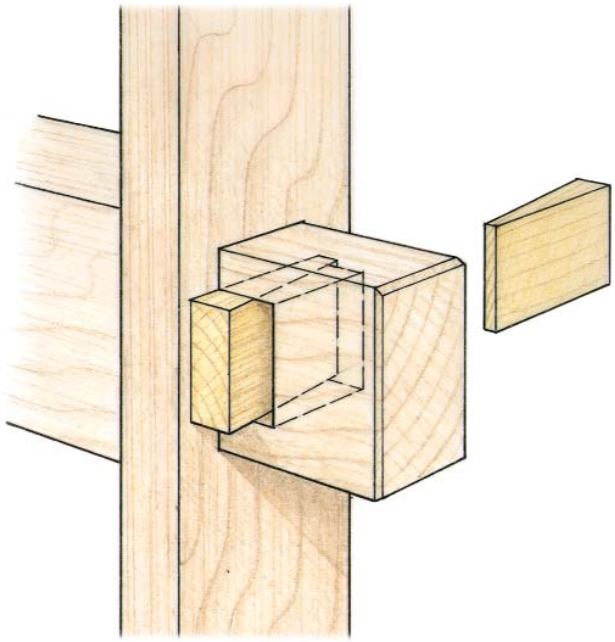
Wedges and grain alignment

Whichever wedge type you choose for your project, you must take into account grain direction. The hard-and-fast rule is that a wedge must be oriented in the mortise so that it applies pressure against the grain, not across it. As young Abraham Lincoln demonstrated in his famous fence-building project, pressure applied across the grain splits the wood. In the case of fixed wedges, this fact of life will determine whether you need a single wedge or double wedges (see the drawings on the facing page).

A single fixed wedge

It's worth spilling some extra ink about this first type of wedge, as it will illustrate many of the general principles for all wedged joints. For example, for any of these wedged joints, start with a carefully fitted, square mortise and tenon. For a fixed wedge (or

Photos: Asa Christiana



DOUBLE LOOSE WEDGES

wedges), leave the tenon just a little long, so it protrudes from the mortise ¼ in. or so.

The magic angle is 5°—The most important thing to know about wedges, fixed or loose, is to cut them at an angle of 5° or less. In this range, friction alone will hold the wedge to the tenon. Also, if the two halves of the tenon are bent too far by a thick fixed wedge, they will be weakened at the base, thus weakening the joint.

Of course, wedges driven into the end grain of a tenon will be subjected to pressure (from racking forces and seasonal expansion and contraction) that would overwhelm friction alone, which is why the bond should be strengthened with glue.

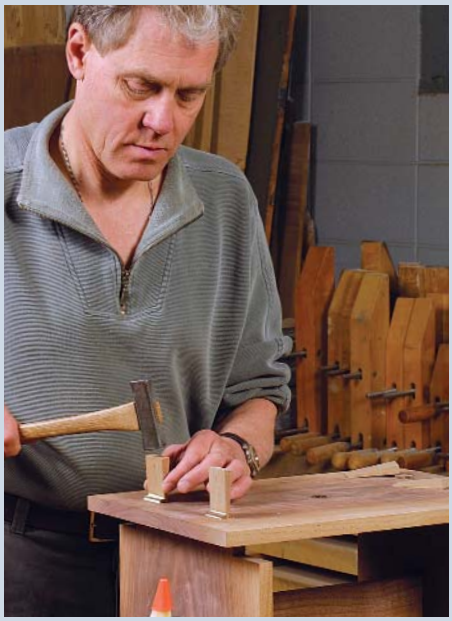
Angle the mortise and slot the tenon—I like to cut a flare into the mortise to accommodate the wedging action, creating a dovetail of sorts and locking the joint. But often it is quite acceptable not to angle the mortise. In this case, just use a thinner wedge—cut closer to 2° or 3°—to increase the pressure against the sides of an already snug mortise.

A 5° angle works well for single fixed wedges, spreading each half of the tenon outward 2½° (see the drawing on p. 50). The top of the mortise wall should be angled on each side to accommodate the wedging action. This offset is laid out on the edges of the mortise, on the outside face of the workpiece.

To chop the angled mortise wall, first pare away the edge of the mortise, steadily creeping back toward the scribe line and down toward the bottom edge of the mortise. The goal is to reach the line and the bottom edge at the same time with a straight surface in between. Use the edge of the chisel to check the cut for flatness.

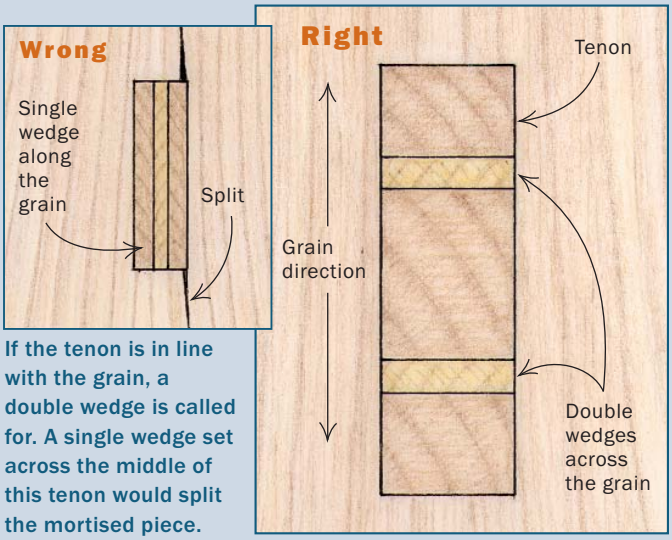
Next you'll want to saw a thin kerf in the tenon to receive the wedge. A handsaw leaves the right size slot. But before sawing this slot, drill a hole a little larger than the kerf through the tenon where the base of the slot should end up: about ⅛ in. from the tenon's

Orient wedges to avoid splitting



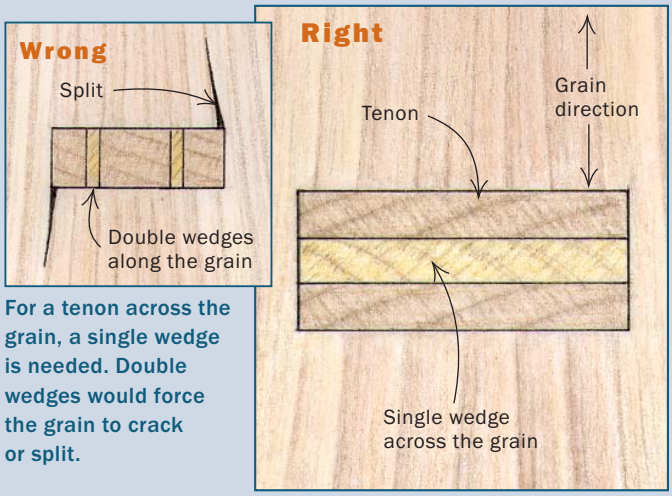
A wedge must push the tenon against the end grain of the mortised piece to avoid splitting the wood. So the orientation of the tenon—along the grain or across the grain—determines the number and orientation of the wedges.

TENONS ALONG THE GRAIN



If the tenon is in line with the grain, a double wedge is called for. A single wedge set across the middle of this tenon would split the mortised piece.

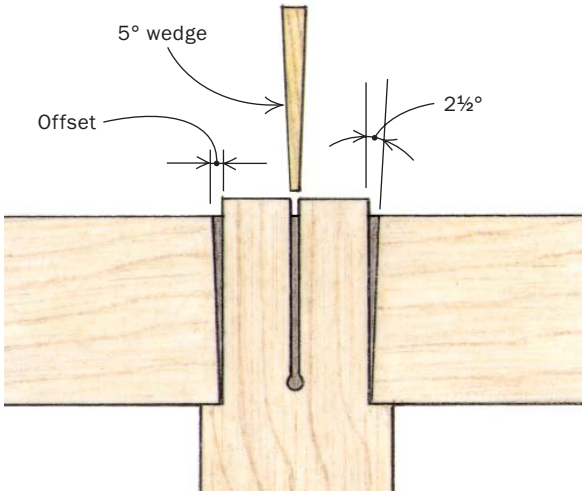
TENONS ACROSS THE GRAIN



For a tenon across the grain, a single wedge is needed. Double wedges would force the grain to crack or split.

Drawings: Vince Babak

FIXED WEDGES ARE GLUED IN PLACE



SINGLE FIXED WEDGE

A 5° wedge requires each face of the mortise to be angled at 2½°. Draw a cross section of the joint to determine the amount of offset at the top of the mortise.

ANGLE THE MORTISE

Lay out the offset of the angled mortise. *After determining the offset at the top of the mortise, scribe lines to indicate where the angled cuts begin (above). Work steadily back toward the scribe line (right) and down toward the bottom edge of the mortise.*

Drill a hole to prevent the tenon from splitting. *Clamp the workpiece vertically in a handscrew. Then drill a hole through the width of the tenon.*

PREPARE THE TENON FOR WEDGING

Saw a kerf down to the hole. *A handsaw leaves an appropriately narrow kerf in the tenon.*

A trick for a clean, flush joint. *To prevent tearout when planing a tenon flush, score a line around the base of the tenon.*

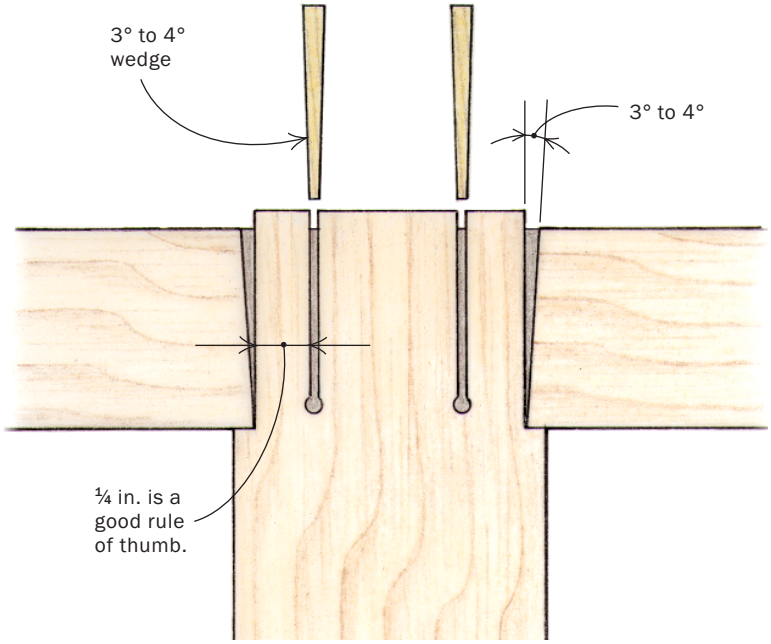
shoulder. This hole helps prevent the tenon from splitting beyond the slot when the wedge is driven in.

Wedge basics—When choosing the wood for a fixed wedge, avoid very soft species such as pine, basswood or redwood. Instead, steer toward species such as yellow poplar, maple and elm, which will stand up to hard pounding without splitting. Use straight-grained wood for the same reason. If you use an oily wood like ebony, clean it thoroughly with acetone immediately prior to gluing.

Cut the wedge exactly as wide as the tenon. Then lay out the appropriate wedge angle and saw it any way you like. Handplane it if the cut is rough. The thickness of the wedge will be determined by where you crosscut it. To allow for the wood to compress slightly, you should add a bit to the overall thickness. There is an easy way to do this: Square off the bottom of the wedge at a point where it is a hair (roughly 1/32 in.) thicker than the sawkerf.

Sharpen the squared edge to a point to make it easier to start in

Watch it on the web — To see a video on wedging a tenon, go to www.finewoodworking.com.



DOUBLE FIXED WEDGES

Each wedge in a double array displaces its end of the tenon by the full thickness of the wedge.

the slot. Then square off the thick end of the wedge at a point where it will protrude from the top of the tenon.

Driving in a wedge—Assembling and gluing-up fixed-wedge joints can be nerve-wracking. I often clamp the assembly to keep the joint square and tight while the wedges are pounded home.

Do a test-run first, making sure that clamps won't come undone when you start waling away with the hammer. Drive in the wedge slightly to check its fit. Then pull apart the joint and apply glue to all surfaces, including some inside the sawkerf and on both faces of the wedge at its narrow end. Then insert the wedge and drive it in with a hammer. The hammering sound will change when the wedge is home, and you should see the tenon halves press tightly against the walls of the mortise.

If the wedge is wider than the head of the hammer that you're using, protect the wedge head with a block of wood as you drive it home. Be careful to hold the block square as you pound on it. When the glue dries, trim the protruding wedge and tenon flush.

Double fixed wedges

With a few additional considerations, the procedures for single fixed wedges apply to double fixed wedges. Like single wedges, double wedges are used in through-tenons both to add strength and to give a decorative touch, but double wedges are oriented across the tenon, making them much narrower.

I use a 3° or 4° angle for double wedges, which is the same amount the tenon sections will bend and the mortise wall will be angled (see the drawing above).

Basically, the wedges go in near the ends of the tenon. But ex-

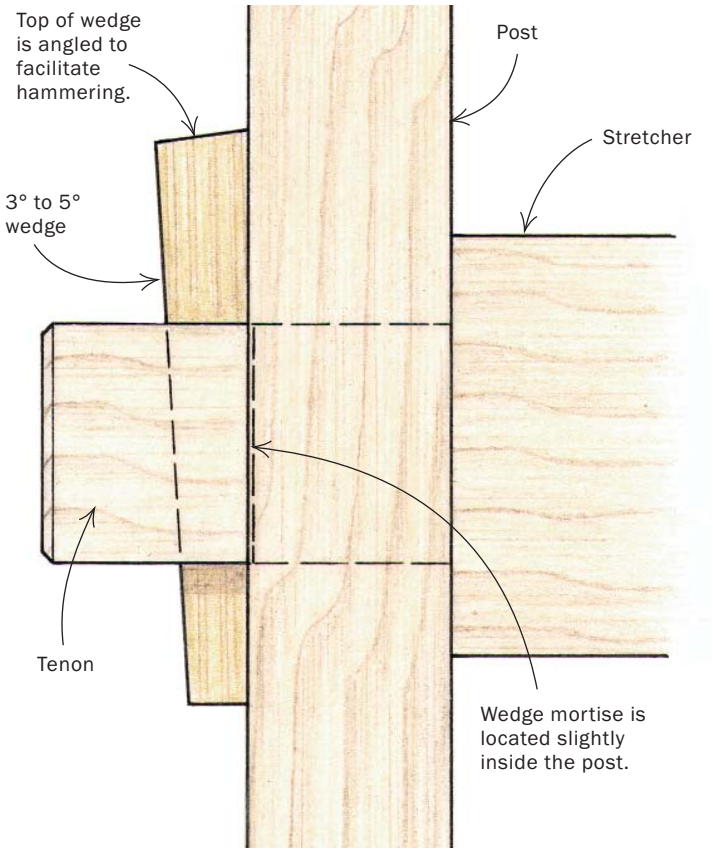
Angle the ends of the mortise. *The layout and chopping techniques are the same as when angling a mortise for a single fixed wedge.*

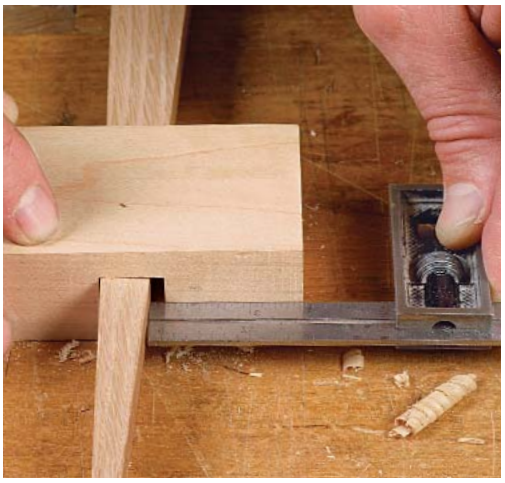
Sometimes clamps are needed. *Nesset uses clamps to keep the tenon shoulders snug and square while he drives home the wedges.*

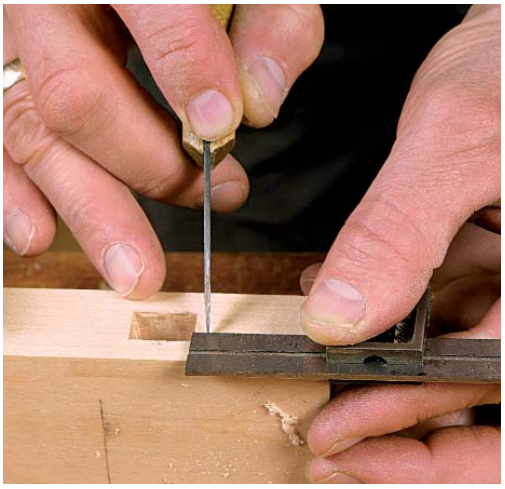
LOOSE WEDGES CAN BE DISASSEMBLED

SINGLE LOOSE WEDGE

This wedge should be oriented vertically so that gravity pulls the wedge downward when the joint wiggles, tightening it. One side of the wedge mortise is angled to match the wedge.



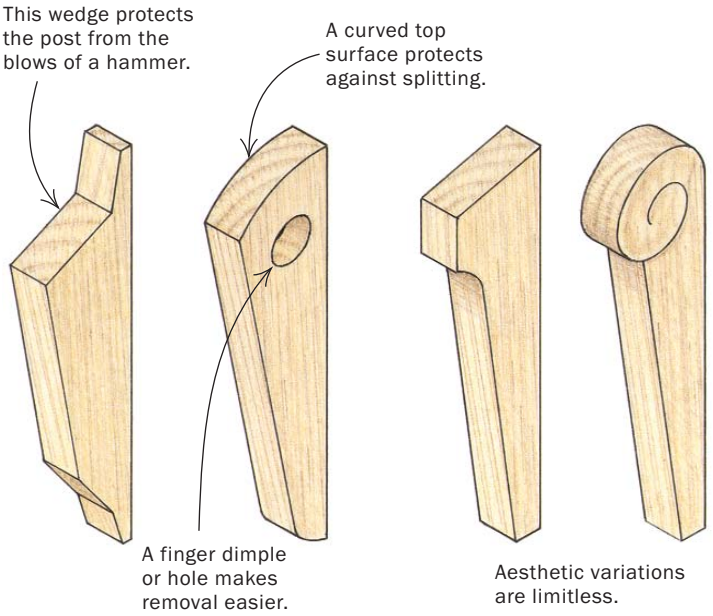




Another method for laying out the mortise angle. *First chop a square mortise through the tenon and make the wedge stock. Insert the wedge and measure the gap at the loose end. That gap is the same amount that the mortise must be offset to match the wedge angle.*

LOOSE WEDGES ADD STYLE

There are many possible variations on the loose wedge, some functional, all decorative.



actly where to place them is a factor of how flexible the wood is. They should not be so close to the ends that the bent pieces will be weak at their base, but they should not be so close to the center that the outer pieces won't spread easily. A good rule of thumb is ¼ in. from the end of the tenon.

Drive in the wedges equally, each a little at a time. Otherwise, the wedges will look uneven when the tenon is trimmed flush.

Loose wedges can be single or double

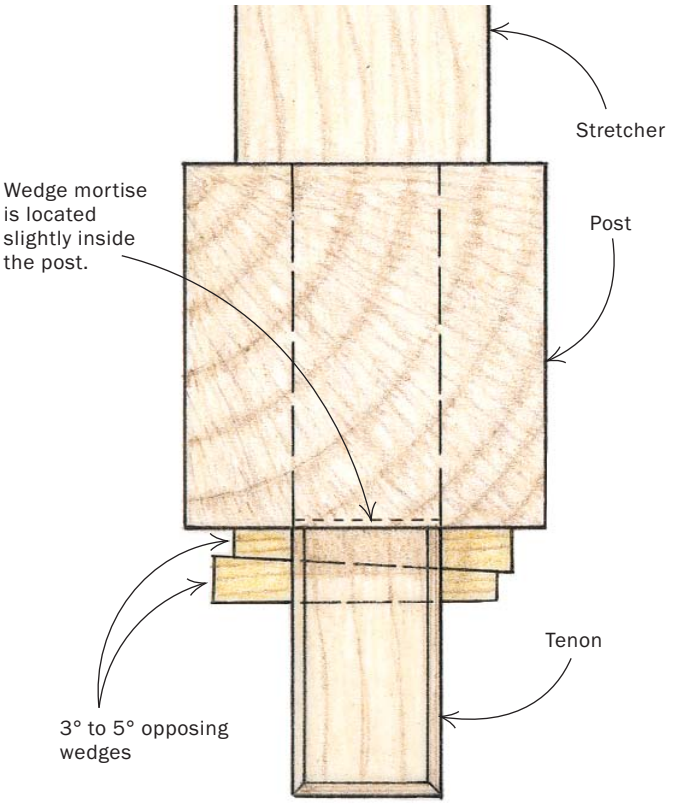
As I said earlier, loose wedges offer a greater decorative effect and a sturdy knockdown joint, suitable for a trestle table, a bed frame or the base of a workbench, among other applications.

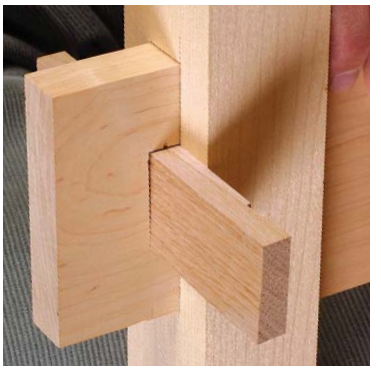
Many of the principles that apply to fixed wedges also apply to loose ones. The 5° limit holds true, and the wedging action must apply pressure against the end grain of the mortised piece. However, unlike fixed wedges, which are driven in with the grain of the tenon, loose wedges are driven in perpendicularly to the grain and should be made from wood as hard or harder than the stock that they wedge to minimize compression against the end grain.

Single and double loose wedges are oriented differently. The single loose wedge generally is oriented vertically, allowing gravity to work in its favor. Double loose wedges, on the other hand, are

DOUBLE LOOSE WEDGES

This type is used when the tenon is too tall to hold a long vertical wedge. The wedge mortise is horizontal and is left square because it holds two opposing wedges. Gravity won't tighten the wedges, but the mortise is easier to cut.





Try the fit, looking for gaps. *The wedges may need light planing to adjust their fit in the mortise.*

Then mark them to length. *These wedges will end just inside the edge of the post.*

oriented horizontally in a square mortise, wedging against each other. An occasional tap might be necessary to retighten the joint.

The familiar trestle base offers a typical application—connecting the long stretcher to the posts—for either type of loose wedge. A long, shouldered tenon at each end of the stretcher goes through the post, protruding sufficiently from the other side to accommodate a mortise for a wedge or wedges.

Start with a square, snug mortise and tenon, and a square mortise for the loose wedge(s).

Single loose wedge is vertical—Single wedges, with their thick ends sticking up in plain sight, often are stylized for greater decorative effect (see the bottom drawings on the facing page).

For the single wedge, cut a square mortise vertically through the protruding tenon. Then angle the mortise face that is farthest from the post to match the wedge. I usually go with an angle of 3° to 5°. Cutting a taper into the wall of this long, narrow mortise is trickier than tapering the short mortises for fixed wedges, but the technique is the same. Lay out the offset on the wider end of the mortise, and begin removing the corner, working back toward the bottom edge and your layout line. Check the mortise wall often with a small straightedge to make sure you are keeping it straight. A mortising chisel will work better than a paring chisel, tracking along a straighter line as you chop downward.

It's important to have clean, square corners inside the wedge mortise; otherwise, the wedge will catch and could split the tenon.

Double loose wedges are another solution—If the tenon is just too tall or thin for a long vertical mortise, use double loose wedges oriented horizontally. Double loose wedges work by locking against each other as well as against the mortise. One wedge is inserted from one side and one from the other, and both are driven in until the two angled faces lock. Orientation is horizontal instead of vertical because the bottom wedge would work loose and fall out in a vertical configuration. With each edge of the wedges and the edges of their mortise neatly chamfered, the double wedge makes a useful, strong and attractive joint.

I cut double loose wedges at a similar angle as singles, but I leave them thinner than single wedges when cutting them to length. This way, the two wedges can fit in a smaller, neater-looking mortise. Double wedges also are usually wider than single loose wedges, to offer more friction between their faces. □

John Nesset is a furniture maker in Minneapolis, Minn.