

Clamping with Wedges

Tapered pieces can clasp or cleave

by Percy W. Blandford

Like many woodworkers, I have found myself needing more clamps than I owned. Because of that, I began to use wedges as clamps, much like medieval artisans and builders who didn't have any alternatives. Thanks to my early boatbuilding experience, I learned how useful clamping with wedges can be and have since been able to apply wedge-clamping techniques to all my woodworking. And of course, cutting wedges from scrapwood is cheaper, and in some cases simpler, than using expensive metal clamps. In this article, I will discuss the most useful wedge-clamping methods I have employed, but first, I'll explain some basic wedge principles.

Wedge actions and properties

Whether you realize it or not, every time you drive in a screw or thread a nut onto a bolt, you are using wedge action. The threads of a screw or bolt can be considered a wedge of considerable length wrapped around a cylinder (see figure 1). If the thread is unwound, you get a long wedge with a very shallow slope (angle). Because of this, screws and bolts rely on many revolutions to advance themselves. But due to its shorter length, a plain wedge requires a steep angle to advance an object appreciably.

Optimum wedge angle is hard to calculate. A steep-angle wedge produces more movement, but requires more driving force. Plus, steep-angled wedges are more likely to slip than shallow-angled ones. Most of us rely on experience to choose a wedge's angle, but for most clamping operations, a wedge that rises about 1 in. in 6 in. makes a good choice. Cabinetmakers might compare this with the average dovetail pitch of 1 in 7.

A wedge's surface is also an important consideration. On the one hand, a wedge with a saw-cut surface has friction to resist slipping, which is good for clamping applications, but it is not as easy to drive as a wedge with a planed surface. On the other hand, a wedge that is meant to be removed periodically, such as those that are used in knockdown joinery (see the sidebar on p. 65), should have a smooth surface. And for a very slippery surface, naturally oily woods, like teak or *lignum vitae*, can be used to make self-lubricating wedges.

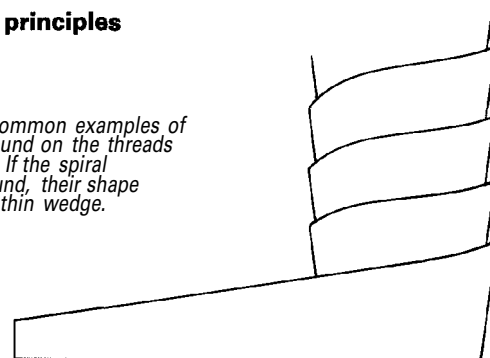
Single vs. folding wedges

For most clamping operations, you can choose between two types of wedge arrangements: a single wedge or folding wedges. When you drive a single wedge, as shown in figure 2A on p. 64, the movement is mostly in one direction toward whatever the wedge bears against. But single wedges can cause problems because there can be some lateral movement as well. When you need to exert pressure perpendicular to a wedge's base without causing lateral movement, you can use a pair of folding wedges (see figure

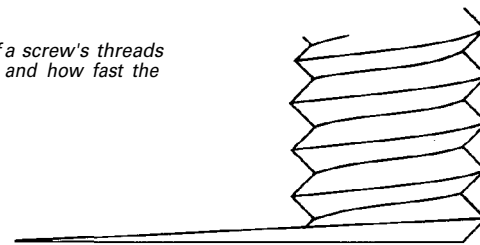
2B) that have the same shallow slope, rather than using one steep wedge. By driving each wedge in turn, you get a good thrust (preferably against a pad to protect the workpiece), with much less sideways force exerted. Since the two bearing surfaces are parallel, the action is like a screw-action clamp, but with a little improvisation, you can get into places that won't allow for conventional clamps. Figure 2B shows how folding wedges are used to edge-glue boards. Just screw or nail a block down, put pads against the work and tighten with folding wedges. Place the pads so the wedges will start with an overlap of about 2 in. on the thin ends. The thickness of one or both pads can be altered to suit the wedges, and usually, 6-in.-long wedges are adequate. By using

Fig. 1: Wedge principles

One of the most common examples of wedge action is found on the threads of a screw or bolt. If the spiral threads are unwound, their shape resembles a long, thin wedge.



The pitch (slope) of a screw's threads determines how far and how fast the screw advances itself.



Similarly, the slope of a wedge governs the amount and rate that an object will be moved. The slope also influences how easily the wedge can be driven.



wedges with blocks secured to deck framing, similar tightening can be achieved when laying down boat planking or house floorboards.

Wedges as bar clamps

The simple wedge action described previously will work for many clamping operations. However, when gluing up boards to make a tabletop, or other wide panel, there is a risk of the boards bowing or popping up. To remedy this, you can make a bar clamp with battens on the top and bottom to obtain even pressure and to keep the boards flat, as shown in figure 2E. A series of holes in the battens allows them to be used on a variety of jobs. Pressure can come from a single wedge or a pair of wedges at one or both ends. Another type of bar clamp can be made by knotting a piece of rope around whatever has to be compressed and driving a wedge under the rope at each side (see figure 2F).

Wedges in other clamping applications

Because they can be sized and placed to fit the situation, wedges are particularly well suited for specialty-clamping jobs, such as large bent laminations. As shown in figure 2D, cauls can be cut to

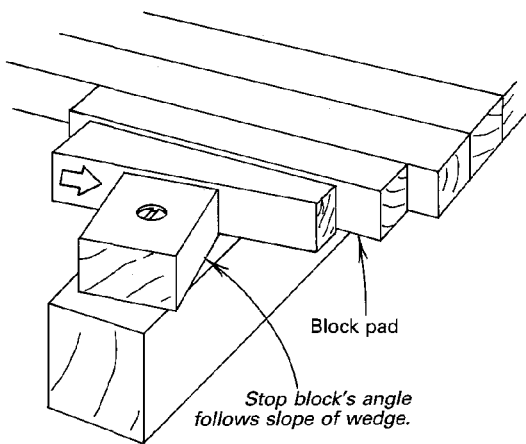
match the shape of the desired bend, and wedges can be used to force the laminates against a form that is mounted on a baseboard. With a little ingenuity, specialty clamps can be fashioned for other projects, too. For instance, in traditional clench-built or lapstrake boats, the overlapping planks need to be clamped a good distance in from an edge. For these clamping jobs, I make a simple, long-reach clamp (see figure 2C) that consists of a couple of boards bolted together. A thick wedge driven into one end forces the other end tight. Usually, I locate the bolt at the center, but positioning it towards the wedge can increase the clamp's leverage.

This is just a sampling of how wedges can be put to work around the shop. In addition to the more familiar wedge uses, like jacking structures, moving heavy objects, plumbing door casings or leveling machinery, there are many other wedge-action possibilities. So keep wedges in mind the next time you need an extra pair of hands, or you're confronted with a challenging clamping job. □

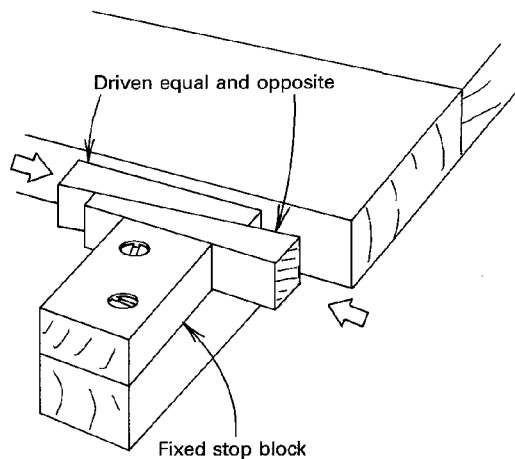
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Fig. 2: Wedges in clamping applications

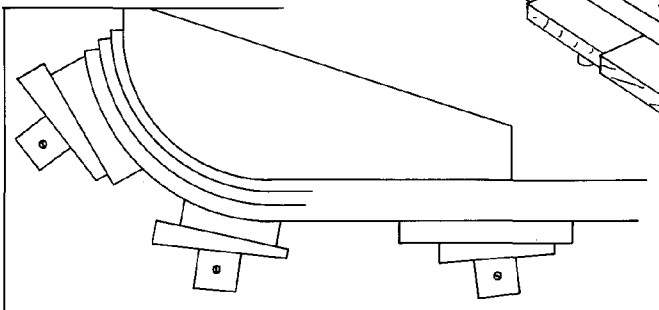
A: Single wedge



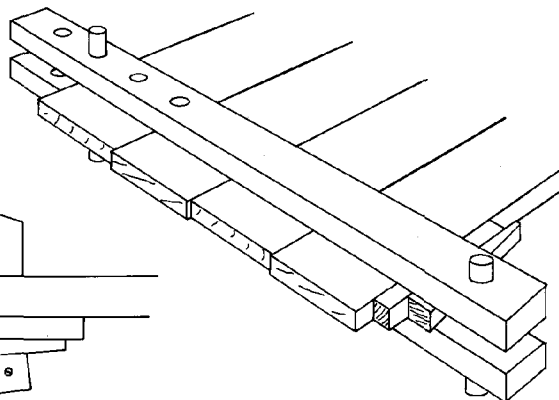
B: Folding wedges



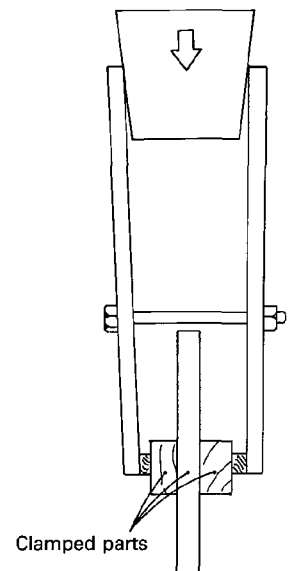
D: Steam-bending form (plug and caul), or bent-lamination clamp



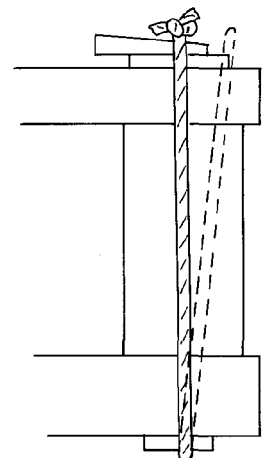
E: Adjustable batten as bar clamp



C: Long-reach C-clamp



F: Rope loop as bar clamp



Integral wedges enhance joinery and ease assembly

Most woodworkers are familiar with wedges that lock tenons in mortises. The wedged through-tenon and the diagonally wedged square tenons, shown at right, are common examples. These drawings also show other types of wedges or tapered pins that are integral parts of a joint and that aid assembly (or disassembly) as well. I will briefly describe the wedged joints shown here and give you a few tips for applying them.

The strength of a **wedged through-tenon** is increased by enlarging the outside of the mortise so the tenon can spread, as shown in the drawing. To reduce the risk of the tenon splitting, drill small holes at the ends of the wedge kerfs. When you're using **diagonal wedges**, locate the mortise away from a component's end to avoid splitting out the mortise stock's long grain.

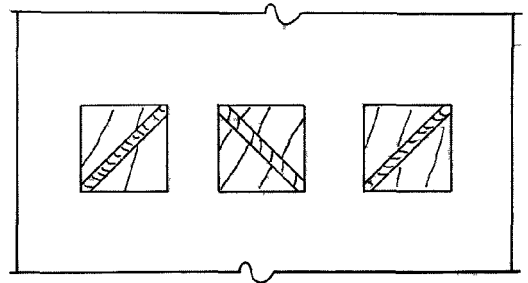
For joints that have to withstand considerable stress but do not need to be disassembled, **blind wedges** can be used within a stopped mortise. Flair the mortise by undercutting the sides as shown, and use short wedges with a steep taper. Experiment with the mortise taper, the wedge size and the kerf width to ensure a tight joint.

Timber framers and furnituremakers often use **offset pegged tenons**. On these

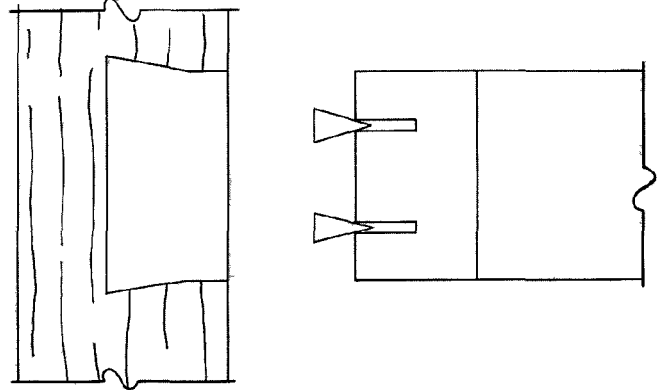
joints, wedge-shaped draw pins pull the tenons tightly into their mortises because of offset holes in the tenon and mortise stock. First, drill through the mortise stock. Next, mark a corresponding hole in the tenon but offset it toward the shoulder, about $\frac{1}{16}$ in. for close-grained hardwoods, and $\frac{1}{8}$ in. for softwoods. Now, taper one end of your dowel pin and drive it through the assembled joint, as shown. The wedge action of the pin will draw the tenon shoulder tight. When the dowel's full cross-section is through the joint, cut off the surplus.

Removable wedges (or pins) for knockdown joinery can be plain or decorative, and they can go through square or turned parts, as shown. Make sure there is plenty of extra tenon length beyond the wedge hole, since there can be considerable thrust on a small amount of short grain. Undercut the hole just enough so the wedge won't bottom out, but will push against the surrounding wood. When you make the wedge, allow for shrinkage (you can always plane a shaving off later), and leave it long as well. Removable wedges for wooden tools can be fashioned in a similar way. If you use a shallow slope (1 in 8 or 9), wedges can usually be tightened or loosened by hand. —P.B.

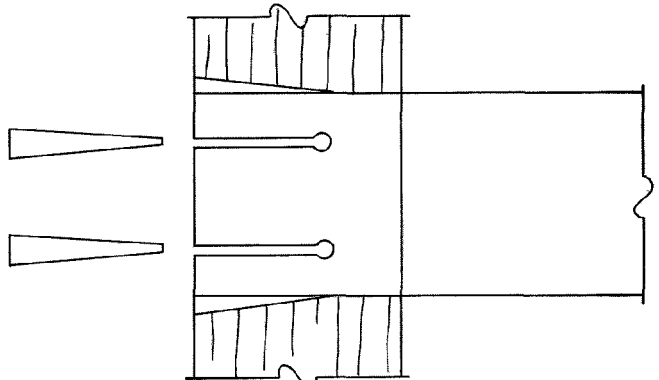
Diagonal wedges



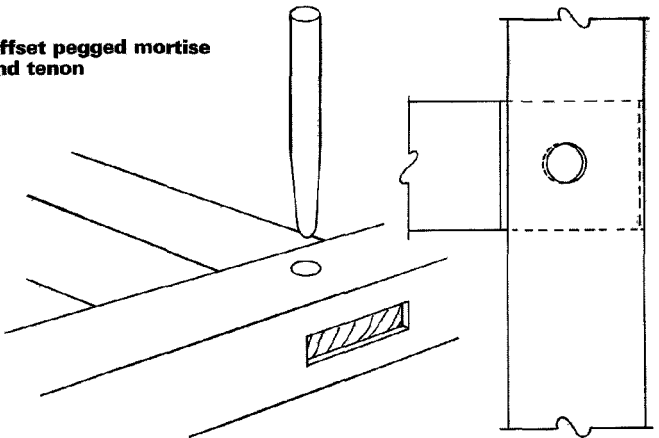
Blind wedges



Wedged through-tenon



Offset pegged mortise and tenon



Removable wedges for knockdown joinery

