Use Screws Like a Pro

Get maximum holding power in every situation

BY ROBERT J. SETTICH

Some purists will tell you there's no place for screws in woodworking. If they mean that screws can't replace a snug mortise-and-tenon or a seamless dovetail joint … OK. But the fact is, screws do the job—and do it well—in many woodworking applications. The trick is to select the right screw for the job, and to understand how to get the most holding power from it.

The basics

Most crucial to a screw's holding power is its resistance to being pulled out. The more thread surface in contact with the wood, the more resistance. So, to muscle up holding power, use a longer or thicker screw, one with a deeper thread pattern, or any combination of those properties.

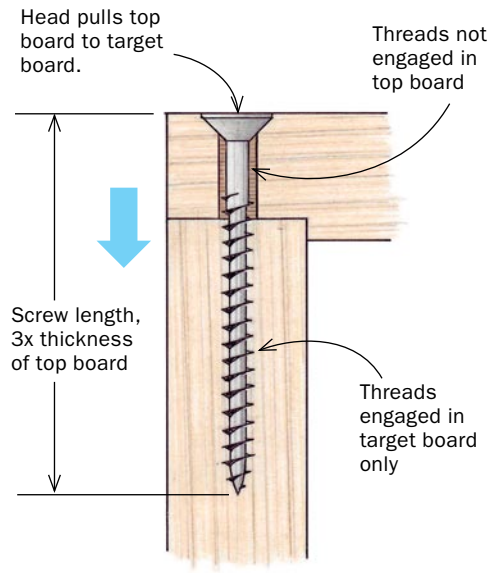
A thicker root (around which the threads are wound) also beefs up a screw's torsional strength, or resistance to twisting forces that can snap it, usually after its head hits the wood. To avoid this, choose the right screw, drill the right-size pilot hole, and don't overdrive. Set the power driver's clutch to a lower setting or make the last few turns by hand. Overdriving also spins the screw after it reaches full depth, reducing the wood fibers to a fluff and leaving the screw with no holding power.

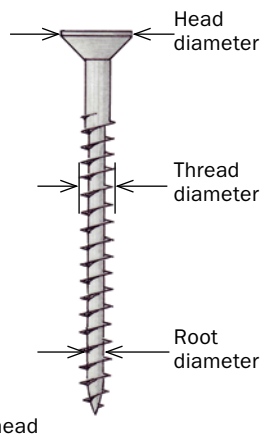
Pilot holes—In woodworking, *always* drill pilot holes. Without them, screws simply push the wood

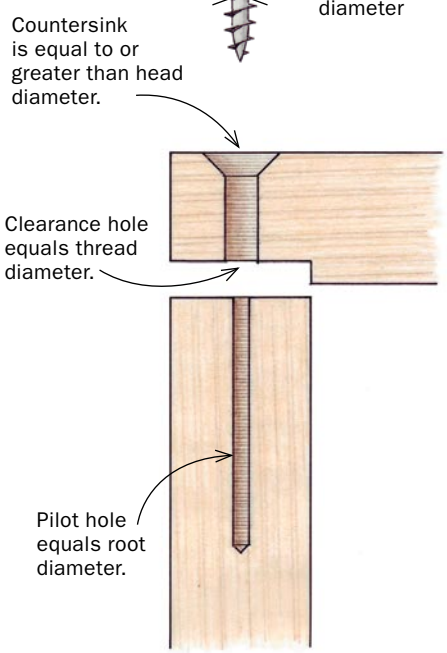
Clearing the way

ANATOMY OF A SCREW JOINT

Drill with the right bits, in the right sequence, and the screw will bring the boards tightly together.



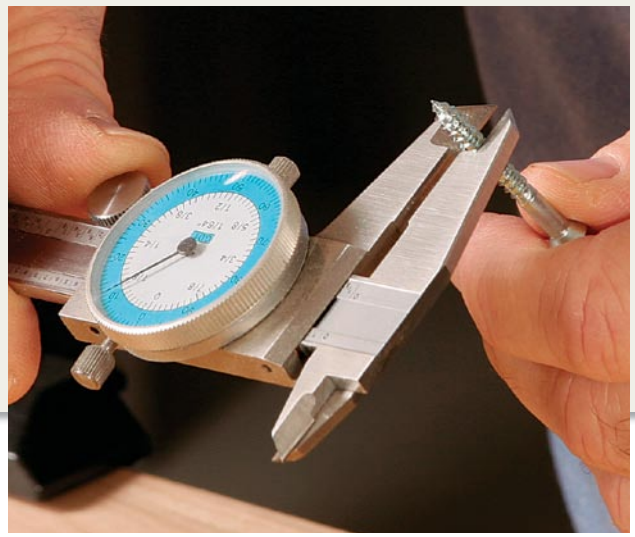




Start with the pilot hole. *With the workpieces clamped tightly together, drill the pilot hole to the depth of the screw's length. The drill bit is the same diameter as the root of the screw.*

SIZING THE PILOT AND CLEARANCE HOLES

A caliper zeroes in on the screw's root and outside-thread diameters. You'll need both measurements in order to choose the proper bits for the drilling sequence.



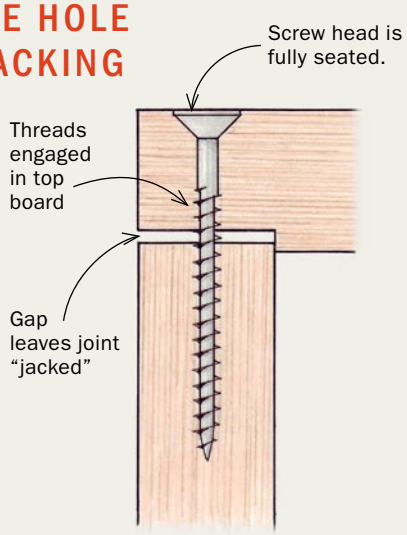
Photos: Charlie Reina; drawings: Vince Babak

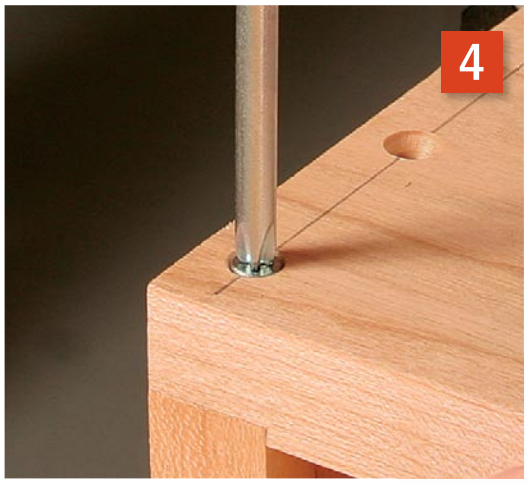
Clearance hole is next. *After switching to a bit matching the screw's outside thread diameter, drill the clearance hole through the top board only. Flagging the bit with tape keeps you from drilling too deeply.*

Then make headroom. *A countersink bit makes the tapered hole that will fit the head of the screw. This single-cutter type creates chatter-free results.*

A CLEARANCE HOLE PREVENTS JACKING

With no clearance hole, the screw threads engage the top board. If the joint is not clamped, the top board can lift and stay separated from the target board, especially if the screw raises a bump of wood as it enters the target board.





Bring it home. *Drive the screw all the way, so it seats firmly in the countersink. This draws the boards together and keeps the screw head at or below the top surface.*

fibers aside. This is OK in carpentry, but with the harder woods and often thinner pieces used in making furniture, it's a recipe for splitting. The general rule is to drill a pilot hole in the target piece that's the size of the screw's root. This is easy when using a rolled-thread screw, in which the root diameter is consistent throughout the length of the screw, tapering only at the tip. For a cut-thread screw, in which the root diameter gradually tapers toward the tip, optimal drilling requires a tapered drill bit.

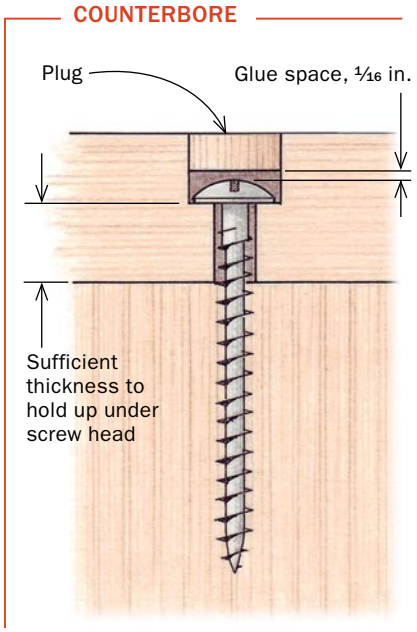
Clearance holes—Another critical element in a successful screw joint is the head of the screw. No matter how great a screw's holding power, the joint won't hold tight if the pieces being fastened are "jacked," or not drawn tightly together. That's where clearance holes come in. These are drilled through the top board (or piece to be fastened), allowing the head of the screw to pull that piece fast against the target board. To achieve this in most cases, the clearance hole should be as wide as the outer diameter of the screw's widest threads.

Dialing in a precise screw fit—Here's an easy way to confirm the pilot-hole and clearance-hole sizes for a batch of screws. This works for all screws and woods, but you need dial calipers ($16 for a 6-in. version from Grizzly; www.grizzly.com; product No. G9256)

COMBO BITS

Using an appropriate-size combo bit saves steps, letting you make the clearance hole and countersink in one drilling (left). Before or after this step, use a smaller bit to drill the pilot hole (below).

Counterboring



Use the counterbore bit first. *Drill deep enough for the plug plus 1/16 in. for glue buildup, but leave enough top board beneath the plug hole to support the screw head. Using a Forstner bit and masking tape helps ensure a straight-walled plug hole with a round, sharp rim.*

and a full set of drill bits, graduated by 64ths of an inch.

First, measure the root diameter of the screw by reaching into the space between threads. This is the diameter of the pilot hole. For very soft woods like pine, go down one bit size; for very hard woods like maple, go up a size. Next, measure the outside of the threads. This is the diameter of the clearance hole. And if you need a counterbore (see next section), use a bit that matches the screw's head diameter—or the diameter of the plug that will cover the screw head.

Countersinking and counterboring—Beginners sometimes use the terms "countersinking" and "counterboring" interchangeably, but they are distinctly different processes. Countersinking chamfers the rim of a hole so that a flathead screw seats flush to, or slightly below, the surface of the wood.

My favorite countersink bits are the single-cutter design (created by drilling a hole through the bit) because the cone point positively engages the hole and the cutter slices the wood instead of grinding it. Countersinks usually have an 82° angle to match the underside of flathead screws.

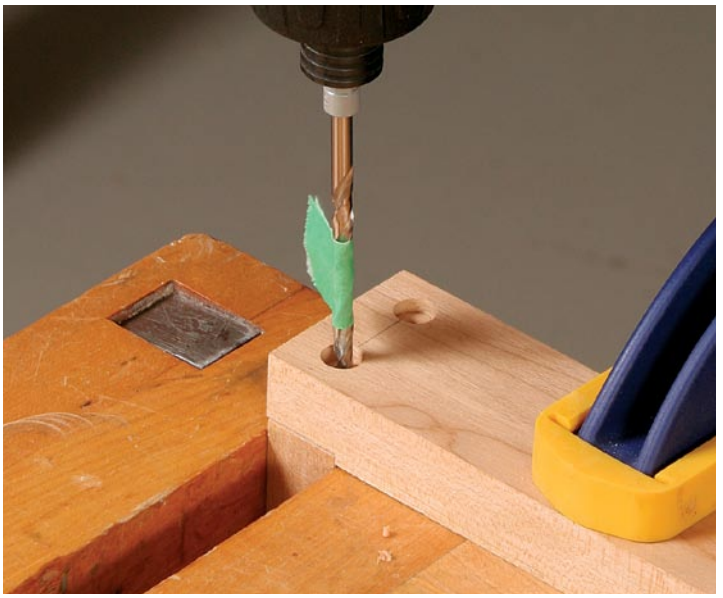
Another countersink is attached to a drill bit. For woodworking, this bit should be sized to make the clearance hole. These combination tools are often sold in sets to accommodate a wide range of screw gauges. The countersinks also match various plug sizes, so if the bit is driven deeper into the wood, the countersink also makes a counterbore for plugging.

A counterbore is a hole with parallel sides, stopped partway through the top board. Sometimes you'll make one simply to extend the reach of a screw, but it's more commonly used to create a home for a plug to conceal the screw head.

The drilling sequence—In furniture making, where accuracy is essential, the order in which you drill your holes can be critical. If you're not careful, you can get into a situation in which a subsequent bit can't pick up the center of an earlier hole.

To attach two pieces of wood with a countersunk screw, clamp the pieces together first. Next, drill the pilot hole through the top board and into the bottom board. Then, using a twist bit (which, because of its tapered tip, centers itself over the pilot hole), drill the clearance hole in the top board.

To create a plugged screw joint, clamp the boards together and drill the counterbore in the top board. Make the counterbore about 1/16 in. deeper than the penetration of the plug. Drill the pilot hole next, driving the bit through the center dimple left by the first bit. Then make the clearance hole with a twist bit.



Two twist bits are next. *Drill the narrow pilot hole through both pieces, and then use the larger bit to widen the hole in the top board for clearance (above). Bring the joint home with screws, and tap in the glued-up plugs (right).*

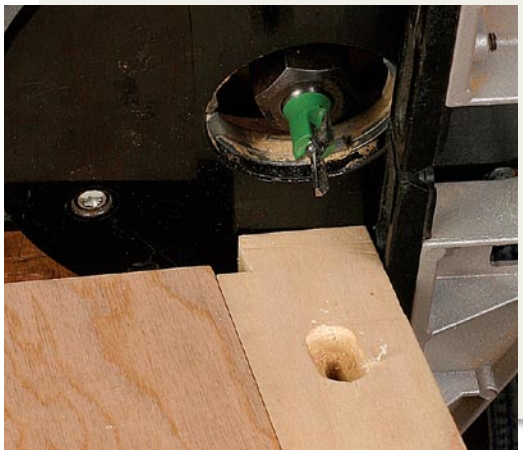
Screws in solid wood

Now the question becomes which screws—and what fastening techniques—work best in which situations. Let's begin with the most common application in making furniture: fastening solid wood to solid wood. Here are a few general rules:

Slotted holes

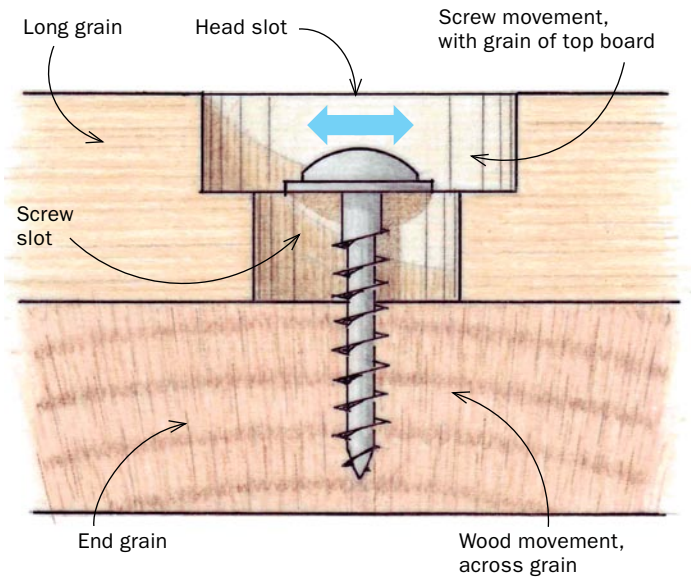
FLAT-BOTTOM BITS

The flat-bottom slot not only accommodates any screw with a flat-bottomed head, but it also allows you to add a washer, further ensuring freedom of movement over the wood surface.



Rout the slot. *With a screw-slot bit in his router, Settich plunges it into a bracket for a solid-wood cabinet top (top). The resulting slot (bottom) leaves ample room for the top to expand and contract.*

CROSS-GRAIN FASTENING



1. Drive the screw through the thinner piece of wood into the thicker one.
2. Avoid "jacked" joints by making sure the threads aren't engaging the top board, and also by clamping parts together tightly before driving screws. Otherwise, the screw entering the target board can raise a tiny eruption of wood that can permanently separate the two pieces of wood.
3. Another cure for jacked joints is to countersink the pilot hole on the bottom of the board you're fastening. This creates a clearance zone for the raised wood fibers.
4. If you must drive a screw into end grain, a cross-dowel in the target board will boost strength.

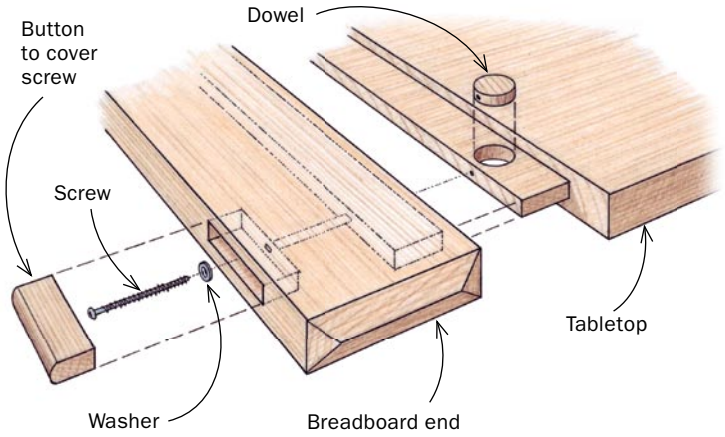
Slotted holes allow movement—Solid wood's seasonal expansion and contraction is a concern that arises most often when fastening the tops of tables or cases. One common solution is to drill slotted screw holes in the cleats used to attach them. The slots allow the top to expand and contract

TAPERED BITS

The tapered-bottom screw-slot bit matches the design of the flathead screw, as with this mounting slot for a solid-wood drawer bottom.

End grain

Use a dowel for grip. *Screwing into end grain, as when applying a breadboard end, is risky because the threads don't grip the wood fibers well. Solve this problem by inserting a dowel near (but not too close to) the edge of the target board and screwing into the dowel.*



across its grain while being held flat by the screws. Slotted holes work similarly for screws attaching solid-wood drawer bottoms.

Another common solid-wood screw application involves breadboard ends for table and casework tops. Screws in slotted holes hold the breadboard to the tongue but permit the top to freely change in width. (A screw-slot router bit is the perfect tool for most slotting applications. Lee Valley offers styles for either flathead or roundhead screws.)

Joining plywood and MDF

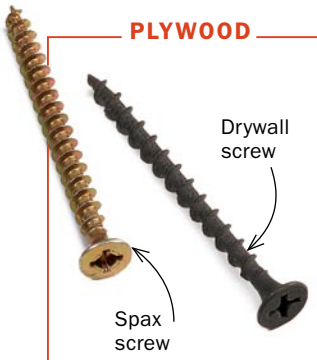
Building cabinets, jigs, and other items with sheet goods such as plywood and medium-density fiberboard (MDF) poses other fastening challenges. Though wood movement is not a major concern, these materials are especially prone to end- and edge-splitting. This can leave the screws that fasten them with very little holding power.

Plywood—You can achieve decent strength screwing into the face of a plywood panel because you're working into face-grain wood fibers. But screwing into a plywood end or edge offers no more than thin layers of edge and side grain, and it takes more thread surface to get a good bite. With conventional screw designs, this means moving to a larger gauge—for example, a #10 screw instead of a #8. But edge-driving a thicker screw also increases the risk of splitting the plywood by separating its layers. So your best bet is to use a fastener that has a deeper thread circling a slimmer shank. That includes Spax screws and Type W drywall screws.

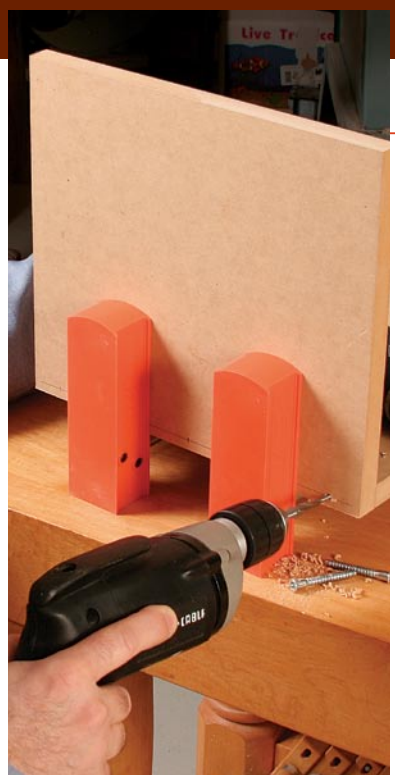
Medium-density fiberboard—Unlike plywood, MDF lacks the structural advantages of continuous wood fibers. As a result, it's

Sheet goods

PLYWOOD



Use deep, sharp threads in plywood. *Most screws won't hold well in the cross-layered fibers of plywood. The solution: Use deep-threaded fasteners such as Spax screws and Type-W drywall screws, especially when fastening into an edge such as a plywood cabinet shelf (right).*



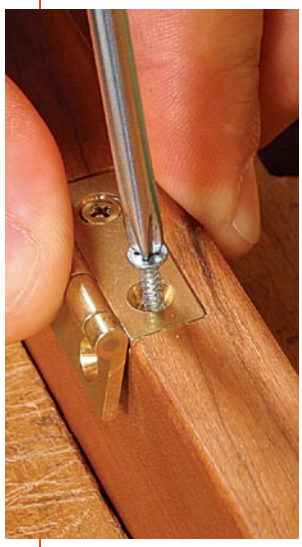
MDF

Special screws for MDF. *Getting a good grip in medium-density fiberboard requires a shallow-threaded fastener with a substantial root diameter such as the Confirmat screw. A special bit allows you to drill the matching pilot hole, clearance hole, and countersink.*

HINGE BIT

Hinges require extra precision. *Drill pilot holes with a self-centering hinge bit. It's best to have two or three different sizes of these bits, to match the most common hinge-screw sizes.*

SWITCHEROO



Steel first, brass later. *Brass screws are soft and often wind up with scratched or stripped heads when driven into hardwood. To avoid that, drive a steel screw into the pilot hole first, then replace it with its brass twin.*

even more prone to splitting and causing spinout. The best solution is to use a low thread design, as seen in the Confirmat screw.

Fastening hardware

You rarely have to deal with seasonal movement or edge-grain liabilities when fastening hardware to wood. Yet this job is not as easy as it seems. Many hardware items, such as hinges, have countersunk holes and include mounting screws. While convenient, this does not ensure that the screws will fit properly or hold well. So, begin by test-fitting each screw into its countersink to be sure that the head is flush with the surface of the leaf. If the head stands proud, and it's the only type of screw available, modify the hinge with a countersink bit, preferably chucked into a drill press.

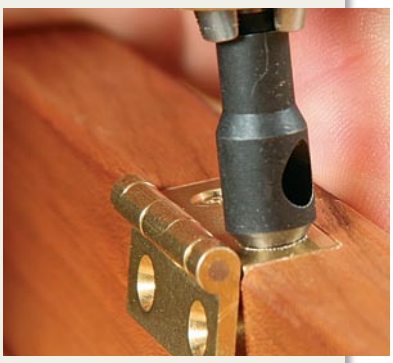
Start with the right bit. A special self-centering drill bit takes the frustration and guesswork out of drilling precisely positioned pilot holes for hardware. Many such bits (including the most common brand, the Vix bit) enable you to replace the twist drill component of the assembly to extend the life of the tool.

Then, go with the right fastener. Use the screws that come with the hinge, or substitute special hinge screws. When you drive screws, the threads typically raise a tiny curl of wood that can become trapped under the head of an ordinary screw and prevent it from fully seating. The undercut head of the hinge screw provides room for the curl, so you can drive the head flush.

If the hinges are brass, the hinge screws should be brass, too. But brass screws are soft, and their heads are easily marred by a struggling screwdriver tip. Avoid problems by first driving an identical steel screw into the pilot hole. This will cut the threads into the wood, reducing the strain on the brass. If you still meet resistance, enlarge the diameter of the pilot hole. □

AVOID WRONG-HEADEDNESS

If the tapers of a screw head and hinge hole don't match (top), the screw might seat proud and prevent the hinge from closing fully. If you don't have the right screw on hand, reshape the hinge hole with a countersink (center). With the hole re-shaped, you can re-seat the screw at its proper depth (bottom).



Robert J. Settich is a writer, photographer, and woodworker in Gladstone, Mo. He is the author of Taunton's Complete Illustrated Guide to Choosing and Installing Hardware (The Taunton Press, 2003).