Become a Better Borer

Drilling clean, accurately placed holes is essential to good woodworking. Learn to become a human drill press with our simple exercises.

PHOTO BY AL PARRISH

The trick to boring accurate holes isn't years of practice (though that always helps). Instead, you need to understand the goal of your hole, and the role each of your hands must play in the boring saga.

Modern woodworkers tend to look at making holes as merely one small step toward crafting a joint. We bore out waste to make a mortise to hold a tenon, or we drill a pilot hole for a screw. But for centuries, it was the holes themselves that were the height of high-technology joinery.

In many pieces of early Egyptian and American Indian furniture, the only joints were holes that were then lashed together with leather strips. I've seen beds, coffins and household goods such as buckets built using this system.

This skill didn't disappear with the Pharaohs. The skill – sometimes called marlinship – survived through the Victorian era. Even the Wright brothers' early airplanes were lashed together using some of these principles.

Today we lean on the drill press when we need an accurate hole, and we use an electric drill when accuracy is second to speed. And when we need a hole at an odd angle or in an odd place, we end up building complex jigs and guides that can consume hours of valuable shop time.

I worked this way for years until I took a chairmaking class. The only boring tools in the chairmaker's shop were the brace and bit. The entire time I was taking the class, I made mental notes about how I could develop a drill-press jig to make the difficult compound bores involved in building Windsor chairs. But by the end of the week, I'd abandoned my plans for jigs.

"I try not to anthropomorphize my tools. They hate that ...."

— Tom Bruce
Akbar 'n' Jeff's Tool Hut
(www.workingtools.biz)

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That's because somewhere after about 30 or so holes, I found I could bore as straight as a drill press with a brace and bit. What was the trick? Well, the practice helped – it always does – but more important was understanding the proper body position for boring and thinking through the goal at hand.

Excited, I took my new-found love of boring back home, and during the airplane ride I contemplated throwing away my cordless drill. The batteries weren't holding a charge, anyway.

That turned out to be a cockamamie idea as well. Cordless drills are a gift from the gods when speed can trump accuracy. Plus, I found that my new-found brace skills spilled over to using the cordless drill as well. In other words, I was an all-around better borer.

You can be one, as well, with just a bit of practice. The first step is to understand the tools and what they're used for. Let's begin with the brace itself.

Brace Yourself

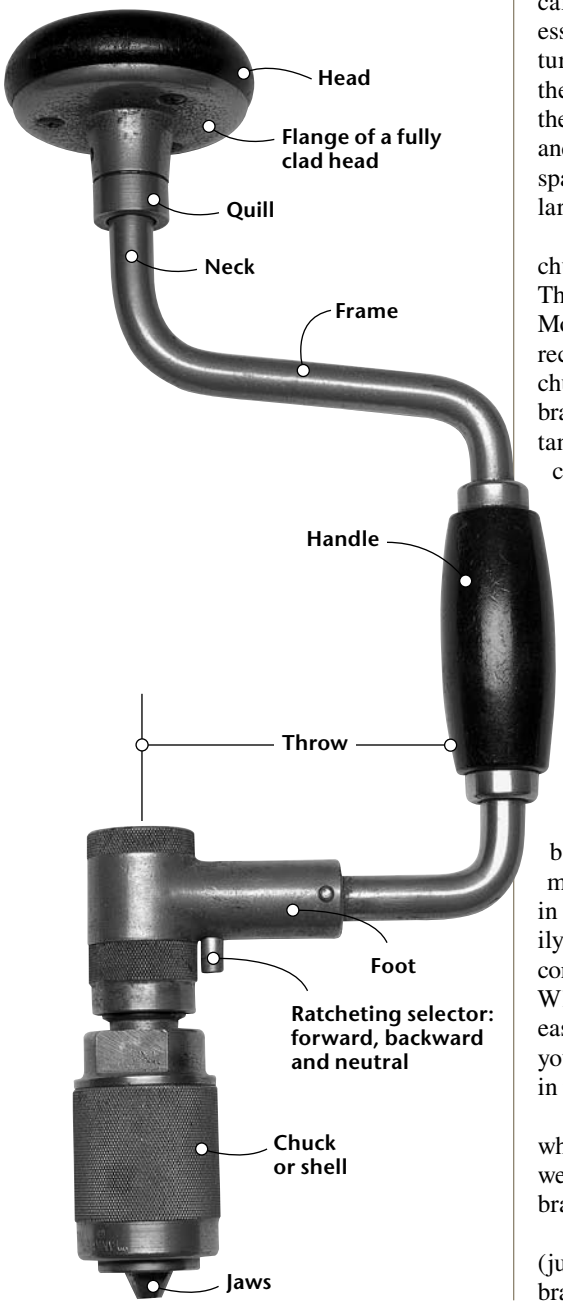
Before braces were invented, holes were bored with a bow drill, according to old paintings and drawings. What's a bow drill? Picture a drill bit held in place at the end of a long wooden handle. Then the string of a bow – much like a bow for arrows – is wrapped around the wooden handle. Each stroke of the bow rotates the bit. It's a fairly inefficient and low-torque way to make holes.

On the other hand, the brace – even in its most primitive form – is a marvel of mechanical advantage, courtesy of the 15th century. The bit is held in a chuck. One hand grasps the top of the tool. The other hand cranks a U-shaped handle. With this simple tool you can develop torque that only large-horsepower motors can achieve.

I stumbled on this revelation while drilling ¾" holes in 3"-thick yellow pine with an auger bit. The task drained a cordless drill's battery after one or two holes. So I switched to a corded drill. After two holes, that drill caught fire. But the brace with the same sharp auger breezed through the wood, and I barely broke a sweat.

Here's an anatomy lesson of a brace, and a discussion of its most important features.

■ The Head or Nave: The round knob at the top of the brace is properly called the head, though you will see other names for it, such as "pad." It is made of metal, wood or a composite material and should spin freely around. When you pick up a vintage brace, one of the first things you should check is how well the head fits. A wobbly head is an indicator that the tool is worn or poorly made. The wobble will make it difficult to bore straight.



■ The Frame: The U-shaped section of the brace is called the frame, though sometimes it's called the crank. The part where the frame joins the head is called the neck. The part where the frame joins the chuck is called the foot. The place you grasp the frame is called the handle. What's important about the frame is how much the handle is offset from the head and chuck of the tool. Braces commonly have an offset from 3" to 7" – this offset is called the throw. Tools with more throw can generate more leverage with less effort, but they require more space to work. If you take the amount of throw and double it, you've calculated the sweep of the tool. The sweep is essentially the diameter of the circle created by turning the handle one revolution. The sweep is the number that tool merchants use to describe the tool's size. The most common sweeps are 8" and 10". The 6" size is good for small bits in tight spaces; the 14" sweep is good for holes that are larger than 1" diameter in tough woods.

■ The Chuck: The part that holds the bit is the chuck, and it is the biggest variable in a brace. There are probably hundreds of different designs. Most of them work fine for holding the tapered, rectangular tang designed for braces. But some chucks also will hold standard round twist and brad-point bits, which is handy. The most important thing to look for is that the jaws of the chuck close tightly and don't flop around inside the chuck, sometimes called the shell. Floppy jaws are usually a sign that the spring inside the chuck is broken or dislocated. I'd pass on a brace with a broken chuck.

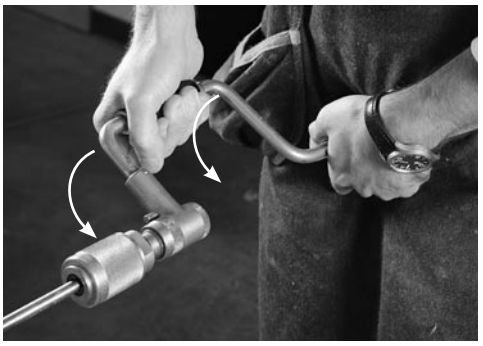
Many chucks have a ratcheting feature, which is a lot like the three-position switch on a socket set. You can set the brace to turn the bit only on the forward stroke, only on the reverse stroke or during both forward and reverse. While some woodworkers think the ratchet is as unnecessary as socks on a squirrel, I disagree. The ratchet allows you to bore easily in tight spots where you can only move the handle through part of its arc, such as in a corner. Also, the ratchet allows you to easily rotate the handle in one part of its arc that is comfortable or requires less effort. One example: When working with the brace horizontal, it's easier to push the handle to the floor (gravity is your helper), and the ratchet allows you to work in that narrow band.

The ratchet does add some weight to the tool, which some people dislike. But I don't mind the weight. Most boring at the bench is done with the brace vertical, so the weight isn't an issue.

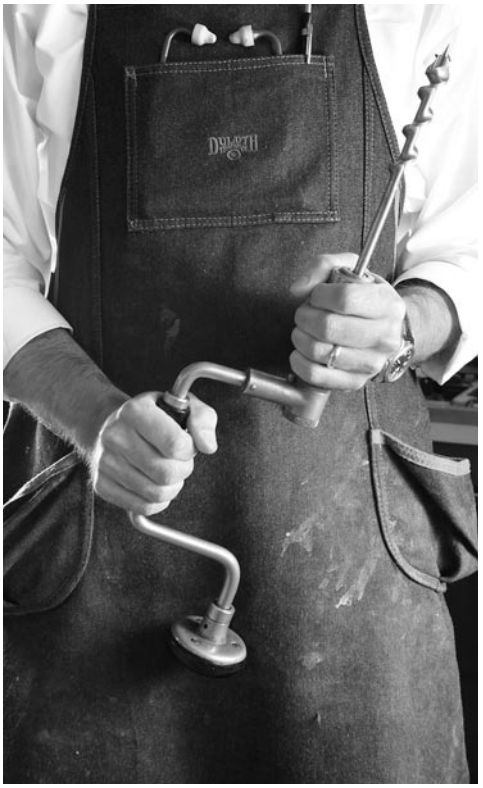
The ratchet should move smoothly and click (just like a socket set) when engaged. In vintage braces, the ratchet mechanism can get gummed up. On some tools it's easy to clean and lubricate these. On others (particularly the fine brace made by North Brothers of Philadelphia) re-assembling the ratchet requires an engineering degree and an extra hand.

Basic Brace Use

Braces aren't difficult to use. To load a bit in the chuck, here's the basic drill: With the chuck pointing up to the ceiling, grasp the chuck with one hand and hold the tool's handle with the



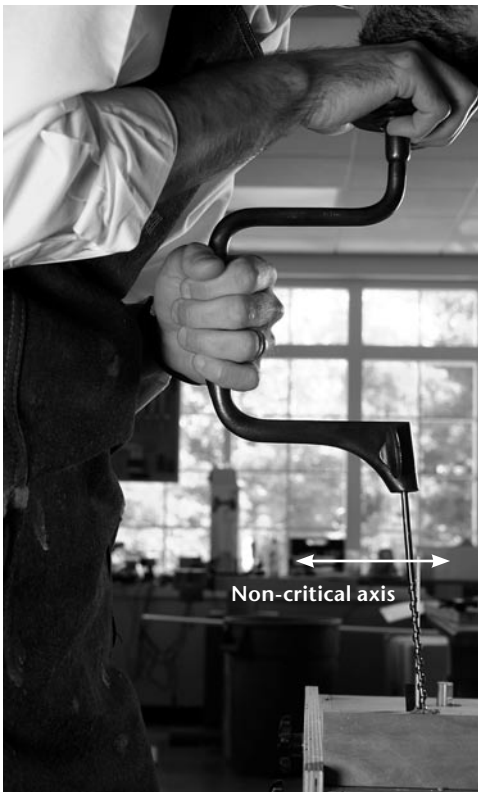
When boring large-diameter holes you can fatigue one set of muscles on the arm that is holding the handle. Instead, engage the ratchet and work only in the narrow area where gravity is working with you.



Cranking the jaws closed by using the handle is faster than simply spinning the shell with one hand. Plus, you can get the jaws tighter on the bit with less effort by adopting this technique.

Keep your body as close to the axis of the brace as possible and focus your downward pressure on the head of the tool. Note that the hand on the handle is employing a loose grip.

With many holes there is a critical axis that requires attention. If I stray left or right here, this door stile is as good as firewood.



Here's the non-critical axis. If I stray forward or back then it's no big deal. That can be corrected with the next hole.

other hand. Set the ratchet (if there is one) to the middle position so it is disengaged. This is like the neutral position on some ratchets in a socket set. Now crank the handle clockwise to open the jaws. Insert a bit between the jaws and close the jaws until they just barely hold the bit. Wiggle the bit until its rectangular shank finds its nesting place in the jaws. Now crank the handle until the jaws close tight.

To make a hole, place the tip of the bit in position. If you are boring with the tool vertical, then do your best to get your body over the tool as much as possible. I'll frequently perch my chin on the head of the brace. This increases accuracy.

If you are working horizontally, brace the head of the tool against your stomach or chest (whichever is more convenient).

Now you want to begin boring. I like to assign separate jobs to each of my hands. My dominant hand typically goes onto the head and grasps tight. That hand has only one job: Steer straight down. My off-hand goes on the handle – lightly now – and has only one job: Travel in a circle.

Mastering this basic stroke and approach to the work is the first step to getting an accurate result with a brace. The other tricks have to do with all forms of boring, whether they are powered by electrons or empanadas.

"The more a guitar is played, the better it will sound; it needs to get used to being an instrument and not a chair, so it's difficult when some musicians expect a guitar to play itself. That's why I think most good luthiers would make great shrinks: It's usually not the guitar."

— Frankie Montuoro
guitar technician for the band Wilco in "The Wilco Book" (DAR)

Learn Plumb; Learn Level

While growing up, we first learned good posture by balancing textbooks on our heads and then walking around the classroom. To learn to bore accurately, there are a couple good crutches to lean on until you get the feel for the tool. These rules apply no matter what sort of boring tool you have in your hands.

Most boring is done at 90° to the work, so you can teach yourself to bore true by sighting your work against a try square positioned on your work or your bench. You also can sight your bit against any layout lines scribed on your work, such as when you've marked out a mortise on a stile. What's critical is to figure out which axis is more important to observe, and to then position your body (and try square) to take advantage of that knowledge.

Here's a classic example: Let's say you are boring out the waste in a mortise in a door stile. The stile is sitting on your bench and you are standing at the end of the board. The critical axis for this job is left and right. If you lean left or right as you bore, the mortise will not be straight – or you might even bore through the face of your stile. The non-critical axis is forward and back. If you lean too far forward or too far back, it's no big deal. The next hole (or your chisel) can correct that error. In some cases the error doesn't even need to be corrected.

So remember this when you bore: It is easier to sense whether you are listing left or right than it is to tell if you are leaning forward or back. That should tell you where to stand and where to place your square as you are training yourself to work at 90°.

But what about when you must bore at an odd angle? That is, anything to do with a chair or a stool? You might not be able to train yourself to hit 17.5° off of 90° in your sleep, but you can train

In critical boring operations, you can use a block of wood that's cut to your desired angle and press the flutes against the block.

yourself to stay consistent once the cut has begun. Just remember that one hand steers and the other hand cranks, and you'll get the hang of it.

When boring odd angles, you can use a sliding T-bevel as a guide, which is a help. But you also can use a friend to act as a spotter. Whenever I get ready to bore something on the odd side, I'll take one of three approaches.

If it's an angle that has to be dead-on, I'll position a T-bevel along the critical axis and have a friend or co-worker spot me as I begin the hole. (Once the cut has commenced, you're committed and it's probably better not to have people watching.) If I'm alone in the shop, I'll begin the hole with the lead screw of the auger only and try to get the bit lined up against the blade of the T-bevel before I commit to burying the bit's cutting spurs into the work.

The third option involves the miter saw. Set the saw to make a cut that matches the angle you're seeking. Cut a piece of 2x4 scrap at that angle. Then clamp or screw that scrap so the flutes of the bit ride the angle as you bore. This final approach isn't as fussy as building a complex boring jig, but it does increase your accuracy dramatically. And remember, if you measure the angle from the underside of the stool or chair you can screw your guide block directly to the work because any holes from that process will be hidden.

The above guidelines aren't just for braces. They work with cordless and corded drills as well. When dealing with drills that have a pistol-grip (corded or cordless), there is an additional trick to learn. When you grip the handle of the drill, point your index finger out so it's in line with the chuck of the tool – don't use your index finger as the trigger finger. That's the job of your middle finger.

This little trick works with any tool that requires guidance (especially handsaws and jigsaws). Sticking your index finger out to point the way is a cue to your body to straighten out and head the direction of the pointer finger. This might sound like bunk. I swear it is not.

Most early tools were designed for a three-finger grip and encouraged the user to extend the index finger. Modern woodworkers who pick up these old tools usually assume that the reason the handle hurts their hand is that it was designed for people back in the day when they had smaller hands. That's just not the case. Study the old books that depict hand-tool use and you'll see immediately that extending the index finger is common. And, in fact, people weren't that much smaller in the 18th century. Not to belabor the point, but if you're interested in this myth, The Plimoth Plantation in Plymouth, Mass., has an engaging article on this topic on its web site: plimoth.org/discover/myth/.

Extend your index finger when drilling, hammering, sawing or planing. Your finger will help bring the rest of your body in line.

Watch the Spurs

Once you have the confidence to leave the try square behind as you bore (and your head has been cleared of images of our forefathers being tiny people), then try this other trick to check your work as you begin boring. When using an auger bit, the first part of the bit to bite the wood is the lead screw. It's a simple cone and can't help you

When you are boring a critical hole, begin the cut cautiously so you can see if the spurs are entering the wood at the same time, which is a good sign. With this wayward bore, there's still time to correct the angle.

Supplies

Tools for Working Wood
800-426-4613 or
toolsforworkingwood.com

- Nicholson 7" Auger Bit File
  # ST-AUG, $9.80

Brass City Records and Tools
203-574-7805 or
brasscityrecords.com

- Walt Quadrato is an excellent source of vintage braces and auger bits at fair prices.

Sydnas Sloot
sushandel@msn.com or
sydnassloot.com

- Sanford Moss's excellent web site is a wealth of information on braces. Sanford also sells a fair number of braces and other vintage boring accessories.

with anything except making sure your bit starts at the right point. Whether or not you are plumb isn't the job of the auger's lead screw. Instead you need to pay attention to the spurs – the football-shaped cutters that rim the bit and score the outside diameter of the hole. These spurs travel the entire circumference of your hole, and you can use that to your advantage.

As the lead screw begins to bury itself into the work, watch the hole and advance slowly. Watch to see if both spurs hit the wood's surface simultaneously. If the bit is angled off 90°, one spur will contact the work before the other spur – assuming your spurs are filed to the same height.

If one spur plows across the wood before the other, then stop boring, release the brace and step back to see where things are going awry. It should be fairly obvious to your naked eye. If not, get out a square to see where you are leaning. With just the lead screw engaged, it's fairly easy to make a slight adjustment and get on track. But once both spurs and the flutes of the bit are engaged, you're fairly committed to cutting that angle.

But not always. Chairmakers commonly use spoon bits to allow themselves some wiggle room before committing to a particular angle. A spoon bit looks like someone split a metal pipe along its length and ground one end to a rounded spoon shape. The rounded end allows the woodworker a fair amount of time to change angles as the cut begins. I'm personally not fond of spoon bits for a few reasons. One, they're somewhat rare. They cut slower than an auger. And the inexperienced borer is just as likely to wander off of a correct angle as wander onto the correct one.

Engage the Autopilot

There are other tricks to drilling holes with precision that don't involve a drill press. Whenever I have a hole to bore that must be located precisely or involves combining bores of different diameters, such as when drilling for a bolt and its washer, then I almost always rely on a narrow pilot hole to guide all of my bits.

A pilot hole is a good idea for a couple reasons. One, a small-diameter hole is easier to drill in a precise manner than a large-diameter hole. With small bits you can focus almost all of your effort and attention on boring true without worrying about swinging your arm wide and throwing off your angle.

Once you get a pilot hole drilled, you can use that to guide all of your other larger bits. The lead screw or brad point of your bit will always want to follow the pilot hole because it's the path of least resistance through the wood.

How big should a pilot hole be? You need to use some judgment here. Use the smallest-diameter bit possible for the thickness of the work you are drilling. Thicker woods will require bits that are bigger and longer. For ¾"-thick work, I'll usually choose a 3/32" bit and work up from there.

Once you get your pilot hole drilled, you should drill the largest-diameter holes first – usually these are the counterbored recesses for the washers, the nut or the head of a bolt or screw. For these counterbores, always pick a bit that has some sort of well-defined point, such as a Forstner, brad-point, auger or center bit. Garden-variety twist bits (designed for metalworking) don't follow a pilot as well. Their blunt tips can be difficult to start without first using a centerpunch on your work to dimple the wood.

Place the point of the bit in your pilot hole and drill your counterbores on the entry and exit points of your pilot.

With the counterbores complete, you can then drill the hole that connects them. Again, choose a bit with a well-defined point. Place the tip in the pilot hole in the middle of the counterbore and bore the through-hole. If it's a particularly deep hole, you can work from both entry and exit holes to increase the chance that your holes will line up just right in the end.

How you stop the cut is almost as important as how you begin it. When you bore through a piece of work, you can blow out the far side of the workpiece as the bit exits the work. You can prevent this blow-out by backing up the exit hole with a piece of scrap. But sometimes that's not practical, such as when boring into the middle of a board. So here's another approach.

Drive the bit into the work until the lead screw just begins to poke out the far end of the work (mark your bit with tape so you'll know when you are close to the final depth). Remember this: Stop boring as soon as you can feel the bit on the exit side. You want the exit hole to be really small. A small hole will make the next hole you make easier to bore accurately.

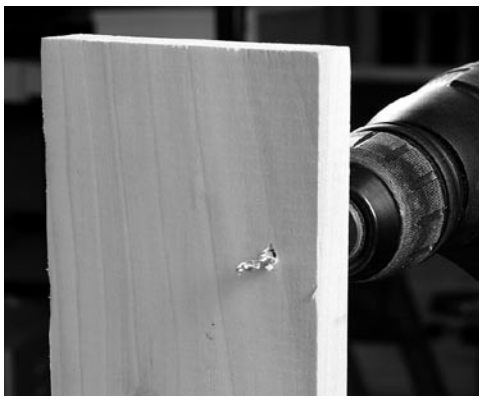
Remove the bit from your first hole then move over to the hole's exit side. Place the lead screw of the bit into the small hole on the exit side and advance the bit. It will cut a clean exit hole that's lined up with your first hole.

Clear a Path

Don't, however, confuse pilot holes with clearance holes. Their names give away their jobs in the shop. A pilot hole is designed to lead the way for something else that will then cut into the walls of the pilot hole – perhaps it's another bit, a wood screw or a cut nail.

A clearance hole, on the other hand, is supposed to clear a wide path for something to follow behind, such as a bolt or a piece of hardware. The difference is important. A clearance hole should be wide enough so the hardware doesn't cut significantly into the walls of the hole. Whereas a pilot hole should be small enough that the hardware can bite into the walls of the hole but big enough to prevent the hardware from jamming and breaking.

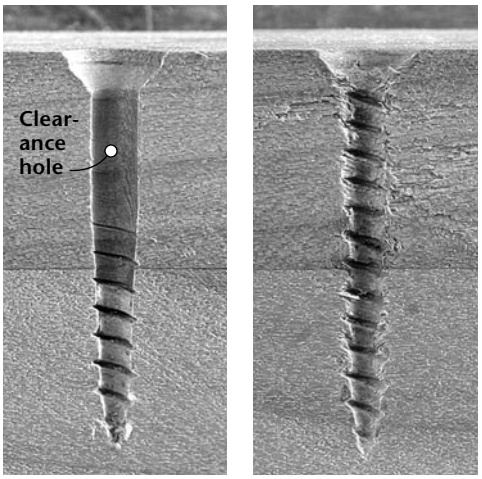
The most common (but misunderstood) application of pilot holes and clearance holes is when using a screw to fasten two pieces of wood. Let's say you are going to screw a top piece to a bottom piece. The best form of this joint is where you first drill a pilot hole through the top piece and



When you need a hole that's dead-on or stepped in size, consider making a pilot hole first to guide your future drilling efforts.

The pilot hole helps guide all subsequent boring operations. For the counterbore, place the lead screw in the pilot hole.

When the lead screw poked through the exit side of this hole I stopped turning the handle, removed the auger and began the cut on the exit side. This eliminates the grain from blowing out as the bit clears your work.



In this cutaway, you can see how the pilot, clearance hole and countersink all work together to ensure that the screw will pull the work up tight (left). And you can see an example of what bridging looks like with the screw removed.

into the bottom piece. The pilot hole should be the same diameter as the shank of the screw (the metal part minus the threads). This is sometimes called the "minor dimension" of a screw.

Then drill a larger-diameter clearance hole in the top piece only. The clearance hole should be slightly larger than the entire diameter of the screw (this is sometimes called the "major dimension" of the screw). Drill a countersink for the head of the screw if necessary then drive your screw. This arrangement of holes will allow the screw to do its job: The threads will bite into the walls of the pilot hole and pull the head of the screw down – pulling the top piece onto the bottom piece. If you don't drill a clearance hole in the top piece, the screw's threads could bite into the top piece and prevent the joint from closing. This is called bridging.

With these basic skills in hand you will be prepared to move into one of the great unexplored realms of woodworking: boring holes. Open any old tool catalog or book from the 19th century and you will be stunned by the wide variety of bits that were available to the woodworker.

And though all the different types of bits might be bewildering, they all work on the same principle. Take heart in that when Joseph Moxon penned the first English text on woodworking in 1678, he barely made mention of the brace, which he called a "piercer."

"Its Office is so well known, that I need say little to it," Moxon wrote. "Only, you must take care to keep the bitt straight to the hole you pierce, lest you deform the hole, or break the Bitt."

That's all you get in the first-ever English book on the craft. According to Moxon, the whole world of hole knowledge is widespread and shallow. But I actually think it goes a bit deeper. WM

— Christopher Schwarz

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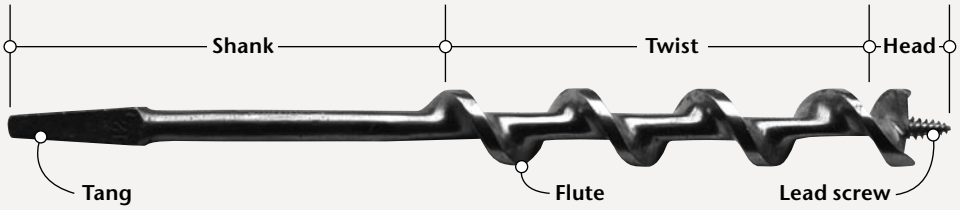
The Care and Feeding of Auger Bits



Auger bits are wondrous, efficient bits of tooling. When sharpened, they eat through wood with little effort. Sharpening them is simple. The first rule is to sharpen them as little as possible. Mimic all the angles present on the tooling and take as few strokes with an auger bit file as possible. Here are the important parts of the auger bit and how to care for them.

■ The Lead Screw: If this is clogged, the bit will not advance into the work. You don't have to sharpen the lead screw, but you do have to keep it clean. If it's gunky, I'll soak it in some mineral spirits and then clean the threads of the screw with some dental floss. If the threads get worn or broken I pitch the bit and reluctantly spend another 25 cents on a replacement at the flea market.

■ The Flutes or the Twist: These carry the shavings out of the hole. If they are rusty, the bit is more likely to clog. You can polish up the flutes with fine sandpaper if things aren't too bad. Or you can spend another quarter. Keep the flutes as shiny as possible. Wipe down the flutes with a little WD-40 or light machine oil when you are done with the bit for the day.

■ The Spurs: These football-shaped cutters score the diameter of your hole. You file them on the inside only. Filing the outside will shrink the diameter of the circle that they score and the auger will jam. Game over. Take a few strokes with an auger bit file and mimic the gentle radius of the spur.

■ The Cutting Lips: These two wedge-like parts of the bit act like levers. They wedge themselves under the waste that's defined by the spurs and force it up the flutes. File their bevels, which face up toward the flutes of the auger. Five or six strokes will do. *— CS*

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To file the cutting lip, brace the bit against a piece of scrap and rub the file against the lip. A few strokes should produce a fresh edge.

To file the spurs, clamp the auger upright and gently file the radius of the spur. Never file the outside diameter of the bit. Work the inside only.