Compound Angles Without Math

Simple set-up block dials in tablesaw settings for accurate butt and miter joints

BY STEVE BROWN

Work from a model

By beveling the edges of a wood block at the desired slope for your sides, you create a working model of the box or tray and all of its angles. Used alone, laid on its side, the block gives you the blade and miter-gauge angles for a butt joint; add a 45° triangle (above), and you have the settings for a miter.

Compound angles add visual interest to a piece. Instead of building a cradle that looks like a stiff box, you can angle the sides to give it a more subtle, inviting appearance. Angled sides are used in many types of woodwork, from simple serving trays and window boxes to the high-style bombé chest, with its flat, sloped case and drawers that are carved into a bulge on the outside.

A compound angle occurs at the intersection of two sloped sides, and there are a number of joints that can be used to connect them. The most basic and fundamental of these is the butt joint. Miter joints and dovetails are more complex options. At North Bennet Street School, where I teach, we've found an easy tablesaw method that handles all three variations required, with some handwork for dovetails.

To form a compound angle on the tablesaw, both the blade and the miter gauge must be angled for crosscutting. The problem is that you cannot get those angle settings from the standard views on drawings. When any piece features surfaces that are not perpendicular to the line of sight, there is distortion in their size and shape. Take the front side of a simple box. If each side slopes outward 10°, the front and side views will show a slightly shortened front side, and the crosscut angle at each end will be distorted. The top view is also deceiving—you are not looking straight down on the top edges of the box, so you can't read the true bevel angle of the butt joints.

Photos: Asa Christiana

There are a few traditional approaches to calculating these two angle settings. The first involves drafting a corrected view that shows the true dimensions and angles of each side of the box. The second is a mathematical solution using trigonometry. However, while working through these traditional solutions with our students, we became dissatisfied with their complexity and potential for inaccuracy. There are chances for error when drawing or making calculations and also when you turn those numbers into actual tablesaw settings. This led us to rethink the problem and eventually figure out a simpler method for determining and cutting compound angles on the tablesaw.

Set-up block is a simple solution

To carry out this method, you need to know only the slope angle for the sides. This slope is also usually the blade angle used to rip the top and bottom edges of each side. If the slope is 10°, for example, most designs call for a 10° bevel along the top and bottom edges.

The basic trick is using that same blade angle to bevel the edges of a set-up block, which then becomes a working model of the box and all of its angles (see the photos and drawing at right). That's it. The edges of the block represent the sides of the box. Simply flip the block on one edge and slide an adjacent edge against the blade to find the appropriate blade and crosscut angles for an accurate butt joint.

This approach lets you walk up to the saw with any slope in mind and quickly create tight joints.

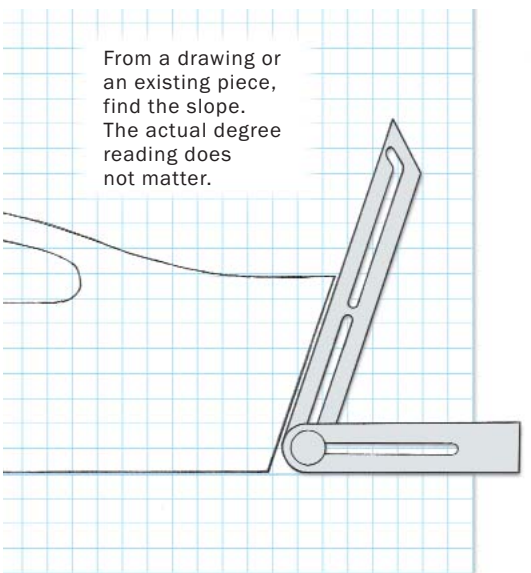
Start by ripping the box parts to width (or height, depending on your perspective) with the appropriate bevel on the top and bottom edges. Next, joint and plane a block of wood flat and square on all sides. Make the block roughly 2 in. thick by at least 3 in. wide by 10 in. long, for reasons that will become apparent later. Next, crosscut each end of the block and rip at least one side at the same blade angle you used to bevel the sides. If necessary, you can hold the box parts in place against the block to see if the slope suits your tastes. You now have your set-up block.

Cut the basic butt joint

At this point a butt joint is easy to produce. Set the blade angle first. Lay the block on one of its beveled sides and change the

PICK A SLOPE, ANY SLOPE

To make the set-up block, you need to know only the slope of the sides of the box. Set the sawblade to that angle and bevel three edges of a long block. The block becomes a working model of the box and all of its angles and can be used to set up the tablesaw to cut the joints.



Transfer that angle to the blade. *This is a good time to rip the top and bottom edges of the box sides, which usually are cut at this angle.*

Now make the set-up block. *Mill a flat, square block roughly 2 in. thick by 3 in. wide by 10 in. long. Then rip one edge (above) and crosscut the two ends at the slope angle (inset).*

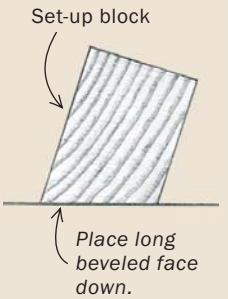
Drawings: Kelly J. Dunton

The set-up block is all you need to cut a perfect compound-angle butt joint. The block should be narrow enough to fit under the teeth of the blade when it is fully raised, with the end of the block flush against the blade's side.

COMPOUND-ANGLE BUTT JOINT

1 Use the block to set the blade and miter-gauge angles

Find both angles in one step. *Place the set-up block on its long beveled side. Pivot it forward and back while changing the blade angle until the end of the block is flush against the blade.*



Hold the block in place and bring up the miter gauge. *When the gauge is flush to the block, lock in the angle setting.*

blade angle until it is flush with the angled end of the block (the block should be narrow enough to fit against the side of the blade without hitting the teeth). Next, keeping the block on its side, hold it against the miter-gauge fence. Adjust the miter-gauge angle until the end of the block mates perfectly with the flat face of the blade. The saw is now set up to cut the correct compound angle on all of the sides.

Tablesaws tilt only one way, so one end of each side will be crosscut on the left side of the blade, with the miter gauge riding in the left miter slot. The other end will be cut on the other side of the blade, with the board flipped edge for edge onto its other face. To help keep track of the cuts, lay out each one and label the inside and outside faces of each part before starting.

This simple approach usually yields a perfectly fitting joint on the first try; however, just to be safe, I recommend cutting a sample joint first. Then set the parts against the set-up block to check the joint. If any adjustments to the miter fence or blade angle are necessary, take another slice off the sample sides and check the joint again. Remember to save all of your offcuts; you'll be able to use them as clamping blocks later during glue-up.

2 Cut both ends of the board

Switch miter slots, not settings. *There's no need to change the blade angle when cutting opposite ends of a box side; just flip the board edge for edge and move the miter gauge to the other side of the blade. Label the inside and outside faces of each part and lay out all of the cuts to keep track of them. Also, use a stop block to index the second cut on each side.*

Miters aren't much harder

To cut miters, the crosscut angle stays the same; only the blade angle has to change. To find that new angle, you will need a 45° triangle. When you have the set-up block on its side and the miter fence properly angled, lay the triangle against the top face of the set-up block. Now crank the blade angle over until it mates with the edge of the triangle (see the left photo on the facing page).

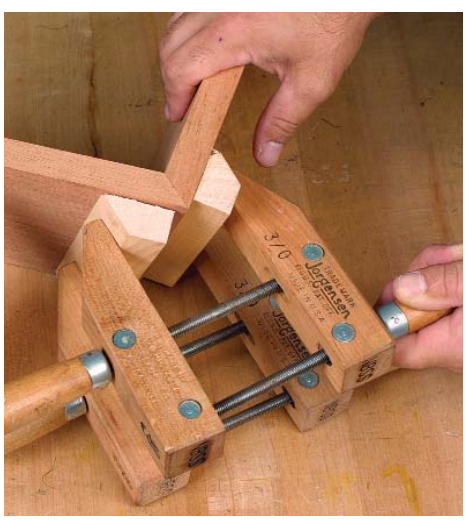
What is happening here is complex mathematically but much simpler visually. If you look at the top view of the box with butt joints, the sides will appear to meet at a 90° angle. Although you know that the

COMPOUND-ANGLE MITER JOINT

To turn the butt joint into a miter joint, simply add a 45° triangle to the front face of the set-up block and reset the blade angle. The miter-gauge angle stays at the butt-joint setting.

Place the triangle flat against the front face of the set-up block. *Angle the blade to meet the edge of the triangle.*

Again, lay out and label the sides to keep track of the cuts. *Workpiece creep is especially a problem with these sharply angled cuts, so clamp on a stop block, or a stop stick.*



Miter-joint clamping strategy. *Rip some scrap stock at the current blade angle and glue these blocks onto the workpieces. Use these clamping cauls to draw the joint tightly together. The blocks can be pared away later.*

ends of the boards were not crosscut with the blade at 90°, from that angle (looking straight down on the sloped sides), the joint is square. That's why you can lay a square across the beveled top edge of the set-up block or the box itself and find a 90° angle between the sides. Likewise, a miter on this compound-angle joint will actually be 45° when viewed from the top. By placing the triangle flat across the top side of the set-up block, you are using this phenomenon to find the right blade angle for a perfect miter. The blade will not actually be 45° from the table, of course, because the triangle itself is being held at an angle.

If all of this doesn't make perfect sense to you, don't worry; the procedure will work anyway.

To learn how to lay out compound-angle dovetails, see Master Class on p. 96.

With this technique you'll never have to fear compound angles. You can cut a butt or miter joint at any angle. You can even set adjacent sides of a box at different angles and still determine the tablesaw settings for perfect joints. Also, with the butt joint in your repertoire, dovetails are just a layout procedure away. □

Steve Brown is the head of the cabinet- and furniture-making program at North Bennet Street School in Boston.