

Machining Stock to Dimension

Start right to finish right

by Roger Holmes

The process of accurately dimensioning lumber lacks the romance of cutting beautiful joints, but is fundamental to quality woodworking. If you want precise joinery, easy assembly and a good finish, you must begin every job by making your cupped, twisted and bowed boards flat, straight and square—the accuracy of all future operations depends on straight, square stock. Before the advent of stationary power tools like the jointer, planer and tablesaw, woodworkers prepared their stock by hand. Today it's possible to sidestep all that handwork and rely on the speed and, to some extent, the built-in accuracy of power tools.

You can check for cup and bow by sight or straightedge, looking across the width for cup and along the length for bow. When placed on a flat surface, a twisted board will rock on the low corners. Sighting over winding sticks (identically dimensioned lengths of wood) placed across both ends of the board will also indicate twist.

Before doing any flattening or thicknessing, it pays to lay out and cut pieces to the rough width and length your project requires. Smaller pieces are easier to handle and less wasteful. A badly bowed 12-ft. board, for example, may make three relatively straight 4-ft. pieces, and the same logic applies for reducing width, as shown in figure 2 on the facing page. You can start with thinner rough stock because you'll need to remove less wood to flatten it. Of course, if you need four 2-in.-wide pieces, it may make more sense to dimension, then rip a 9-in.-wide board, and so on. If you'd rather not lay out the pieces before finding what's hidden beneath the rough surface, skim both faces in the planer before you cut it up.

Regardless of the size of the pieces, you must start by flattening one face of each on the jointer. Resist the temptation to skip this step and go right to the planer. A planer can't remove twist, bow or cup because the machine's rollers will flatten the board before it reaches the cutterhead. The board will lose its rough-sawn exterior, but the defect will spring back as the board leaves the planer.

A jointer is basically an upside-down, motor-driven handplane. It has two adjustable tables flanking a cutterhead. Each table should be perfectly flat, and, across its width, parallel to the cutterhead. The outfeed table is set at the same height as the highest point in the arc of the cutterhead. This alignment is critical—if the table is high, the board will taper end-to-end; if it is low, the end of the board will be gouged by the cutterhead as it leaves the infeed table. Moving the infeed table up or down sets the depth of cut. When flattening wide boards, I usually align the jointer's fence with the end of the cutterhead, allowing

maximum width of cut. For narrower boards, you can set the fence to use the sharpest part of the cutterhead. Rub paraffin or pastewax on the tables so the board will slide easily—the less force required to push a board across the cutterhead, the better. Before running a board over the jointer, remember that the most finely-wrought machines you'll ever see are attached to your wrists. Be careful.

If the board is badly cupped or bowed, I flatten the concave face, which is more stable on the tables than the convex face. It often doesn't matter which face of a twisted board is flattened first, but if the board is also cupped or bowed, plane the concave face first. Once you've picked a face, check the edge of the board to determine grain runout, as shown in figure 3, to avoid tear out. Set the infeed table for a shallow first cut, about $\frac{1}{32}$ in., then feed the board into the jointer so the grain is rising into the cutterhead. If there is much tear out on the first pass, turn the board end-for-end. If the grain changes direction along the board, taking light cuts or angling the board across the cutterhead to produce a shearing cut will help.

Once you've determined the grain direction, increase the depth of cut, if necessary (I find $\frac{1}{16}$ in. is usually plenty), and continue. Place your left hand near the front end of the board, and make sure that all four fingers and your thumb are touching the top face, not hanging over the end or edge. Sometimes I put my right hand on top of the board to push; on longer boards I grasp over an edge to begin the cut, then move my hand on top of the board or to a push stick.

As the face passes over the cutterhead, push it down on the outfeed table with your left hand. The contact of the newly planed face with the outfeed table ensures that the remainder of the face will lie in the same flat plane. Keep pressure on the board over the outfeed, not the infeed table. When 6 in. to 1 ft. of the board has moved across the cutterhead, I often move both hands over the outfeed table to feed the remainder of the board through. If you need more horizontal force, or if the board is short, push the end through with a push stick, not the end of your fingers. Be especially careful with thin or narrow pieces.

Work all the stock for a particular job in one batch—face it all at once, thickness it at once, and so on. Stack the boards by grain direction as they come off the jointer. An arrow on the flattened face helps for future reference. Keep the piles straight for all remaining operations and you'll save time and avoid frustration and torn grain.

When flattening cupped or bowed boards, try not to push down too hard as the board goes over the cutterhead—the board will spring back, thinner, but still bowed. For long, badly bowed

Fig. 1: Board defects

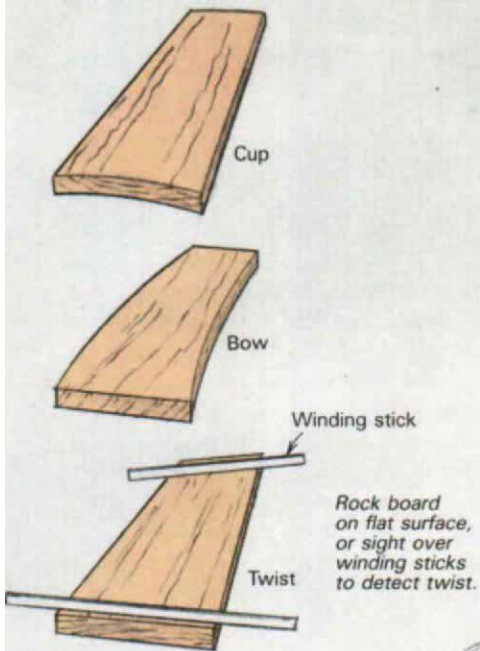


Fig. 2: Efficient material use

To use material more effectively, lay out and cut pieces roughly to size before flattening and thickening.

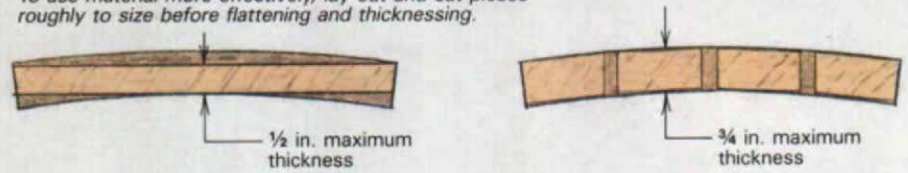


Fig. 3: Jointer

Feed rising grain into cutterhead to avoid tear out.

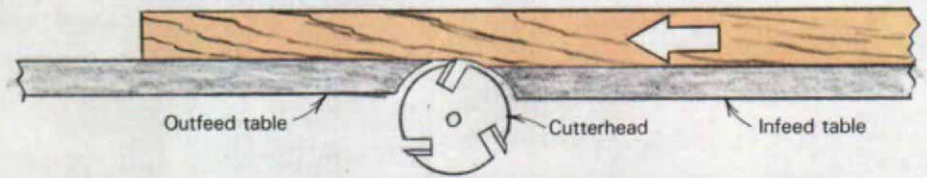
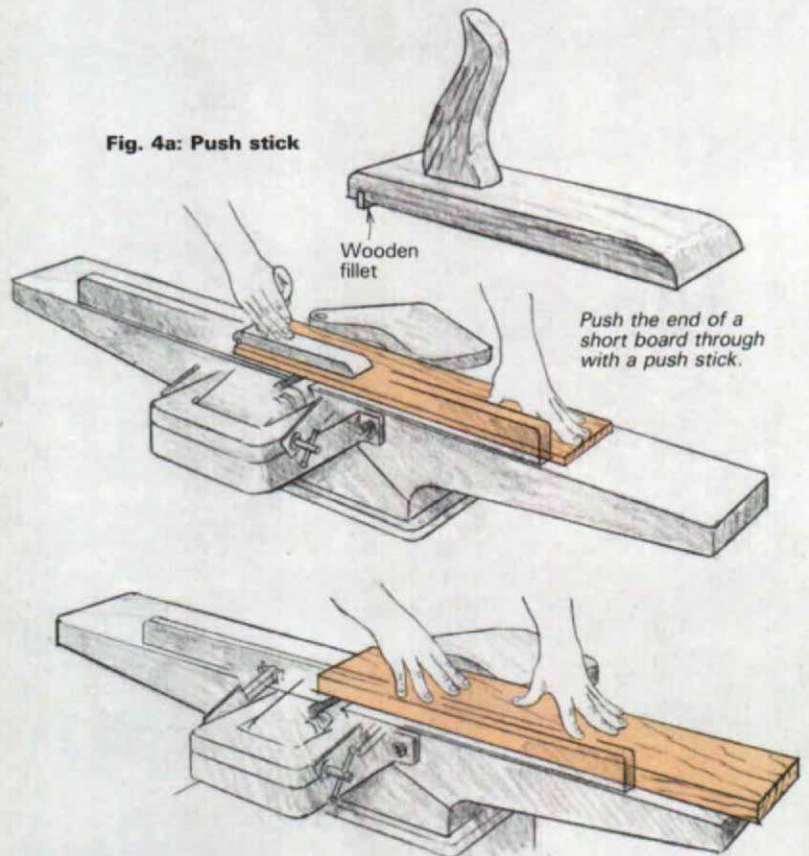


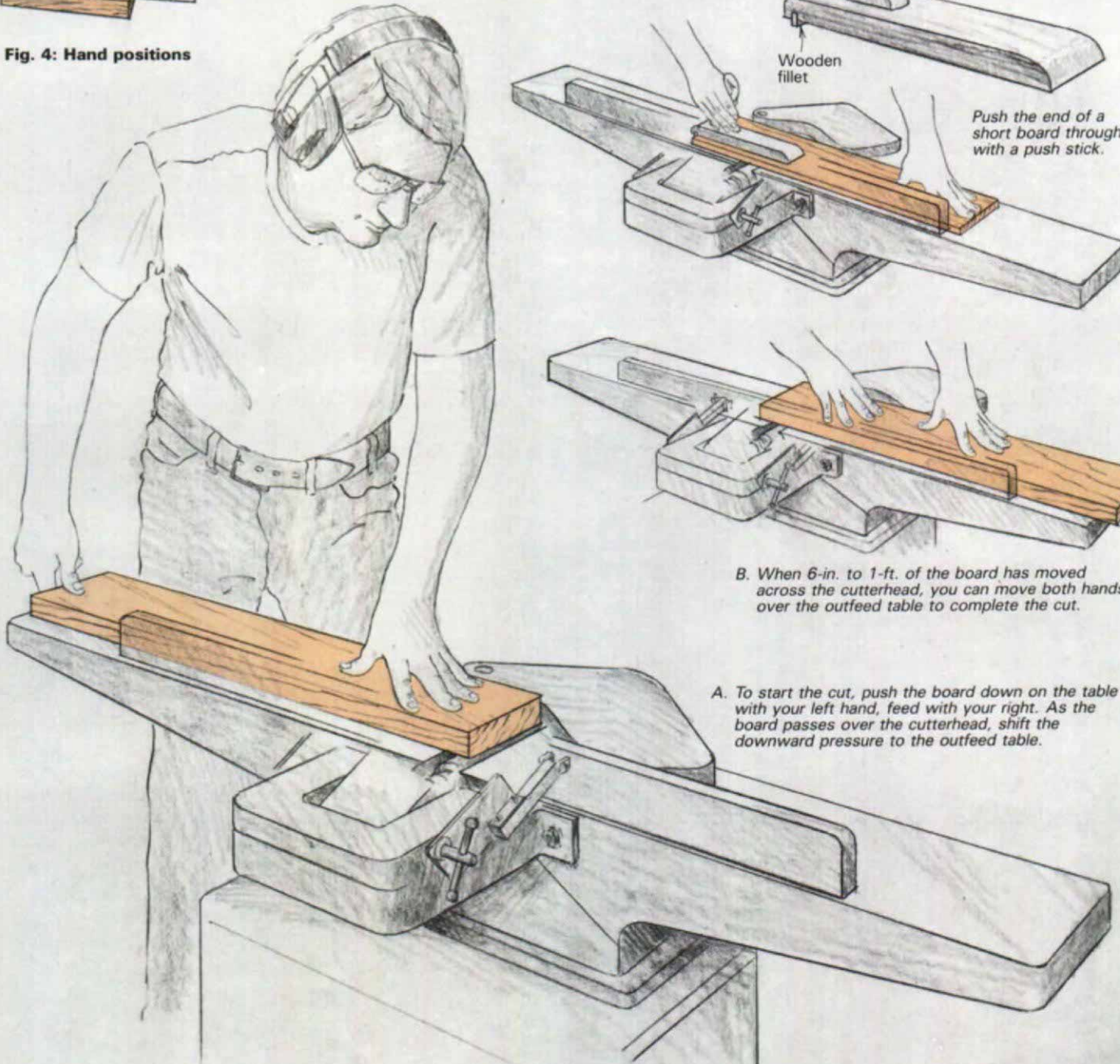
Fig. 4a: Push stick

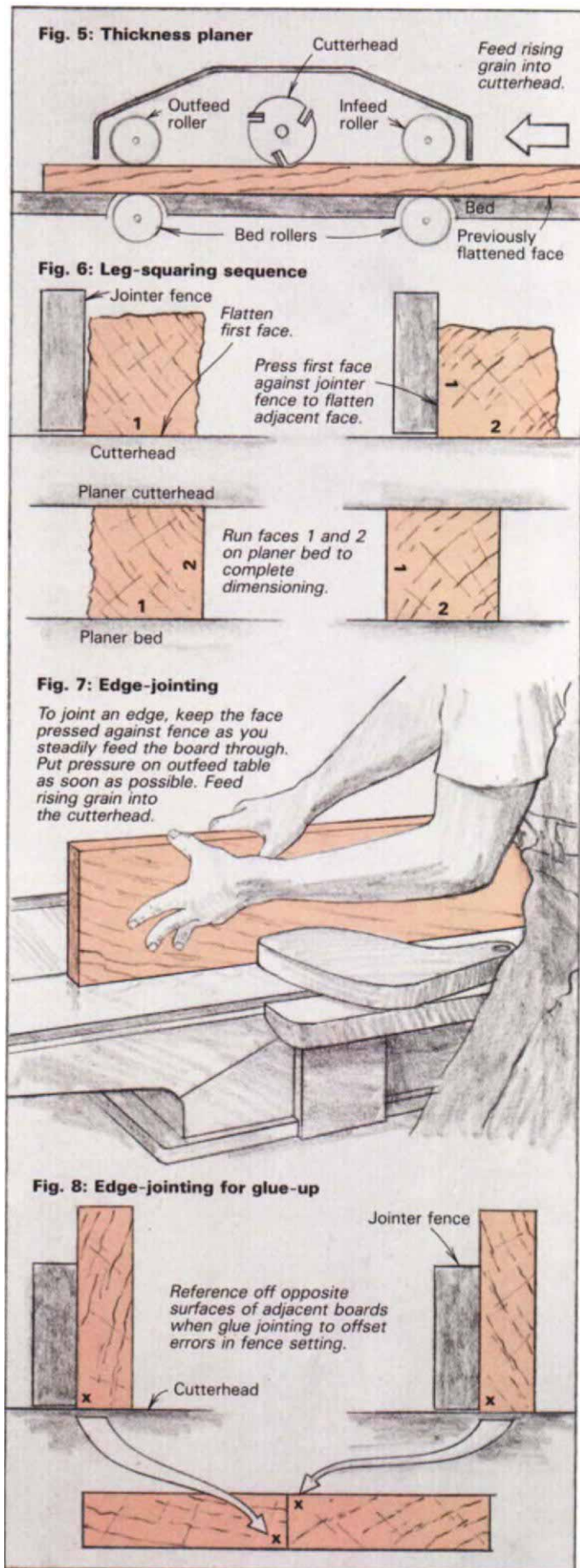


B. When 6-in. to 1-ft. of the board has moved across the cutterhead, you can move both hands over the outfeed table to complete the cut.

A. To start the cut, push the board down on the table with your left hand, feed with your right. As the board passes over the cutterhead, shift the downward pressure to the outfeed table.

Fig. 4: Hand positions





boards, lower the middle of the board over the cutterhead and joint the trailing end, then reverse the board and repeat the process. Continue until the board looks straight, then make a pass from end-to-end.

Flattening a twisted board is a little trickier, and you can waste a lot of wood if you're not careful. You can see why by first balancing the board on its two diagonally opposed high corners, so that the corners are an equal distance above the surface. This distance indicates the amount of wood that must be removed to eliminate the high spots and flatten the face. Now, push down on one end of the board so the board is resting on three corners, and note how the gap increases at the fourth corner. This difference in height indicates how much more wood must be removed to flatten a board pushed over the machine balanced on three corners. The trick, then, is to balance the twisted face on two corners as it is fed into the cutterhead until there is enough flattened surface to support the piece. Don't rock the board as you push it through; this will just create another twist. When the board looks flat, make a single pass over the whole face.

Dimensioning table legs can cause headaches—it's maddening to end up with a rhombus instead of a square section. The solution is simple. Rip the legs roughly to size, flatten one face, then press that face firmly against the jointer fence and joint a second, adjacent face square to the first. Check to make sure the faces are at 90°; adjust the fence if necessary. Move to the planer to finish, alternating the two flattened faces on the bed.

Flattening a board wider than your jointer is always a problem. The safest solution is to rip the boards as wide as the jointer will take, flatten and thickness them, then reglue to make the wide, flat pieces needed. If you're loathe to rip that beautiful width of walnut, a less reliable and more risky method is to run first one half of the face, then the other over the jointer. Set the machine for a light cut and don't worry if the surfaces don't match each other exactly. If you can flatten the face, you can clean it up on the planer.

Pushing a board over a jointer always removes wood; whether it's the right wood depends on you. Pay attention to defects in each board as you try to remove them, and make a mental note when something goes right or wrong.

The planer excels at two jobs the jointer is not intended to do. It can create a flat surface that is parallel to an already existing flat surface, and it can uniformly reduce the thickness of stock. The planer is also one of the few woodworking machines that requires very little skill to operate, beyond organizing the boards so the machine cuts with the grain.

Most planers consist of a cutterhead and one or more powered rollers suspended over, and parallel to, a machined table (called the bed), which can be moved up or down to set depth of cut and thickness of board. Lay the flattened face down on the table, engage the end of the board with the powered roller and the machine does the rest. Remember, a planer won't flatten a bowed or twisted board, it will just make it thinner. (If a board is thick enough to resist the roller pressure, a planer may slice off the high spots of a cupped board enough to flatten it.)

I always run the thickest boards first, planing the whole batch at one setting before changing it. Add thinner boards into the batch as you raise the bed. Run the entire batch through at the same setting on the final pass to ensure uniform thickness. Take light cuts, not more than $\frac{1}{16}$ to $\frac{1}{8}$ in. If you must remove a lot of wood, alternating the faces after the second face has been flattened will reduce the possibility of warping.

Saw it straight

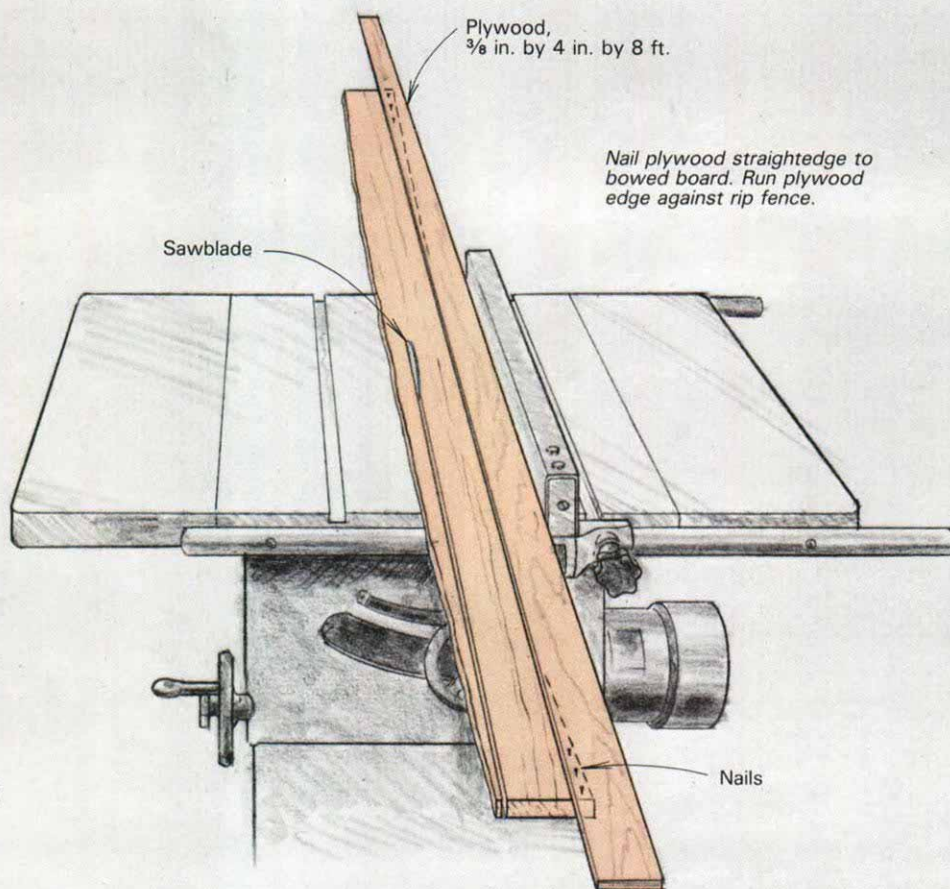
by Larry Montgomery

As an apprentice boatbuilder, I was taught a method of straightening long, bowed edges that is much more efficient than repeatedly jockeying 12-ft. boards over a jointer.

The method is simple, as the drawing shows. Tack a perfectly straight piece of $\frac{3}{8}$ -in. plywood about 8 ft. long and 4 in. wide along the concave edge, leaving the nail heads about $\frac{1}{4}$ in. proud, for easy removal. Run the package through the tablesaw with the plywood guide against the fence. Pull the nails, flip the board, set the fence, and run the newly trued edge against it for a second edge parallel to the first. For longer boards, splice two pieces of $\frac{3}{8}$ -in. by 4-in. by 8-ft. plywood, end-to-end, with an overlapping backing piece.

If you don't have a tablesaw, or don't want to nail into FAS walnut, you can clamp a length of $\frac{1}{4}$ -in. by 2-in. by 2-in. aluminum angle (available from building supply houses) to the board for a guide, and rip along it with a circular saw and a combination or rip blade. If all else fails, snap a line and bandsaw the edge. □

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For thin stock, say $\frac{1}{4}$ in. or less, lower the bed rollers flush with the bed, or place an auxiliary bed of plastic-laminate-covered plywood or chipboard on top of the planer bed, to prevent the knives and rollers from distorting the piece. I find using an auxiliary bed as long as the pieces being planed works even better. The bed travels through the planer with the thin piece and cuts down on chatter. Wear good ear protectors, and don't ever attempt to reach or look into a planer while it is on.

Edge jointing involves straightening and squaring the edges of the board to its now-parallel faces. Use an accurate try square to check that the first board's edge is square to its face and adjust the fence as necessary. I push the board firmly against the fence with my left hand and push it along with my right. Keep the fingertips of your left hand in contact with the board and at least a couple of inches above the table and behind the cutterhead when starting out, and keep it on that same spot on the board as it passes over the cutterhead onto the outfeed table. When your left hand is over the outfeed table, a few inches beyond the cutterhead, leave it in that position and slide the board between it and the fence. As soon as possible, the downward pressure should be on the outfeed, not the infeed, table. When you need to reposition your right hand on the top edge, keep the board moving by pushing with your left. The whole operation should be smooth, the two hands working in unison so the edge doesn't

stall over the cutterhead. Don't do all the work with your arms, but shift your weight as the board goes over the cutterhead. A slower feed produces a smoother edge.

If necessary, make a couple of passes to straighten the edge, taking off $\frac{1}{16}$ in. or so, then a final, slow, shallow pass for a smooth edge. If possible, feed the board in the direction of the rising grain. If you must go against the grain, feed very slowly and take a shallow cut. If the faces are flat, the machine will more-or-less automatically correct all defects in the edge, except bowing along the length. Bowing can be remedied by flattening increasingly larger sections on the ends of a concave edge or the center of a convex edge. Lower a concave edge over the cutterhead, as described for face flattening. If you've cut the pieces roughly to width, joint one edge, then rip the other to exact width. For glue-joint edges, reverse adjacent boards, as shown in figure 8 on the facing page, to compensate for slight inaccuracy in the fence setting.

Those are the basics of dimensioning stock. I tend to treat precise cutting to length as part of the joinery or assembly, because it makes more sense to me to lay out the finished length of a piece at the same time I'm laying out the location of a through-mortise or some dovetails. The shop is quiet, I get myself in a meticulous mood, sharpen my pencil and get to work. □

Roger Holmes is an associate editor of Fine Woodworking.