

# An Easy-to-Build Workbench

*Bolted butt joints for rigid construction*

by Richard Starr

## Knockdown workbench

### Joinery detail

Countersunk hole,  
1 in. dia. by ½ in. deep,  
for bolt head and washer

Optional alignment dowel, ½ in.

Cross hole bored with  
1¼-in. bit, with squared  
side chiseled out

Bolt ends at center  
of cross hole when  
joint is assembled.

Hole is ⅝ in. oversized for ¾-in. bolts.

Hex-head bolts,  
¾ in. dia. by 6½ in. long,  
secure legs to stretchers.

Relief area is cut out  
on stretcher ends.

Legs, 3 x 3 x 32

End stretchers are 1½ x 5½ x 22.  
Edge is flush with top of leg.

Boards, ¾ in. thick, are  
screwed to battens to  
form removable shelf.

Battens,  
1 in. thick by  
1 in. wide

Side stretchers are  
1½ x 5½ x 52.  
Bottom edge is  
6 in. from floor.

As a school woodshop teacher, I must often solve problems on the spur of the moment. That's how the design for my easy-to-build workbench came to me. A couple of kids wanted to build a bench as a gift for a neighboring preschool. The bench had to be quick and easy to construct, yet professional looking and, above all, absolutely rigid. When all the elements for a simple, bolt-together frame came together in my mind, I hit my palm to my brow. It seemed so obvious. I wondered why I hadn't thought of it before.

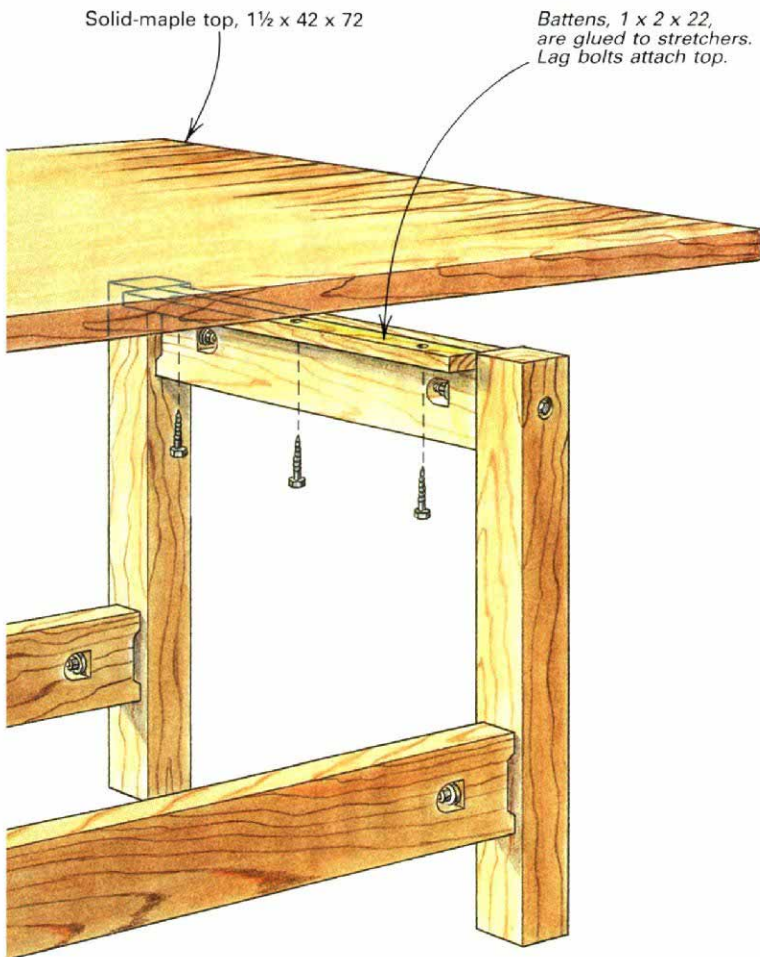
## Designing the workbench

The workbench mainly consists of four legs and four stretchers held together with eight identical joints. The joints are easy to cut yet forgiving because they are fastened with common hex-head bolts available at any hardware store. The joint, equally effective in hardwood or cheap construction-grade lumber, is also perfect for many types of knockdown furniture. It's even solid enough for permanent installations, such as a built-in work counter.

The first step in building the frame is to decide the dimensions

of the top. This decision should be based on the bench's intended use (a carving bench should have a narrower top than a cabinet-maker's assembly bench) and on the shop space you have available. The bench I built has a 42-in.-wide by 72-in.-long top, good for general woodworking tasks. From these dimensions, I calculated the size of the frame and the length of the stretchers. You can determine the length of each pair of stretchers by subtracting twice the thickness of a leg plus the amount the top will overhang at each end from the length and width of the benchtop. When deciding on the amount of overhang, keep in mind that it's a good idea to leave plenty of room on all sides, for mounting vises and for clamping things to the top. For example, I chose a 7-in. overhang and used 3-in.-thick by 3-in.-wide legs, so my end stretchers were 22 in. long and the side stretchers were 52 in. long. I made my stretchers from 2x6 stock.

I used soft maple for my bench's legs, but you can use glued-up hardwood or construction-grade 4x4s. Cut the legs to a length that equals the height of the bench less the thickness of the top. I find that bench height is largely a matter of personal taste. I'm a six-



footer, and I like a 34-in.-high bench whenever I'm sawing or planing wood; for small assembly work, though, I'd want the benchtop an inch or two higher. The workbenches in my school shop are 30 in. high, which is right for most adolescents, although younger woodworkers might do best with a 26-in.-high bench.

### Making the stretcher joints

The function of a stretcher is to prevent the frame from racking and the bench from rocking, so it's imperative that each stretcher connection be rock solid. A joint held together with a single bolt focuses pressure at the center of the joint, which doesn't adequately prevent the joint from racking. Two bolts are better because they pull the stretcher against the leg closer to the edges, thus keeping the joint square. But you need to buy twice as much hardware, plus it takes twice as long to knock down or assemble the bench. After trying several variations of the bolted stretcher joint, I finally came up with the version shown in the drawing. A single bolt is used for each joint, and an arched relief area is cut out on each end of the stretcher. As the joint is tightened, pressure is focused at the outer edges (like a two-bolt joint), effectively locking the stretcher square to the leg and preventing racking.

To begin making the joints, crosscut the stretchers square and to length, and drill cross holes to provide the space for the nut and washers that are fitted to the end of each bolt. The center of each cross hole is located where the bolt end will be when the joint is assembled. For my bench, I used 3-in.-sq. legs and 6½-in.-long bolts with the heads countersunk ½ in. deep. This places the center of my cross holes at 3½ in. from the end of each stretcher. You should avoid locating the cross holes any closer to the stretcher

ends than that or you risk the force of the bolt splitting out the endgrain and ruining the stretcher.

Bore out the cross holes with a 1¼-in.-dia. bit, which will leave a hole large enough to allow a box wrench to fit around the nut during assembly. Next, the portion of the hole facing the end of the stretcher is squared up for the nut. I used a try square to mark out the pocket, as shown in the drawing. Then I chopped out the waste with a chisel. If you like, you can whittle or sand the edges of the opening to give them an attractive chamfer.

To locate the bolt holes in the ends of the stretchers, I made a thin-plywood (you could use cardboard) template cut to the same dimensions as the cross section of a stretcher, in this case about 1½ in. by 5½ in. The template is used to mark the center for each ¾-in.-dia. bolt hole, and then these holes are drilled through until they intersect with the cross holes. A spade bit in a portable electric drill works fine in endgrain, although I prefer to use a modified auger bit in a hand brace. To modify the bit, I just filed the spurs off, and it chewed right through endgrain. I tried to drill accurately by checking that the bit was parallel to the face and edge of the stretcher, and stopping and rechecking frequently. Because the hole is much larger than the bolt, dead accuracy isn't necessary; as I've said, this joint is very forgiving.

If you plan to disassemble and assemble the bench often, you might want to add an alignment dowel on the end of each stretcher. This short, ½-in.-dia. dowel keeps the stretcher aligned during assembly and mates to a slightly oversized hole in the leg.

Next, mark and cut out the relief area on each stretcher end, leaving two 1-in.-long contact areas. A ¼-in.-deep relief is all you need, but if you'd like to add a decorative touch, you can cut a fancy shape; just avoid cutting too near the cross hole or you'll risk splitting the joint when you tighten the bolt. I cut out the relief area on a bandsaw, but you could use a sabersaw or chop out the waste by hand with a chisel.

Use the same template described above to mark the positions of the bolt holes on the legs. Each pair of legs is laid out differently, so be sure to mark carefully. If you choose to countersink the bolt heads, drill the countersunk holes first. A 1-in.-dia. hole matches the diameter of washers normally used with ¾-in. bolts. Drill the bolt holes oversized—¾-in. holes for the ¾-in. bolts—as you did on the stretcher ends earlier.

Assemble the bench frame by first bolting together the legs and end stretchers, and then joining them with the side stretchers. The joints will seem loose and sloppy when first assembled; simply position and tighten them using two washers under each nut. You might need to retighten the joints after they've settled for a few days.

### Fitting the benchtop

For my benchtop, I glued up some 1½-in.-thick maple I had lying around. An easier (although more expensive) alternative is to buy a length of ready-made butcher-block countertop, available from many building-supply stores, home centers and lumber dealers.

Bolt the top to the frame through a batten glued to the inside faces of the end stretchers (see the drawing). Bore three ¾-in. holes in each batten, and then fasten the top with ¾-in. lag bolts and washers. While the battens keep the top flat, the oversized holes allow the solid-wood top to move with changes in humidity. If you want to add a shelf under your workbench, screw battens to the underside of some ¾-in.-thick shelf boards; then drop the shelf in place, as shown. □

*Richard Starr is a teacher and author. Building this workbench is the topic of the first show in his television series, Woodworking for Everyone, on PBS this fall.*