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WJ114

Workshop Classic: A Bench you can Rely On

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Workshop Classic: A Bench You Can Rely On

A family tradition continues with this no-nonsense maple workbench. Granddad would likely approve.

The work-top on contributing editor John English's grandfather's bench was a pair of railroad ties with an eight inch gap down the middle. Granddad, who lived in Ireland, was a skilled artisan who built coaches and wagons.

John's father is pretty good with his hands, too. The bench in his Dublin workshop is better suited to the work he does — refinishing antique furniture, tuning small engines — than Granddad's would be. The three inch thick hardwood top rests on an iron frame, but the vise is a metalworker's and the top shows scars of butane torches, solder and even a few hammer blows.

The point is that a workbench is personal — it must match both the work and the worker. Neither of the benches described above would be suitable for fine woodworking, but the model shown here is ideal for building furniture and casework. And it's easily modified to suit an individual craftsman's needs.

Design Basics

John built this workbench to fit his six-foot-tall body. The rule of thumb is to locate the work-top at half the height of the user (in this case, 35⅜"). If you need to build it higher or lower, simply adjust the length of the legs (see the *Leg Subassembly Drawings* on page 12).

The top of the bench features two parallel rows of bench dog holes. The front row is close to the edge, but the back row is set in a few inches to help support wide subassemblies like drawers or cabinet doors. The top is large enough to clamp a standard five-foot-long kitchen base cabinet, with a few inches left to set down tools or hardware.

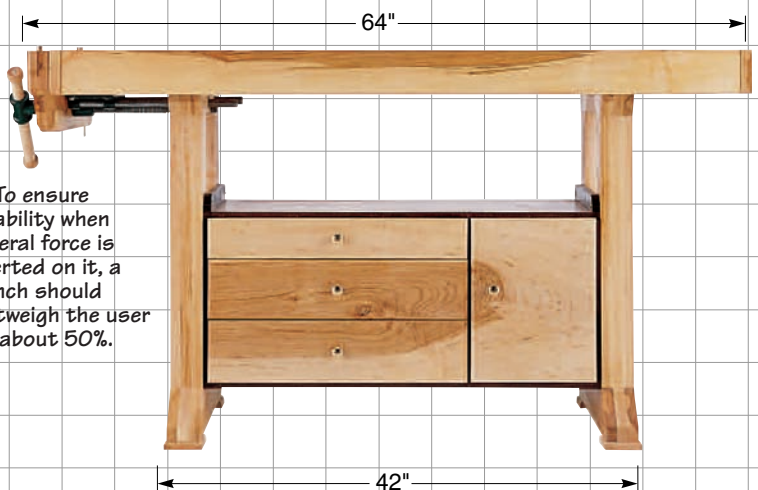
Quick Tip

Another Pitch for Baking Soda

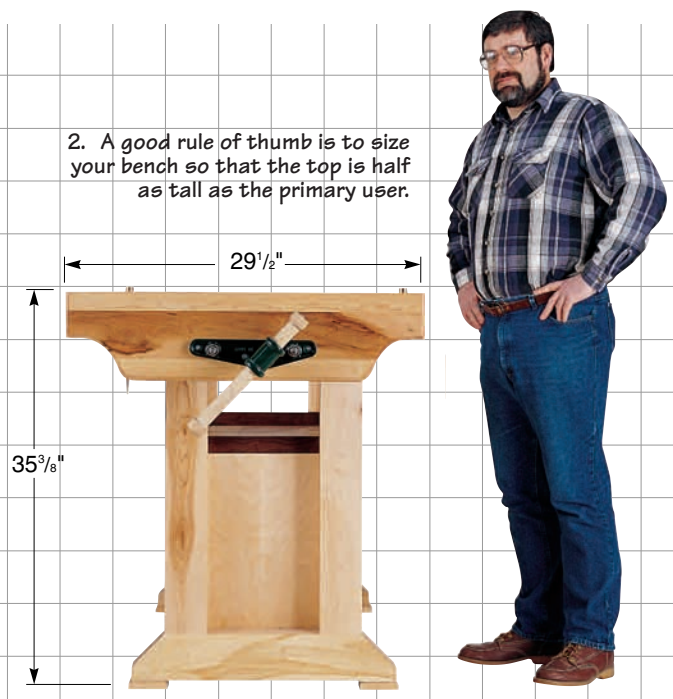
Here is an environmentally safe way to clean pitch from saw blades and router bits: In a plastic dishpan with an inch of boiling water to cover the blade, sprinkle a couple of tablespoons of baking soda around the perimeter of the blade. Light deposits of blade gunk should start to dissolve within a minute. For heavier deposits you may need to charge a plastic bristle brush with more baking soda and do a bit of scrubbing. Once the blade is clean, dry it thoroughly and wipe on a thin coat of wax or oil to inhibit rust. Now, your saw blades are cleaner and so is the environment by not using a caustic or volatile blade solvent!

Four Bench Building Basics.

1. If you regularly build furniture or cabinets, the space between the last bench dog and the wide open vise jaw should accommodate a standard five-foot base cabinet.

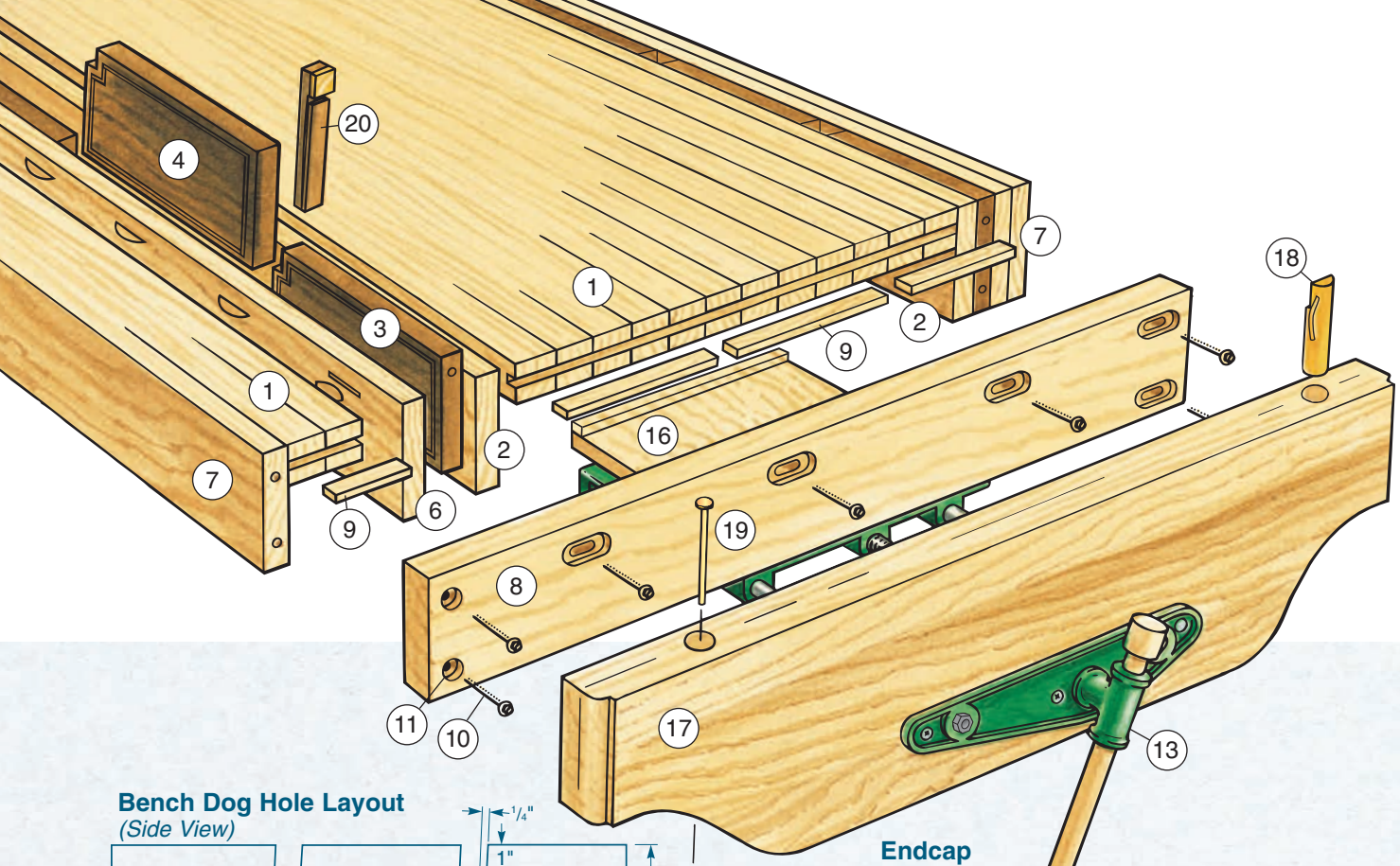


2. A good rule of thumb is to size your bench so that the top is half as tall as the primary user.

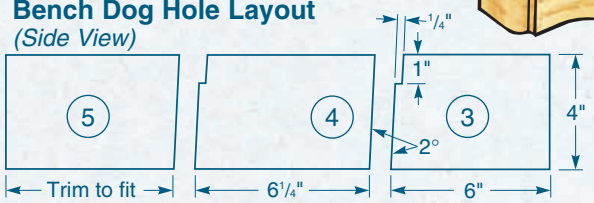


3. To ensure stability when lateral force is exerted on it, a bench should outweigh the user by about 50%.

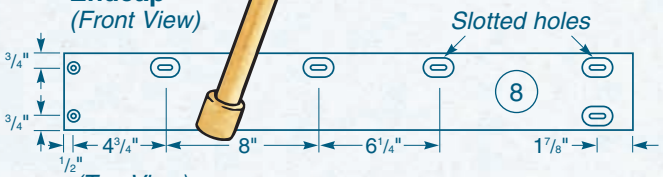
4. One row of bench dog holes should be set in a few extra inches. This makes it a little easier to support doors, drawers and other large parts during clamping.



Bench Dog Hole Layout
(Side View)

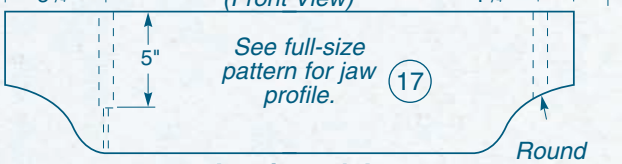


Endcap
(Front View)



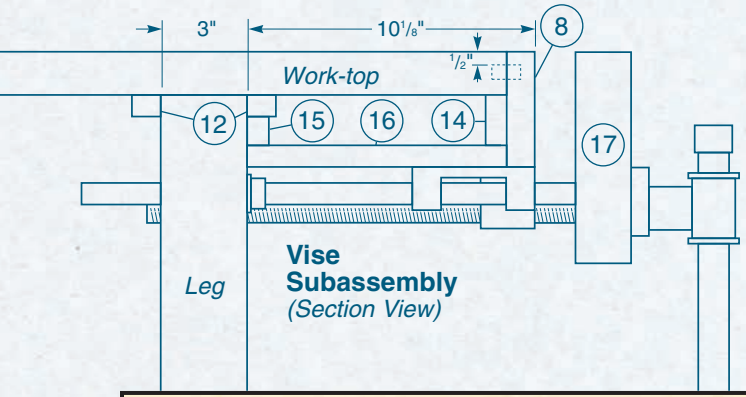
(Top View)

(Front View)

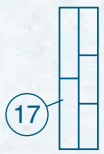


Laminated Jaw

Round bench dog location.



Vise Subassembly
(Section View)



Jaw Lamination
(Section View)

MATERIAL LIST

	T x W x L		T x W x L
1 Work-top (1)	1½" x 24⅛" x 60"	**11** Washers (14)	⅜" ID
2 Inside Liners (2)	¾" x 4" x 60"	**12** Leg Cleats (4)	¾" x ¾" x 20"
3 First Spacers (2)	¾" x 4" x 6"	**13** Large End Vise (1)	
4 Common Spacers (14)	¾" x 4" x 6¼"	**14** Vise Support Endcap Cleat (1)	¾" x 1¾" x 12"
5 Last Spacers (2)	¾" x 4" x 5½"	**15** Vise Support Leg Cleat (1)	¾" x 1" x 12"
6 Outside Liners (2)	¾" x 4" x 60"	**16** Vise Support (1)	¾" x 10" x 9"
7 Work-top Sides (2)	¾" x 4" x 60"	**17** Laminated Jaw (1)	2" x 7⅜" x 30"
8 End Caps (2)	1" x 4" x 30"	**18** Round Dogs (2)	Brass
9 Spline (1)	½" x 1" x 30"	**19** Round Dog Button (1)	3½" Brass Hinge Pin
10 Lag Screws (14)	⅜" dia. x 3½" Long	**20** Square Dogs (2)	Steel

Before even sharpening a pencil for this project, make sure you have your vise and bench dogs on hand. Open the vise fully and measure the opening, then subtract the thickness of the jaw (see the *Material List* on the previous page). This is the maximum spacing you can allow between the dog holes in the bench top, but you may want to downsize a little: traditional bench builders have discovered that a space of six or seven inches works best for most projects.

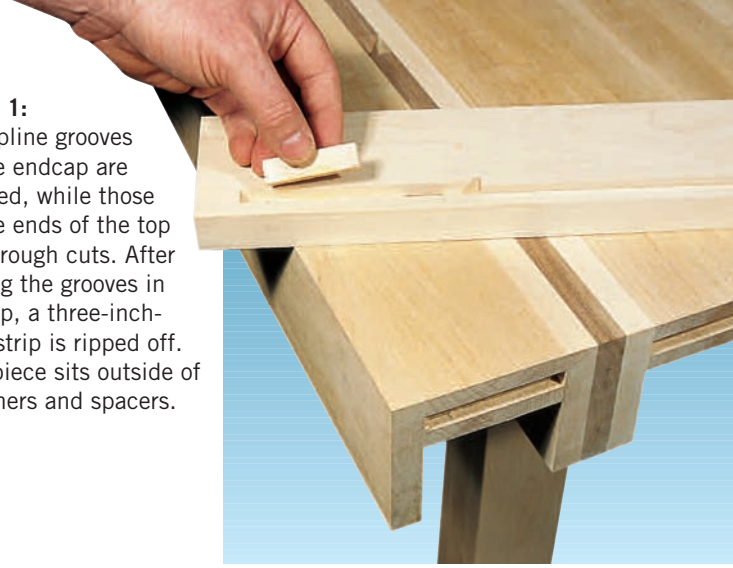


Figure 1: The spline grooves on the endcap are stopped, while those on the ends of the top are through cuts. After routing the grooves in the top, a three-inch-wide strip is ripped off. This piece sits outside of the liners and spacers.

A Butcherblock Top

While designing this bench, John recalled something from his days in the kitchen cabinet business: one of the most common kitchen renovations is countertop replacement, and more and more homeowners are discarding their gorgeous old solid maple butcherblock tops. He got lucky on his third phone call: a shop in the city's historical district sold him an eight-foot-long section of 1½" thick butcherblock for just $10. It took only a few minutes of trimming to make the work-top (piece 1). He rough-cut the blank a bit oversized with a circular saw, after first scoring with a utility knife to help avoid tear-out.

Then John clamped on a straightedge and trimmed the top to final dimensions with a straight bit chucked in his router. During this process he cut across the grain first, then with the grain: this approach virtually eliminates blowout on the corners.

If you prefer to build a top from scratch, make sure the quartersawn (tight) grain is visible, and the more open, wavy plainsawn becomes the gluing surface. Glue and clamp three or four overly long pieces of ripped and jointed stock together at a time. When they're dry, glue and clamp these subassemblies together to form the completed piece. Biscuits help to line up all these edges as you clamp. After the glue dries, take the entire piece to a cabinet shop and ask them to run it through their wide drum sander, to reduce it to final thickness. Another option is to order your top glued-up and made to order at a local home center. This is a little more expensive but often results in a more secure and stable top.

Figure 2: Dry-fit the bench dogs and spacers, leaving gaps that are the size recommended by the dogs' manufacturer. When everything fits, trim the final spacer to length.

The Bench Dog Holes

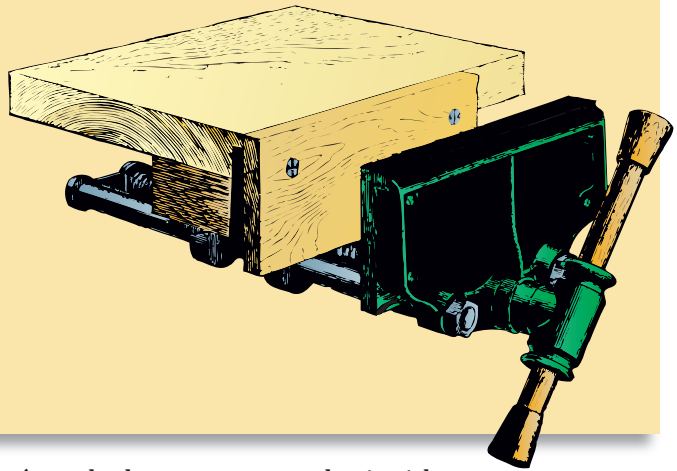
After trimming the top to size, chuck a ½" rabbeting bit in your portable router to cut the spline groove in each end of the work-top (see the *Exploded Drawings* on page 8 and as shown in *Figure 1,* above.

Rip a 3" wide strip off one side of the top and set it aside, then biscuit, glue and clamp the inside liners (pieces 2) in place. Place the work-top on a couple saw horses while attaching these liners, so your clamps have plenty of room to operate.

The liners need to be flush with the top of the butcherblock when it's finished, so it's a good idea to set them in place a hair proud of the top rather than shy of it.

The bench dog holes are formed when a series of spacers (pieces 3, 4 and 5) are attached to the liners. The business edges of these spacers are cut at a 2° angle (verify this angle by reading the bench dog manufacturer's instructions), and they're notched to allow the bench dogs to be stored below the work-top surface. All of these dimensions are shown on the *Elevation Drawings*, and the cuts can be made on a bandsaw. Dry-fit and mark the spacer locations on the inside liners, verifying each placement with a bench dog (see *Figure 2*). Score a shallow line about a ¼" in from the edge on both sides of each spacer — use a sharp knife or a rotary tool - to create a glue well: this will limit excessive squeeze-out.

Getting Started:
You should have the vise and bench dogs on hand before construction begins, in case you have to adjust the plan to fit the hardware. Beech and hard maple are the traditional species of choice for the frame and top, and walnut makes an excellent accent. During the course of construction you'll use a table saw, biscuit joiner, band saw, drill press, portable and table-mounted routers and a belt sander.

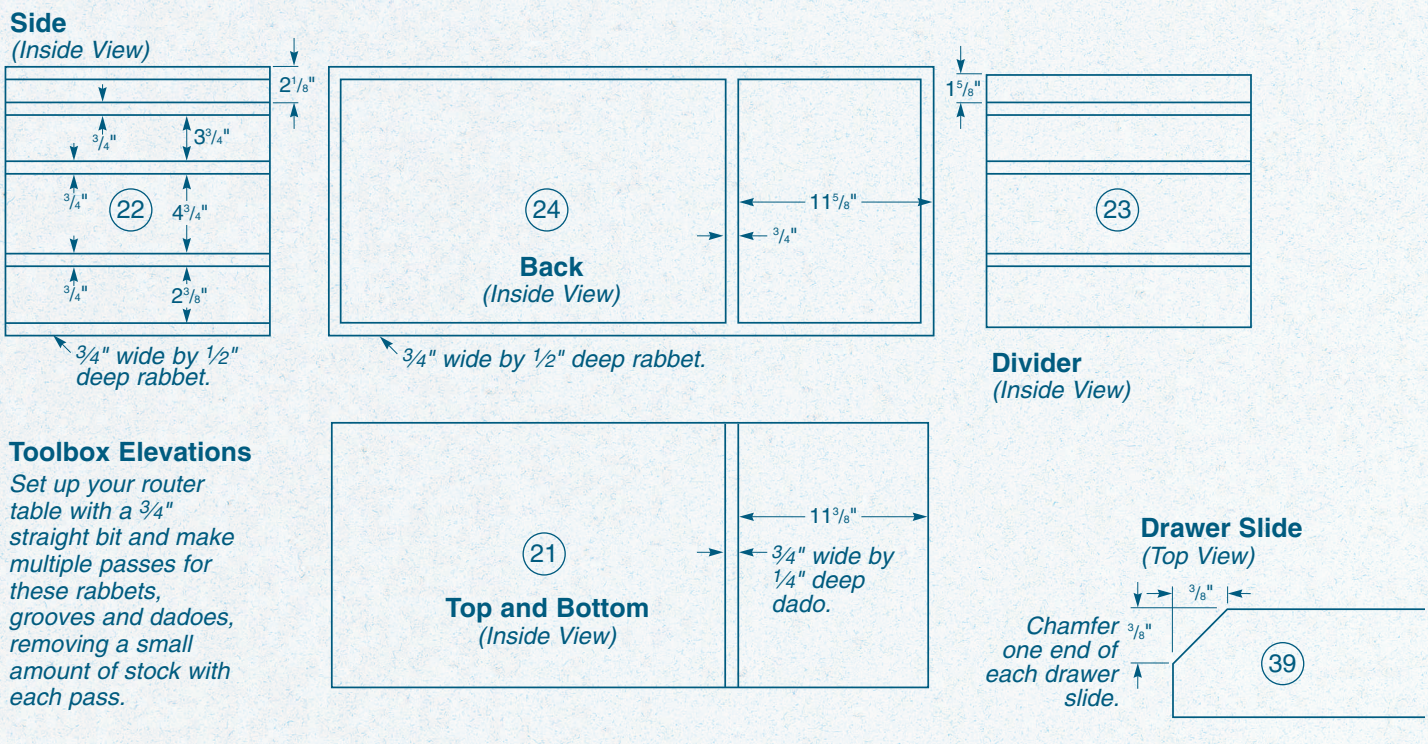


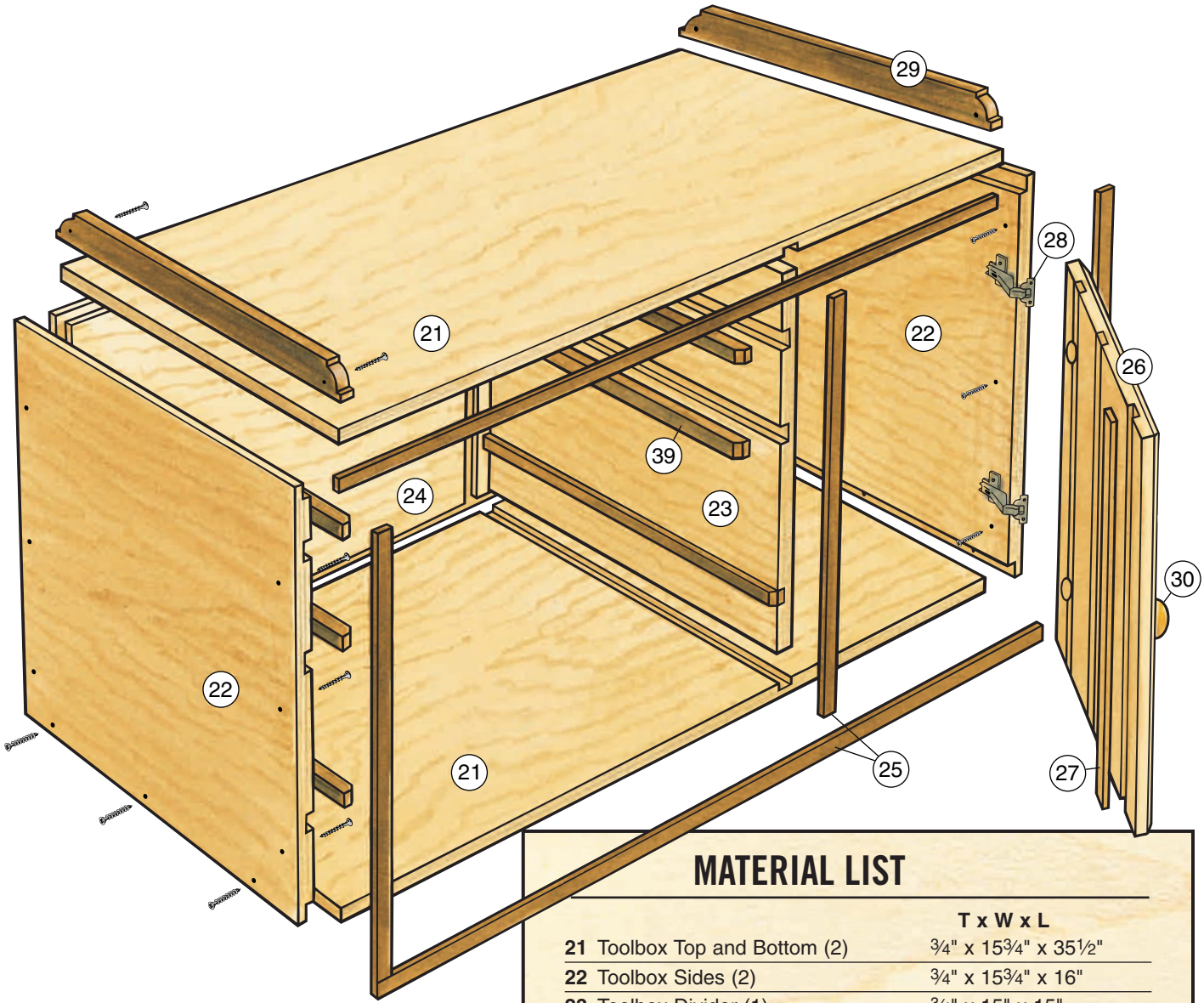
Attach the spacers to the inside liners with glue and clamps. When they're dry, you can glue and clamp the outside liners (pieces 6) in place. Use biscuits and glue to attach the remaining 3" wide butcherblock strip to one of the outside liners (see the *Exploded View* on page 8 for its location), then glue and clamp the work-top sides (pieces 7) in place.

Splined Endcaps

As woodworkers well know, wood has an annoying habit of shrinking and swelling across the grain. To cope with this tendency in a large assembly such as the work-top, the endcaps (pieces 8) are splined and attached with lag screws driven through oversized, slotted holes (See the *Elevations* on page 8 for marking the slotted hole locations).

Figure 3: Use your drill press to bore two step slotted holes in the endcaps: these will allow the benchtop to adjust to various levels of moisture in the workshop.





MATERIAL LIST

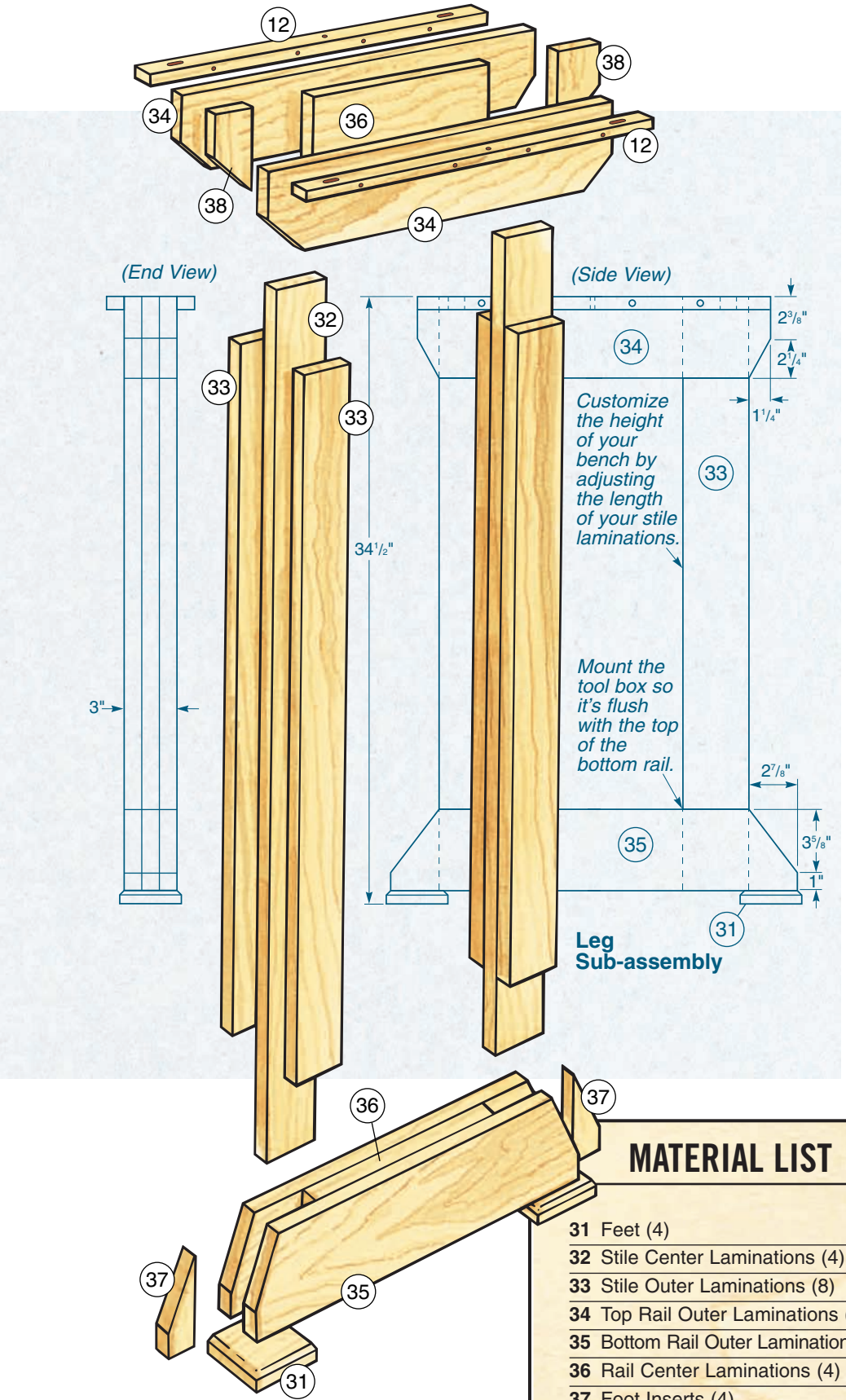
		T x W x L
21	Toolbox Top and Bottom (2)	¾" x 15¾" x 35½"
22	Toolbox Sides (2)	¾" x 15¾" x 16"
23	Toolbox Divider (1)	¾" x 15" x 15"
24	Toolbox Back (1)	¾" x 16" x 36"
25	Toolbox Trim (1)	¼" x ¾" x 120"
26	Door (1)	¾" x 11⅜" x 14¾"
27	Door Stiffeners (3)	½" x ¾" x 14¾"
28	Hinges (2)	European Style
29	Toolbox Top Trimmers (2)	¾" x 1½" x 16¼"
30	Knobs (4)	Brass

Chuck the rabbeting bit (the one you used earlier to create grooves in the work-top ends) in your portable router and, with the workpieces held securely, create a stopped groove in each end cap. Then mark the locations of the lag screw holes in each groove.

Trim splines (pieces 9) to fit around the lag screws, then move to the drill press to bore the two-step elongated and round lag screw holes, as shown in *Figure 3.* Note that the endcaps are not identical, but are mirror images of one another. Use the drilled endcaps to locate pilot holes in the work-top, drill these holes, insert the splines and attach the endcaps with lag screws and washers (pieces 10 and 11). Don't glue the splines in, otherwise the work-top will buckle or crack if it's not allowed to move.

Brace-up for Some Brackets

Turn the benchtop upside down and mark locations for the leg cleats (pieces 12), using the dimensions on the *Section View* on page 8. You'll use these locations as a reference as you build up a support structure for the large end vise (piece 13). Begin by screwing and gluing a vise support cleat (piece 14), to the endcap, located ¾" up from the bottom (see the *Elevations* and *Detail Drawings* on page 8. Drill pilot holes and screw a second cleat (piece 15) to the vise support (piece



16) at the location shown on the *Elevation Drawings*, then dry-fit the vise support to the endcap cleat and finish drilling your pilot holes. When all the screw holes have been established, remove the screws until the legs and the laminated jaw (piece 17) are installed. At that time, you'll also address the bench dogs (pieces 18, 19 and 20).

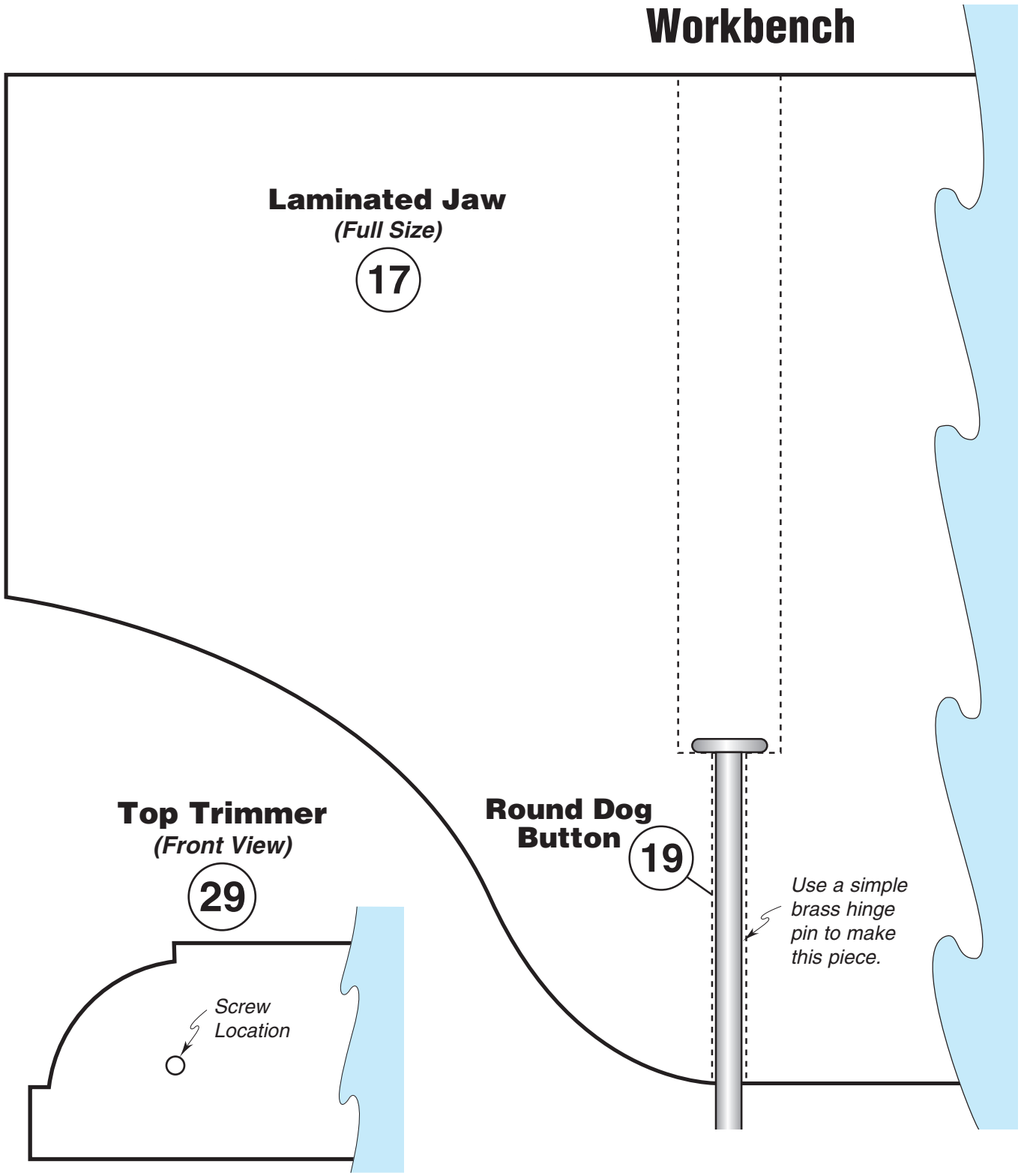
The Toolbox

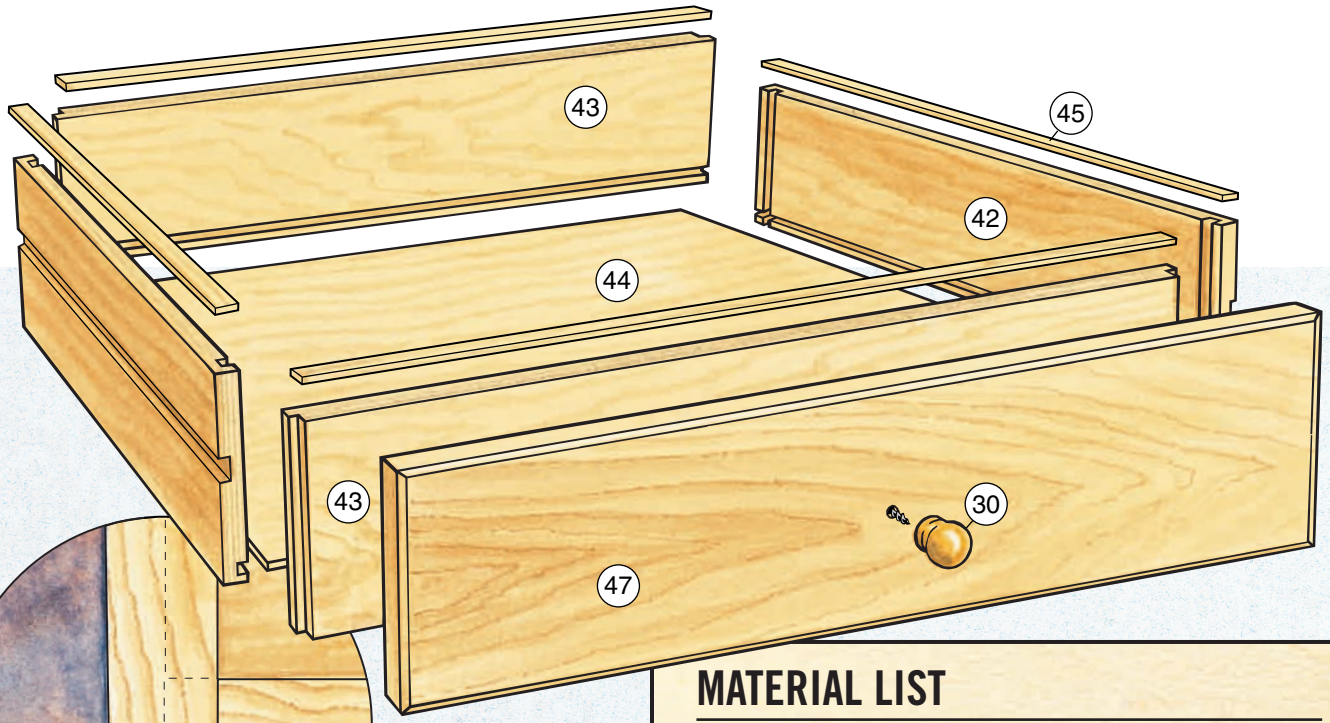
Stability is perhaps the number one requirement in a workbench, so the storage area on this bench is designed to add weight and lateral stability to the legs, while also providing three drawers, a cupboard and a large shelf for tool storage.

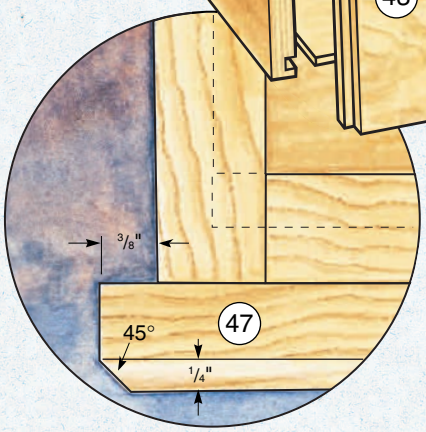
The toolbox top, bottom, sides, divider and back (pieces 21, 22, 23 and 24) are cut from one sheet of ¾" hardwood veneered plywood. John used birch ply, a good color and grain match for the maple in the rest of the bench, and far easier to find as a stock lumberyard item than maple ply. Use the *Elevation Drawings* to lay out rabbets on the appropriate edges of these pieces, then mill them with a ¾" straight bit chucked in your router table. For clean and safe cuts, make several passes to mill each rabbet.

MATERIAL LIST

		T x W x L
31	Feet (4)	¾" x 3½" x 3½"
32	Stile Center Laminations (4)	1" x 3¾" x 33¼"
33	Stile Outer Laminations (8)	1" x 3¾" x 24½"
34	Top Rail Outer Laminations (4)	1" x 4⅝" x 20"
35	Bottom Rail Outer Laminations (4)	1" x 4⅝" x 23¼"
36	Rail Center Laminations (4)	1" x 4⅝" x 10"
37	Foot Inserts (4)	1" x 4⅝" x 2⅞"
38	Top Inserts (4)	1" x 4⅝" x 2⅞"

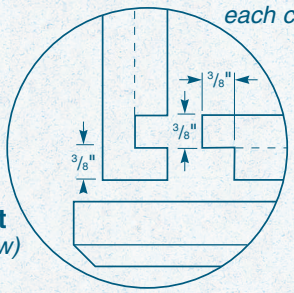

Workbench
Laminated Jaw
(Full Size)
17
Top Trimmer
(Front View)
29
Screw
Location
Round Dog
Button
19
Use a simple
brass hinge
pin to make
this piece.





Drawer Face Location *(Top View)*

*To create the drawer corner joints, use the technique described in the **sidebar** on page 16. Only one set up is required to make both the rabbets and dadoes for each corner.*

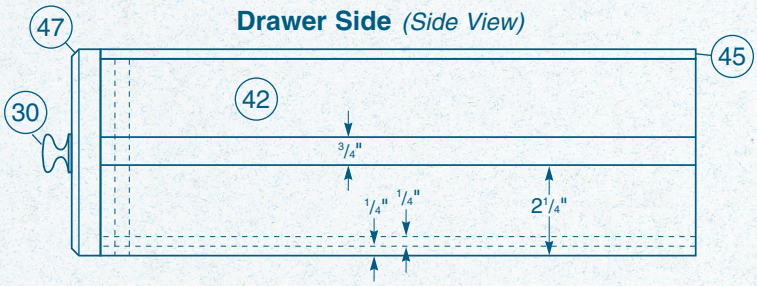


Drawer Corner Joint *(Top View)*

MATERIAL LIST

		T x W x L
39	Drawer Slides (6)	¾" x ¾" x 15¼"
40	Top Drawer Sides (2)	¾" x 3" x 15½"
41	Top Drawer Front and Back (2)	¾" x 3" x 22"
42	Lower Drawer Sides (4)	¾" x 5⅛" x 15½"
43	Lower Drawer Fronts & Backs (4)	¾" x 5⅛" x 22"
44	Drawer Bottoms (3)	¼" x 14⁷⁄₁₆" x 21⁷⁄₁₆"
45	Drawer Trim (1)	¼" x ¾" x 228"
46	Top Drawer Face (1)	¾" x 3⅝" x 23½"
47	Lower Drawer Faces (2)	¾" x 5⅜" x 23½"

Drawer Side *(Side View)*



Use the same bit to plow dadoes for the drawer slides and divider, then glue and clamp the top and bottom to the sides. Dry-fit the back, check for squareness and glue it in place.

The front edges of the case are trimmed with walnut (piece 25). Apply this with glue and 3d finish nails. Set the heads and fill them after the glue dries, then scrape or plane the trim flush with the plywood. Now you need to build and install the legs before coming back to finish up the rest of the toolbox — the door, top trimmers and knobs (pieces 26 through 30).

Stile and Rail Legsets

The bench's legs are standard stile and rail construction, with a twist: both stiles and rails are built-up laminations. This allows you to assemble the legsets with mortise and tenon joinery without ever having to chop a single mortise.

After cutting all the leg parts (including the feet, pieces 31) to the sizes on the *Material List*, dry-fit the stile center laminations (pieces 32) to the outside laminations (pieces 33): their dimensions are shown on the *Leg Elevations* on page 12. Face-glue and clamp each set of three laminations together to

Figure 4: Dry-fit the legset parts together, then use this as a template to determine the shape of the foot and top inserts.

create four individual legs, then set them aside.

Don't be overly anxious about perfect matches or glue squeeze-out — after the glue dries, you can scrape off any excess and then joint the uneven edges.

Use the *Elevation Drawings* to lay out the top and bottom rails' outside laminations (pieces 34 and 35), then cut these to shape on your band saw. Dry-fit these and the rail center laminations (pieces 36) to the legs, then temporarily clamp them in place. Use this setup as a template to lay out and mark the foot and top inserts (pieces 37 and 38), as shown in *Figure 4*. Trim the inserts to size on your band saw, glue and clamp each legset together and set them aside to dry.

Attaching the Legs to the Top

Sand the work-top thoroughly, then turn it upside down. Use your drill press to create slots in one face of the leg cleats (pieces 12) and pilot holes in the other face of the piece. Attach the cleats flush to the top of the legs with glue and screws driven through the holes — not the slots. When the glue dries, attach the legs to the toolbox (flush with the top of the bottom rail) by temporarily clamping everything in place. Predrill the inside of the toolbox for 2" screws and, when everything is lined up, drive them home.

Round up some strong help and set the leg assembly upside-down on the underside of the work-top. Complete the assembly driving screws through the cleat slots into your predrilled holes in the underside of the work-top. This secures the legs and toolbox to the top.

Installing the Vise

You have already made all the parts for the vise support assembly. Now, begin the vise installation by positioning the vise on its support at the location shown on the *Elevation Drawings*. Next, use the vise as a template to mark mounting holes on the support. Predrill these holes (see the manufacturer's instructions), then install the cleat subassembly you made earlier with screws (See *Section View* on page 22). You can now begin to mount the vise to the bench.

Again using the vise as a template, gently wind in the jaw until the two guide rods just touch the leg rail. Mark the rod locations, and the locations of the screw holes in the guide rod bushings that come with the vise, as shown in *Figure 5*.

Remove the vise and platform, then use a Forstner bit to drill slightly oversized holes in the leg's rail assembly for the rods and screw to pass through. You may want to remove the legs and perform this step on your drill press to ensure truly vertical bores. Then screw the bushings in place.

Figure 5: The vise attaches to both the endcap and vise support. With two screws holding the unit in place, establish the locations for the guide rod and center screw holes in the legs.

The Laminated Jaw

There are two good reasons to use five separate boards to laminate a blank for the moveable vise jaw (piece 17): it will be more stable than a single board, and it will be far stronger. Follow the *Jaw Lamination* layout on page 8 to face-glue and clamp the blank together.

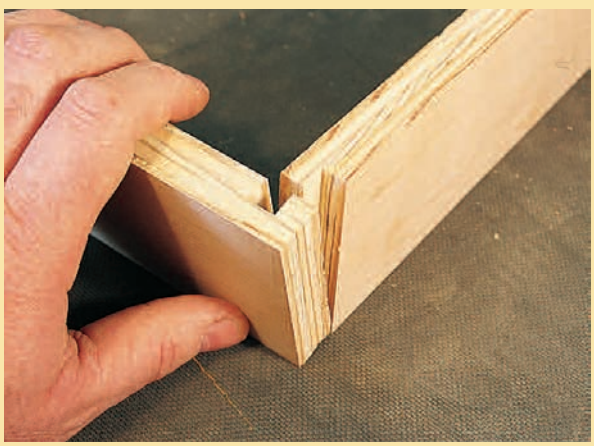
Using the *Pattern Drawing* on page 13, cut the jaw to shape on your bandsaw, and sand out the saw marks with a 2" drum sander. Shape the outside bottom and side edges with a ½" radius guided beading bit chucked in your portable router.

To locate the holes in the jaw for the guide rods and screw, remove the screw and guide rods, clamp the jaw in place and use the vise

Step-by-step drawer joinery

Step 1: Install a ⅜" dado head and a zero-clearance insert in the saw and cut a rabbet at the end of each drawer front and back.

Step 2: Without moving the rip fence, switch to the miter fence to form matching dadoes in the drawer sides.



Step 3: Dry-fit the joints and then switch to a ¼" dado head to cut the grooves for the bottoms.

mounting plate as a guide to locate the three holes. Drill these holes ⅛" oversize.

Slip the laminated jaw over the guide rods and the screw, then gently wind the vise closed. Position the wooden jaw flush with the top and sides of the work-top's endcap, drill pilot holes for the mounting screws and drive them home.

Building the Drawers

Chamfer the leading edges of the drawer slides (pieces 39), as shown on the *Elevation Drawings* on page 10, then glue them in their dadoes.

After cutting the drawer sides, fronts and backs (pieces 40 through 43) to size, use the dimensions shown on *Drawer Corner Joint Detail*, page 14, to create the locking joints on their corners (see the photo series sidebar on this page). These joints are cut on the table saw. It's a good idea to make a practice joint on scrap wood to establish the saw settings before milling the actual workpieces.

Stay at the table saw to cut grooves in the inside faces of these pieces for the drawer bottoms (pieces 44), as shown on the *Exploded View Drawing*, page 14. Glue and clamp the drawers together, checking that they're square and flat before setting them aside. When the glue is dry, trim the top edges of the plywood drawers with solid hardwood (piece 45), gluing and nailing at 6" intervals. Fill the nail holes and sand the filler flush, then install a dado head in your table saw to mill grooves in the drawer sides for the slides. Test your setup with scrap, using three pieces to represent the three drawer sizes, and make any minor adjustments needed to ensure that the drawers will slide properly. After milling, test fit the sides in the case to be sure they move easily on the slides.

The Drawer Fronts and Door

John cut the drawer fronts and the door for his bench from a single wide board, to take advantage of a very attractive grain pattern. You may have to glue up stock for this process. Cut the faces (pieces 46 and 47) to size, then shape their front edges on the router table with a chamfering bit (see the *Elevation Drawings* for dimensions).

You can now return to the door and finish machining it. The grain pattern on John's door (piece 26) ran horizontally. To prevent cupping,

he plowed three dadoes from top to bottom in its back and glued in three stiffeners (pieces 27). After sanding, he chamfered the door's front edges to match the look of the drawer faces.

European style hinges with a ¼" overlay (pieces 28) are completely hidden when the door is closed. Follow the included instructions for mounting these hinges.

On your bandsaw, shape the walnut toolbox trimmers (pieces 29) to the profile shown on the *Pattern Drawings*, page 13, then sand them smooth. Screw one to the legs at each end of the toolbox top, to stop tools from falling off the shelf. Finally, chamfer the top and bottom edges of the feet and screw them to the bottoms of the legs.

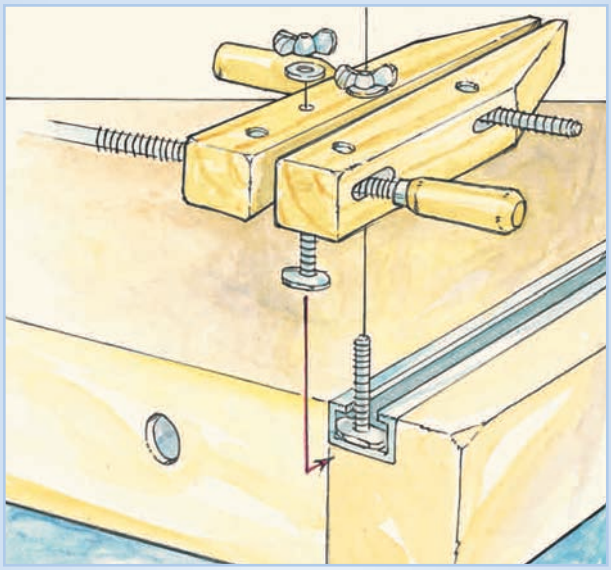
Finishing Up

Disassemble the entire bench, then sand all surfaces with 120-grit, 180-grit and finally 220-grit sandpaper. Wipe it down with a tack cloth and apply four coats of natural Danish Oil to the legset and toolbox, and an additional couple of coats to the work-top. Sand each coat except the last, using 400-grit paper, wiping it clean before and after sanding. When the finish is dry, reassemble the bench and mount the knobs on the drawers and door.

Install a pair of bench dogs (pieces 18) by using the *Elevation Drawings* to locate their holes in the top of the vise jaw. Drill the right-hand hole vertically all the way through the jaw (back up the exit area with some scrap, to avoid tear-out). Drill the left hole to a depth of 4½", then use a bit extender or a long twist bit to drill a second hole in the bottom of this boring (see the *Elevation Drawings* for dimensions). This hole is for a brass pin that's actually a door hinge pin, available at most hardware stores. This pin is used as a button to push the top of the bench dog up above the surface of the jaw when needed.

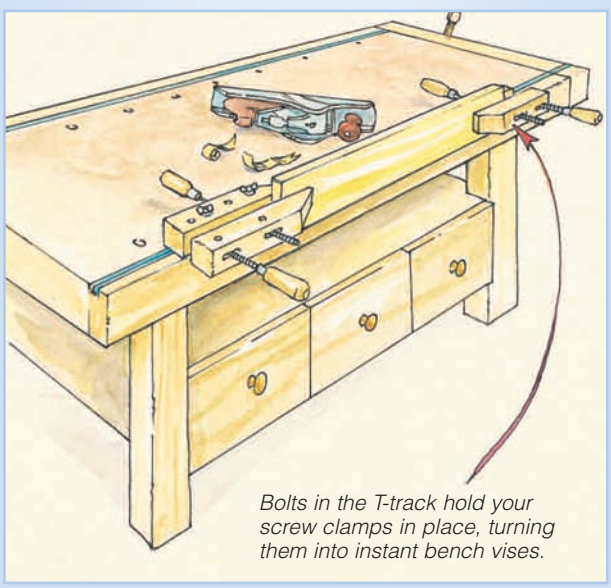
Pop the square dogs into their holes at this time, then fill the top drawer in the toolbox with all those project plans you'll need over the next few decades. After all, once people see the great job you did on building your workbench, they're bound to have all sorts of great ideas that will help you use it!

Quick Tip



Instant Workbench Vise

Most workbenches have more than one vise so the user can work either along an edge or at the end of the bench. If your workbench has only one vise, you can provide a second means of clamping using a length of metal T-track, t-bolts, wingnuts and a few hand screw clamps. Rout a dado in your benchtop to recess the T-track, bore a hole through the thickness of the hand screw clamp and assemble the parts. Install a second hand screw for holding long work, when necessary.



Bolts in the T-track hold your screw clamps in place, turning them into instant bench vises.