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A Traditional European Workbench

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- Tips to help you complete the project and become a better woodworker.



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A Traditional European Workbench

If you'd like to build a bench to top all other benches, ours was designed by master woodworker Frank Klausz. It takes a lot of wood and a lot of work to build, but the result is worth the investment: you will use it for a lifetime. Your children's children will use it, too.



Building a bench like this is an enjoyable process made up of many simple steps. A craftsman worthy of such a bench will be able to make it with ordinary hand and power tools. The benchtop is very heavy once it is glued up, so you'll want to have a helper on hand when you need to maneuver it around your shop.

Building the Base

The base of this bench consists of two leg trestles connected by two heavy rails that support a storage shelf. (For details, see the *Exploded View Drawings* on page 10.)

The first thing you must do is determine how high you want your bench to be and size the legs accordingly. For planing, the ideal height is generally considered to be the height of your palms from the floor when your arms are at your sides. This height allows you to make the best use of



Cut the shorter bottom tenons of the legs and the stub tenons of the rails with a tenoning jig on the table saw. Use the band saw for shaping the through tenons.



Mortise the feet before cutting out the recesses on the undersides. Here the author uses a mortising attachment on a drill press.

your body weight to push a hand plane down. For chiseling and other bench work, you can put blocks under the feet to raise the height a couple of inches. To determine the overall length of the legs, subtract 6½" from the overall bench height.

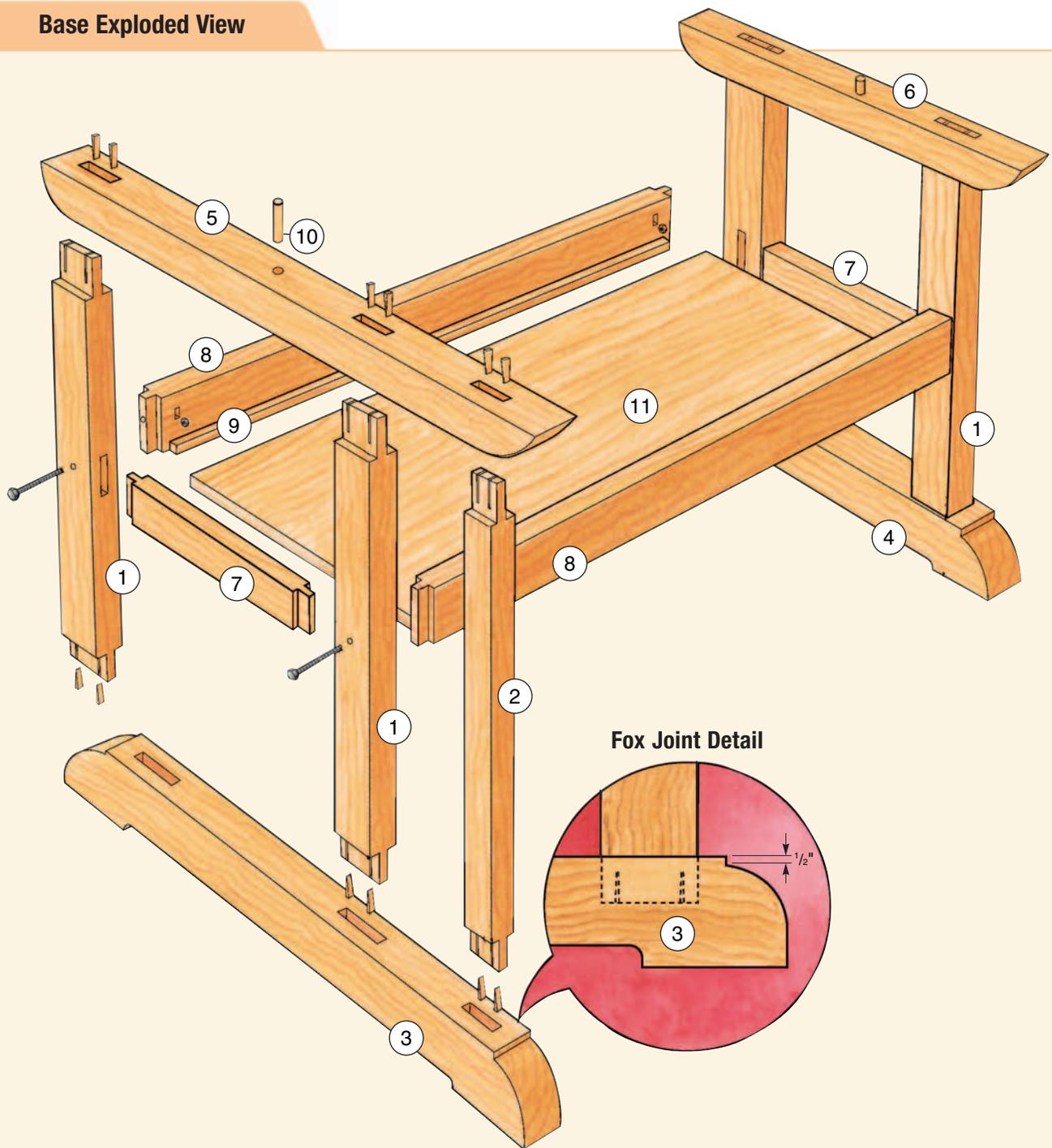
The legs are connected to the top rails with through-wedged mortise and tenon joints and to the foot rails with fox-wedged mortise and tenon joints. (See the *Drawings* on the next two pages and the *photo* on page 12). The shorter tenons may be cut on the table saw, using a tenoning jig for the vertical cuts; but the longer ones are best cut on the band saw, as demonstrated in the *photo* at left.

Use a cardboard template to lay out the curves on the feet and the top rails. Cut the curves on a band saw and smooth them out with a light pass on the disk sander, but don't cut out the recesses on the bottom of the feet until you have made all the mortises.

Cut the mortises for this bench with a mortising attachment on a drill press (see *photo*, above), but you could drill them out with a brad-point or Forstner bit and clean them up with chisels if you don't have a mortiser.

Before you glue up the trestles, mortise the legs for the

Base Exploded View



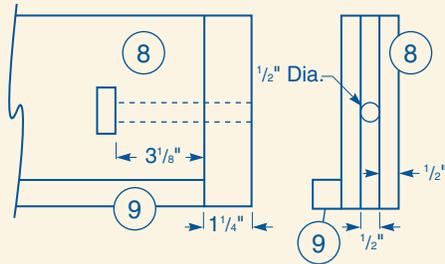
Fox Joint Detail

MATERIAL LIST – Base

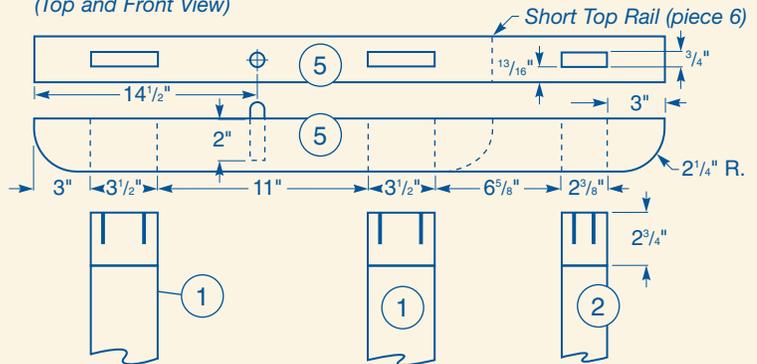
	T x W x L		T x W x L
1 Legs* (4)	2 ³ / ₈ " x 3 ¹ / ₂ " x Varies	7 End Stretchers (2)	1 ¹ / ₂ " x 2 ¹ / ₂ " x 13 ¹ / ₂ "
2 Narrow Leg* (1)	2" x 2 ³ / ₈ " x Varies	8 Long Rails (2)	1 ¹ / ₂ " x 5" x 45"
3 Foot (1)	3 ³ / ₄ " x 2 ³ / ₄ " x 33"	9 Shelf Support Strips (2)	3/8" x 3/4" x 43"
4 Short Foot (1)	3 ³ / ₄ " x 2 ³ / ₄ " x 24"	10 Bullets (2)	3/4" Dia. x 3"
5 Top Rail (1)	2 ³ / ₈ " x 2 ³ / ₄ " x 33"	11 Shelf (1)	1/2" x 13" x 43"
6 Short Top Rail (1)	2 ³ / ₈ " x 2 ³ / ₄ " x 24"		

*The legs are cut to length according to your height (see text).

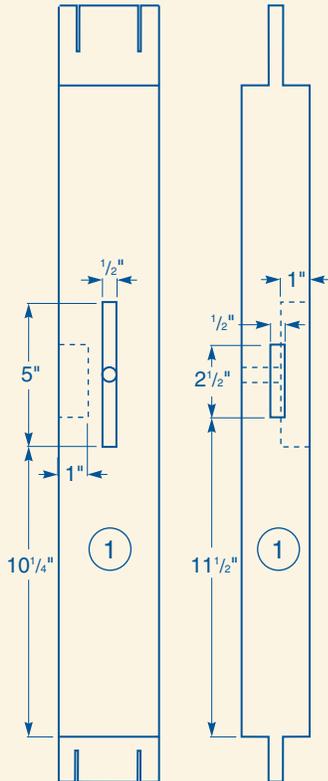
Long Rail and Shelf Support
(Inside and End Views)



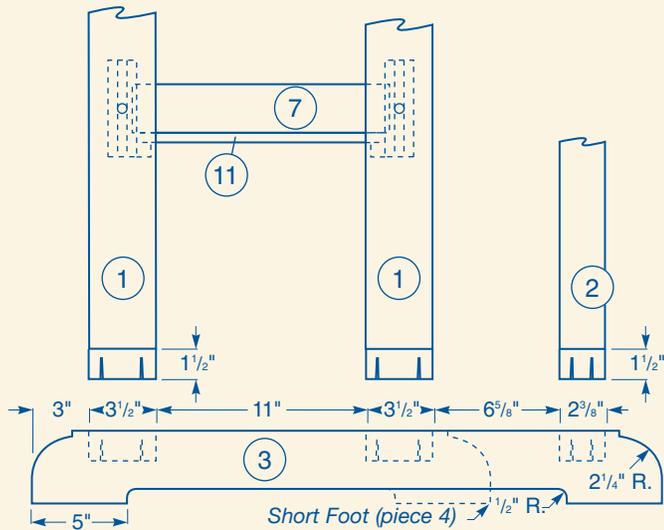
Top Rail and Short Top Rail
(Top and Front View)



Leg
(Stretcher and Rail Locations)



Bench End Subassembly
(Front View)



At the heart of the bench are the screws: Benchscrew; shoulder vise (Garrett Wade, part #70G02.03). Benchscrew; tail vise (Garrett Wade, part #70G02.02). You'll need two bench dogs (Rockler, part #21868) and a small holdfast (Rockler, part #90407). Visit a local hardware store for the following additional supplies:

Hex head bolts (6)	1/2" x 6"	Flat Washers (6)	3/8"
Lag Screws (6)	3/8" x 4"	Hex Nuts (8)	1/2"
Lag Screw (1)	3/8" x 4 1/2"	Flathead Screws (2)	#12 x 1"
Lag Screw (2)	1/2" x 4"	Flathead Screws (15)	#8 x 1 1/4"
Threaded Rod (1)	1/2" x 36"	Flathead Screws (12)	#8 x 2"
Flat Washers (8)	1/2"	Screws for Benchscrew Nuts (8)	To fit



Assemble each trestle section with white glue and clamps. Here the author uses a mallet to drive the fox-wedged tenons home (at the bottom of the legs).



The legs are attached to the feet with fox-wedged tenons.

stub tenons of the stretcher rails that connect the trestles. Drill a 1/2" hole through the center of each mortise for the hex bolts that will join the rails to the legs. Dry-assemble the rails to the legs and drill the long holes into the ends of the rails. Rout or mortise a pocket about 3/8" from the shoulder of each rail for a hex nut. Frank usually makes this pocket over-

size, in order to get fingers or pliers in there to hold the nut in place. Finally, glue up the trestles (see the *photo*, left) and set them aside until the top of the bench is completed.

Selecting Lumber for the Workbench Top

Next, make the main part of the benchtop. The top of the bench consists of a long section, usually made of two hefty 7"-wide boards, and a short front section that becomes the fixed jaw of the tail vise. (See the *Drawings* on pages 14 and 15.) The front piece of this shorter section is 4" high and contains a series of bench dog holes that align with opposing holes in the tail vise.

Begin by letting your lumber acclimate in your shop for a week or so before you start milling it. Then rip, joint and surface all the pieces. It does not matter if there are some rough mill marks or defects on the underside of the top, because these will not affect the utility of the bench. Frank recommends using the band saw to rip lumber that is more than 2" thick, because a band saw blade cuts through thick lumber much more efficiently than a table saw blade.

Making the Bench Dog Holes

To make the bench dog holes, cut slots in the front lip of the bench before gluing it to the other short section of the top (see the *Drawings*). You want the dogs to tilt 2° toward the opposing bench dogs, so the slots must be at an 88° angle to the bench surface.

To cut the slots in both the front strip and the tail vise, Frank used a table saw sled that works like a box-joint jig, with a 3/4" dado blade and a tapered auxiliary fence that skews the workpiece 2° from perpendicular (see top *photo*, next page). Reverse the tapered fence for cutting the tail vise slots, because they need to slope 2° in the other direction.

After you make the first cut, tack a strip of wood the same thickness as your dado blade to the base of the sled at the appropriate hole spacing—in this case 5 1/2". After cutting the first slot, you can cut each successive slot by indexing the previous slot on the wood strip. Note: the last slot, at the end of the strip, has a different spacing. See the *Drawings* for more details about this slot.

Assembling the Top

Assembling the top involves several steps. Before you can glue the various parts together, you need to drill the hole for the threaded reinforcing rod that goes through the full width of the top at the shoulder vise.

To do this, clamp the two planks of the long section

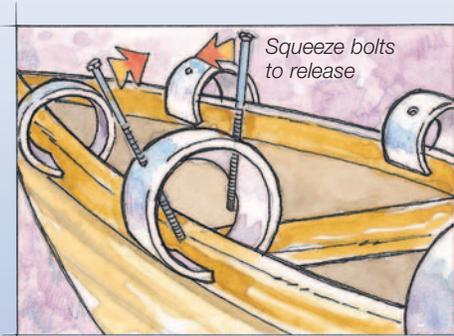
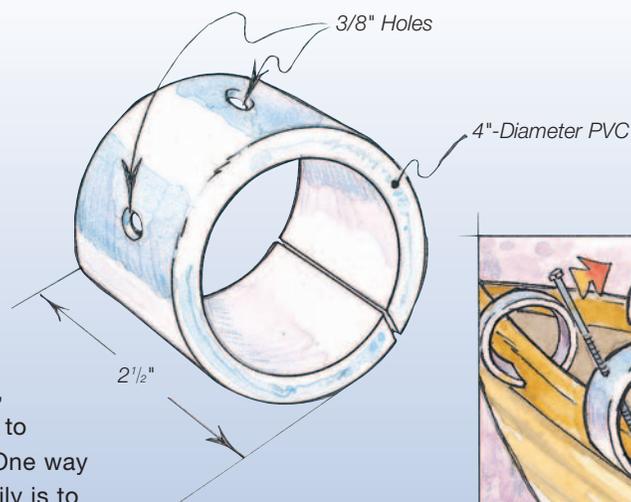


Use a table saw sled with a 2° auxiliary fence to cut the bench dog slots in the tail vise face. Reverse the fence for the opposing slots in the front lip of the bench. A guide strip tacked to the sled ensures equal slot spacing.

QuickTip

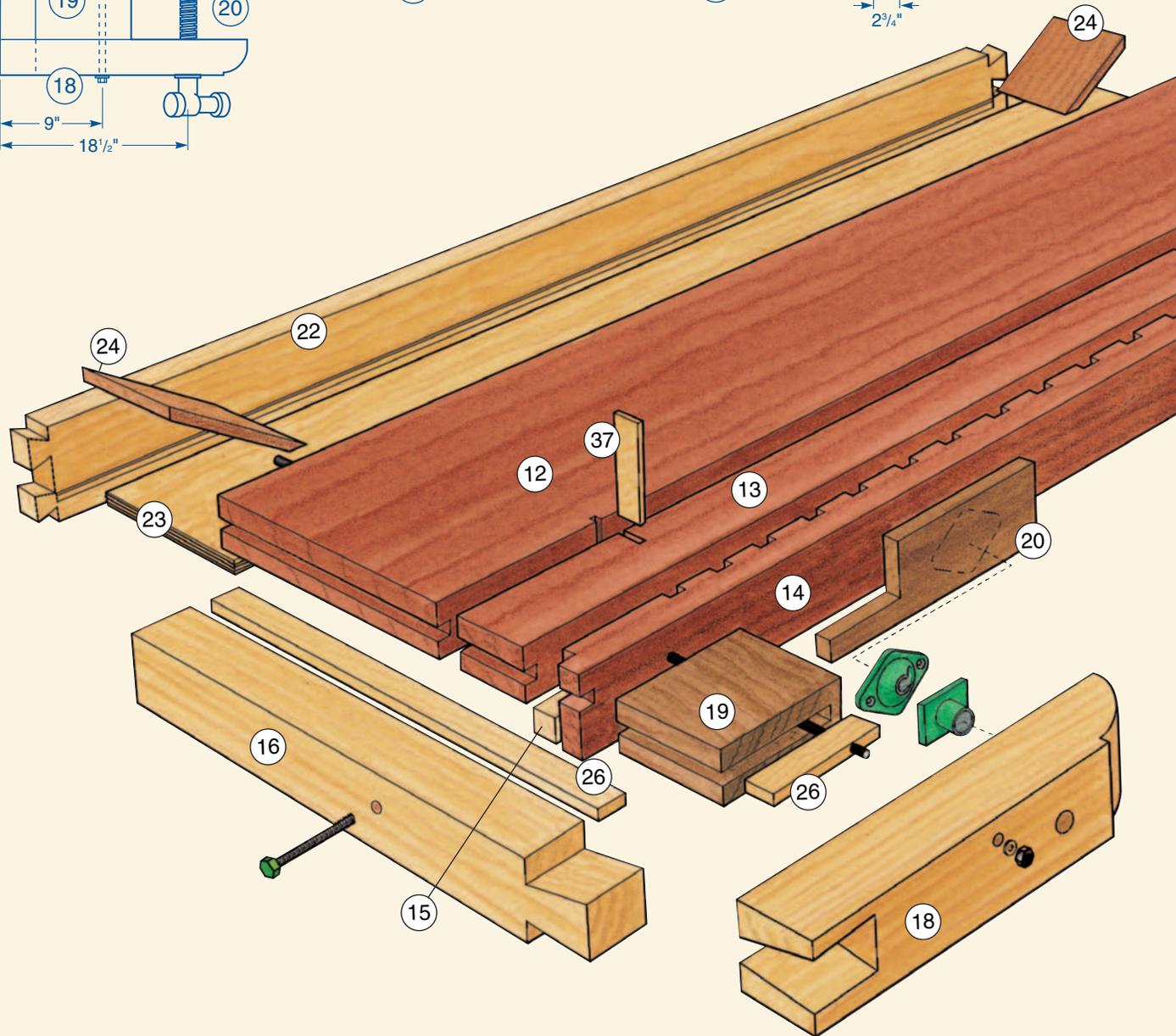
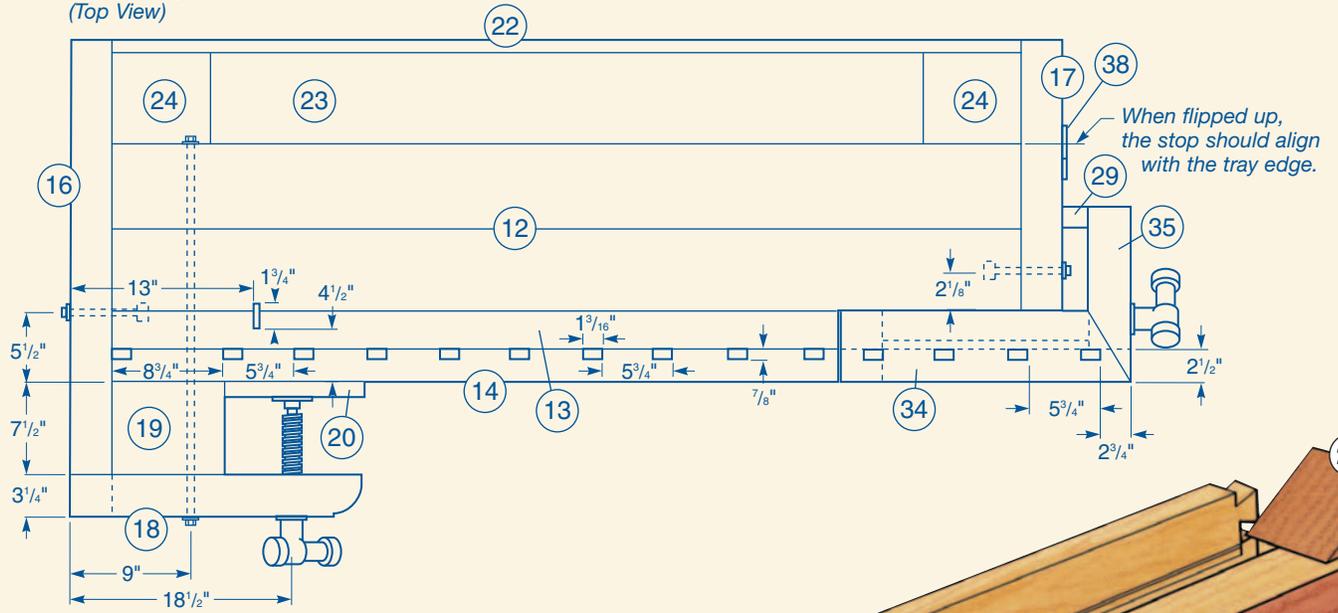
Dirt-cheap Pipe Clamps are Easier on Fingers

Short sections of PVC pipe make good clamps, but they tend to be hard to open with your fingers. One way to open them more easily is to drill holes and insert 5/16" x 6" (or longer) bolts. The bolts act like temporary clamp handles.

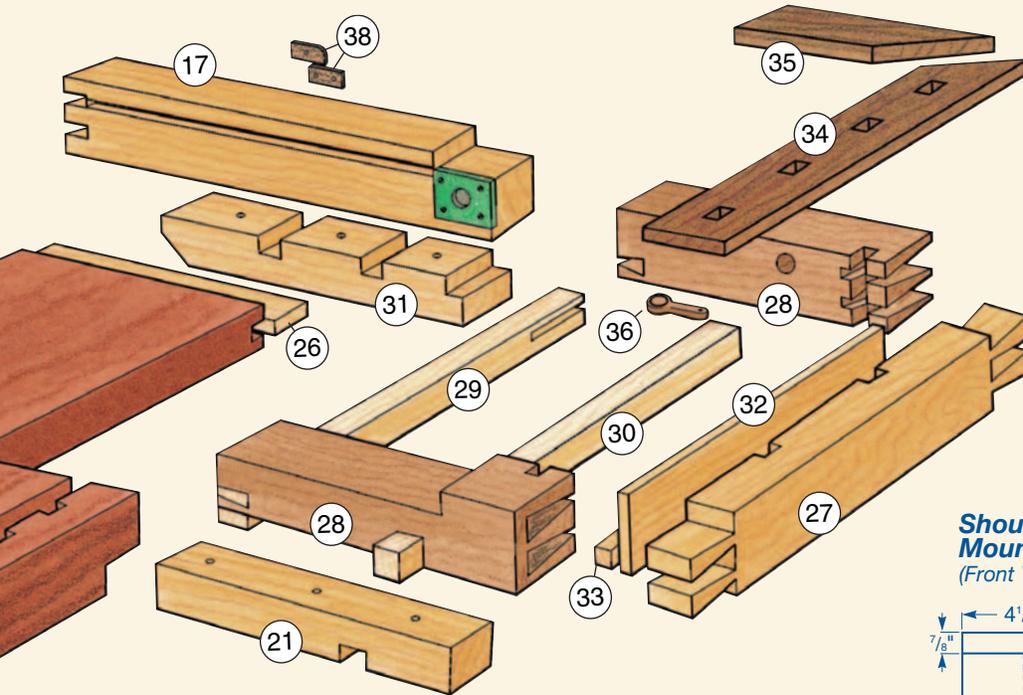
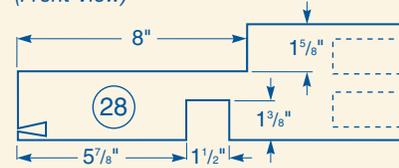


Top Exploded View

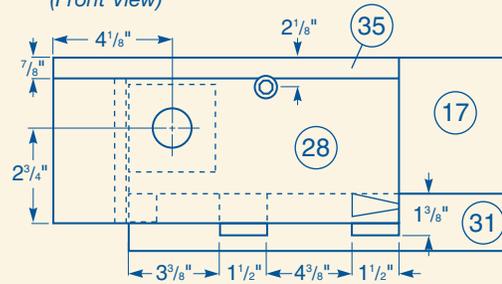
Benchtop
(Top View)



Inner Jaw Detail
(Front View)



Shoulder Vise Screw Mounting Detail
(Front View)



MATERIAL LIST – Top

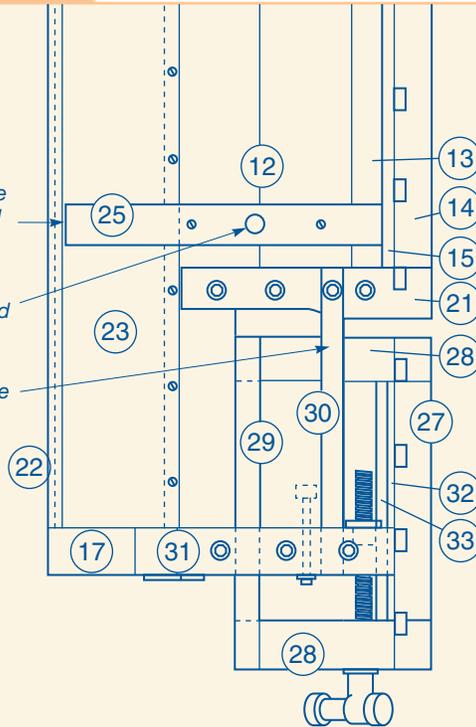
	T x W x L		T x W x L
12 Long Section (1)	2 1/2" x 13" x 72 1/2"	20 Shoulder Vise Jaw (1)	1" x 4" x 17 1/2"
13 Short Piece (1)	2 1/2" x 3" x 58"	21 Inside Guide Block (1)	3" x 2 3/4" x 17 1/4"
14 Front Lip (1)	2 1/2" x 4" x 58"	22 Backboard (1)	1" x 4" x 75 1/2"
15 Backer Strip (1)	1 1/2" x 1 1/2" x 58"	23 Tool Tray (1)	1/2" x 8 3/8" x 72 1/2"
16 Long End Cap (1)	4" x 3 1/4" x 37 1/2"	24 Tool Tray Ramps (2)	1/2" x 7 1/2" x 6 1/2"
17 Short End Cap (1)	4" x 3 1/4" x 24 1/4"	25 Spacer Blocks (2)	1 1/2" x 3 1/4" x 22"
18 Shoulder Vise Arm (1)	4" x 3 1/4" x 23"	26 Plywood Spline Material	1/2" x 1 1/2" x 60"
19 Shoulder Block (1)	2 1/2" x 8 5/8" x 7 1/2"		

Technical Drawings

The two spacer blocks are notched to accommodate the tray bottom, providing a level base for the top.

Drill a 3/4" hole for a "bullet" dowel so the top can be placed accurately on the base.

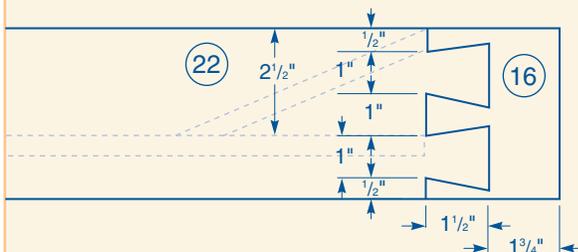
The center rail is screwed into the inside guide block and short end cap. It supports and guides the vise movement.



Tail Vise (Underside)

MATERIAL LIST – Top

Tail Vise	T x W x L
27 Front Face (1)	2 1/2" x 4 1/4" x 22 1/2"
28 Jaws (Ends) (2)	3 1/2" x 4 1/4" x 13 1/2"
29 Back Rail (1)	1 1/2" x 1 3/8" x 23"
30 Center Rail (1)	1 1/2" x 1 3/8" x 17 1/4"
31 Outside Guide Block (1)	3 1/4" x 2 1/4" x 20"
32 Plywood Liner (1)	1/4" x 4 1/4" x 16"
33 Front Runner (1)	3/4" x 7/8" x 16"
34 Long Vise Cap (1)	7/8" x 5 1/2" x 23"
35 Short Vise Cap (1)	7/8" x 4" x 13 1/2"
Miscellaneous	T x W x L
36 Carved Oil Cup (1)	1/2" x 2" x 6"
37 Wooden Stop (1)	1/4" x 1 3/4" x 7"
38 Crosscut Stops (2)	1/4" x 1" x 3"



**Backboard/
Long End Cap
Dovetail Detail**
(Rear View)

together and drill a 9/16" hole through the first into the second. Then clamp this section to the next section and repeat the process, drilling the hole progressively through all the parts, including the block and the arm of the shoulder vise. Use a spade bit with an extension attachment to do this.

Once you have drilled through all the pieces, rip grooves for the splines with a dado blade on your table saw. Glue up the 13"-wide section and the short front section separately. Use 1/2" x 1 1/2" plywood splines and glue to join all the parts of the top, including the end caps and shoulder vise block.

Square off the short section and glue it to the long section, making sure that all the holes line up and that the splines don't interfere with them. Finally, trim the ends square and rout the grooves for the end cap splines (see top photo, next page).

Attaching the End Caps

Before you can attach the end caps, you'll need to first join the long end cap to the arm of the shoulder vise. This is a simple through-dovetail joint that you can cut on the band saw and clean up with chisels and rasps (see photos, facing page). Make an angled ramp, clamped to the band saw table, to tilt the shoulder vise arm when cutting the dovetail socket.

Dry-fit this dovetail, then disassemble the parts and rout or rip the spline grooves in both parts, stopping the grooves so they won't show when the parts are assembled. Cut the groove in the short end cap also. All the spline grooves should be centered on the thickness of the top.

Notch and drill the short end cap for the benchscrew nut at this time. You will need to drill a hole in the inside face with a Forstner bit for the cast-iron nut,

then a smaller hole the rest of the way through for the screw itself. Then trace the benchscrew flange around the larger hole and rout the end cap to the depth of the flange. (A typical installation is shown in the *photo* on page 19.) Repeat this procedure for the shoulder vise benchscrew nut, and install both nuts with the appropriate sized screws before glue-up.

Next, drill the 1/2" holes through the end caps for the hex-head machine bolts that will reinforce their connection to the top (see *Drawings*). Start the holes from the inside of the end caps, centered on the spline groove. Then dry-assemble the caps to the top and drill the long holes into the endgrain of the top. Remove the caps and continue the holes to their full depth. Drill or rout pockets in the underside of the top for the hex nuts, as you did with the rail joints in the base of the bench.

If necessary, trim the shoulder block for a perfect fit between the top and the end cap assembly. Rout spline



Use a router with an edge guide to cut the spline grooves in the ends of the glued-up benchtop. These grooves will match the spline grooves you'll form later in the end caps.

grooves on three sides of the block and dry-assemble it. Then, mark the finish length of both end caps at 8½" past the back edge of the top, and cut them to length on a miter or radial arm saw.

The final step before gluing on the end caps is to rout the dovetail sockets in the ends for the backboard. Frank

used a simple router jig similar to the one for the tail-vise dovetails (see *photos*, page 20). The jig uses a 1/2"-diameter straight bit and a 5/8" template guide bushing.

Glue-up isn't difficult, but it is somewhat complicated, so it's good to have a helper, if possible. Start by turning the top over, with a couple of beams underneath it to raise it off your assembly table. Do a dry run first, to make sure you have everything you need, including all the clamps, bolts and splines.

Frank used a brush to spread glue in the grooves and a small disposable paint roller to roll it onto the various surfaces quickly. White glue is a good choice for this application, as it allows more open time than yellow glue.

Get all the parts assembled before clamping them, because they must be tightened in all directions at once. At the shoulder vise end, clamp the big dovetail first with one long clamp lengthwise and another squeezing the joint itself. Then use another clamp to pull the vise arm and the shoulder block tight against the top and two more to



Cut the large dovetail that joins the shoulder vise arm to the end cap with a band saw. Note the angle ramp clamped to the band saw table.

clamp it to the end cap. Now, clamp both end caps at the same time with two 8-foot bar or pipe clamps, and tighten the bolts to pull both caps into tight contact with the ends of the top.

The final step of this main glue-up is to install and tighten the threaded rod with washers and hex nuts at each end (see *photo*, page 21). When the glue dries, plane or belt-sand all the joints flush.

Next, mill and install a solid strip of hardwood behind the row of dog holes. This encloses the holes and provides a larger clamping surface under the front lip of the bench, where you are always clamping workpieces. The backboard and tool tray are next on the list.

Frank likes to use a special piece of wood for the backboard, since it is so prominent on the customer side of the bench. Cut the backboard to the correct width and length to span the end caps. Then, clamp it temporarily to the ends so you can lay out the dovetails. Cut the dovetails with a band saw and clean them up with a chisel.

Now, plow a 1/4"-deep groove in the backboard for the tool tray, at a height equal to the thickness of your benchtop. Rip your plywood for the tray to a width that will underhang the benchtop by about an inch when fully seated in the groove in the backboard.

Glue the tray into the backboard, then install the assembled parts to the bench, gluing and screwing the tool tray to the underside of the bench (see *right photo*, page 22).

To complete the top, install spacer

blocks with screws and glue to the underside, where the top rails of the base will meet the top as shown in the *left photo* on page 22.

Making the Tail Vise

Many woodworkers are nervous about making a tail vise, because it appears so complicated. In fact, it is only parts and pieces, like anything else you make.

Begin by building the tail vise frame, which consists of two jaws



Clean and finish the joint with a paring chisel. Test-fit the joint before you try to glue it up and join it permanently. It should fit snugly but not too tight.



dovetailed to a face piece, and a back runner connecting the front and rear jaws (see the *Exploded View* on page 14). Frank's design uses through dovetails at the rear jaw but half-blind dovetails at the front jaw, to provide an unbroken face-grain surface where it meets the other jaw. Here again, he uses a simple router jig to hog out the dovetail sockets, then cleans them up with a chisel. The tails themselves are band-sawn carefully and then pared to final fit with chisels. While the front vise jaw is still free, joint about 1/8" off the rearward part so you'll be able to resurface the clamping surface of the jaw a couple of times in the future, as necessary.

The dovetail joints that join the back rail to the jaws are also easily cut with a band saw. The top of this runner should be even with the bottom of the end cap when the vise is assembled to the bench. To make sure this happens, drill the clearance hole for the benchscrew in the rear jaw so that it is the same height up from the runner as the benchscrew nut is from the bottom of the end cap. Drill this hole slightly oversize so you have some room for adjustment when assembling the tail vise to the bench. (Refer to the *drawings* for details.)

To complete the tail vise subassembly, you still need to glue a thin piece of plywood to the inside of the face piece to

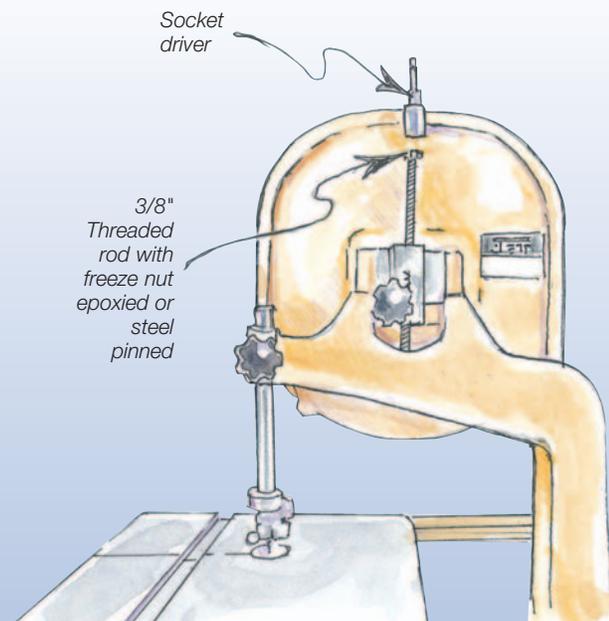


Bar clamps and hex-head bolts with captive nuts connect the end caps to the benchtop. Note the installation of the benchscrew nut in the short end cap.

QuickTip

Band Saw Tension Release

Tensioning and releasing band saw blades can be a chore. Here is a simple solution you can employ on your band saw (a JET band saw is shown here). All you need to buy is a short length of 3/8—16NC threaded rod and a nut. Drill and pin the nut to the rod (or immobilize it with epoxy) and use a regular 9/16" socket driver to change the tensioning.





Through and half-blind dovetails join the face of the tail vise to the front and rear jaws. A simple router jig guides a template bushing to remove most of the material, and a sharp chisel finishes the job.

vise, it is critical to make all the parts accurately and to be sure the runners are parallel to each other and to the benchtop. Before you install the benchscrew, move the tail vise through the full range of its motion by hand to check for binding and interference. Any misalignment or eventual sagging can be fixed by shimming the runners and rails as needed.

Once you have everything running smoothly, with as little slop as possible, you can install the benchscrew. Run it all the way in, center it in the clearance hole, and screw the flange to the rear jaw of the tail vise.

Making the Vise Caps

Next, make the vise caps. The two parts of the cap should be thicker and wider than necessary; you will trim them after installation. Miter the ends where they meet, then set the larger part of the cap onto the completed tail vise, with the inside of the miter aligned with the inside corner of the frame. Mark the bench dog hole locations from the underside, then drill and chop the corresponding holes in the top cap.

Finally, glue the two parts of the cap together at the miter, and assemble them to the frame with glue and clamps. Then plane them flush with the benchtop and tail vise surfaces.

close off the bench dog slots and install the hardwood runner to support the front of the vise.

Installing the Tail Vise

In order to attach the tail vise, you'll need to make two guide blocks and one more runner. The outside guide block bolts to the underside of the end cap, and the inside block is bolted and glued to the underside of the top, where it forms the lower part of the vise jaw. (Again, look at the *Elevation Drawings* for these construction details.) The runner is bolted into a notch in the inner block and slides in the notch in the main jaw of the vise as shown in the lower *photo* on the next page.

For smooth operation of the tail





After clamping all the parts together and bolting the end caps, the final step in the glue-up is to install and tighten the threaded rod that reinforces the shoulder vise.

Finishing Touches

At this point, you are almost finished with your bench. There are just a few more important details left to do.

First, mount the top on the base. Frank uses rock maple “bullets” to register the top to the base. Turn the bullets to 3/4" diameter as shown in the *drawings*. Glue one into each of the two bearing strips on the underside of the benchtop. Drill mating holes in the top rails of the base so the bullets will register the top in the exact location each time you assemble the bench. After you install the bullets, drill through the top rails of the base for the 1/2" lag screws



To assemble the tail vise, bolt the center guide rail to the fixed tail vise jaw and then bolt the outside guide block to the end cap. Finish up by installing the bench screw.



Attach spacer blocks to the underside of the benchtop where it meets the trestles. Then glue one maple "bullet" into each spacer block and drill mating holes in the tops of the trestles to locate the top perfectly each time you assemble the bench.



After gluing the backboard to the ends of the end caps, glue the plywood tool tray into the groove in the backboard and screw and glue it to the underside of the benchtop.

that secure the top.

Next, modify the benchscrew for the shoulder vise. The shoulder vise on this bench is designed to open to about 5½". When the vise is closed, you want the handle to come to rest about 1/2" from the arm of the shoulder vise. The stock benchscrew that Frank used for the shoulder vise was 2" too long, so he had to shorten it.

First, he punched out the roll pin that holds the screw into the handle casting. Then he used a reciprocating

saw to cut off 2" from the end of the screw and ground the end of the screw to fit back in the handle casting. He made a simple V-block jig to hold the screw at the proper height for grinding (see bottom *photo*, next page). Frank screwed the jig to his grinding bench with a single screw at the rear corner in order to pivot the jig toward the grinding wheel. When he reached the right diameter, he reinstalled the screw in the handle. This procedure worked well and took very little time to carry out.

Building the Wooden Vise Jaw

Once you have bolted the top to the base and cut the benchscrew to length, you're ready to make the wooden vise jaw for your shoulder vise. Frank used a 1"-thick piece of rosewood for his, but any seasoned hardwood is okay for this detail. Make it a little wider than necessary so you can plane it flush with your bench after you install it.

The wooden vise jaw has an extension on the left end that fits between the shoulder block and the top rail of

DETAILS MAKE THE DIFFERENCE



Carved Oil Cup



Leather Vise Liners



Ebony Crosscut Stop

Small but important details elevate Frank's bench to the highest level of craftsmanship. The carved oil cup mounted to the underside of the tail vise, for instance, is a handy place to keep a little vegetable oil to lubricate anything that needs it, such as saws and plane soles.

Leather vise liners are another delightful finishing touch

featured on Frank's bench. The leather protects the jaws and the work. When it wears out or gets damaged, you can soak it off and replace it.

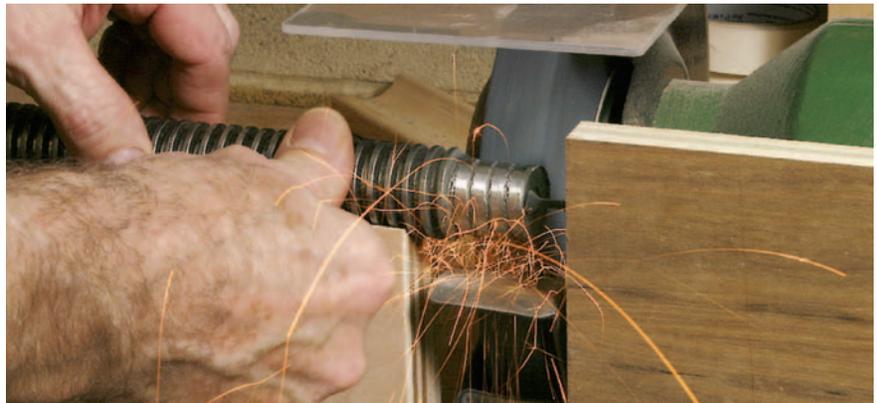
And, of course, the fold-down crosscut stop at the end of Frank's bench is another detail that truly enhances the performance of his classic design.

the base. It is connected to the benchscrew by a cast-iron foot that allows the jaw to pivot left or right to accommodate tapered or odd-shaped workpieces.

To locate the pivoting foot accurately, hold the wooden jaw in place and tighten the benchscrew against it (with the swiveling foot attached), making sure the open side of the foot faces to the right. Trace the outline of the foot onto your vise pad, then remove the pad and rout a 3/8"-deep recess in it to receive the foot. This allows the jaw to open a bit wider, and it looks better, too.

Constructing a Wooden Stop

The wooden stop is another useful feature of this bench. It is simply a strip of tough hardwood—Frank used holly—that fits tightly into a rectangular mortise through the top (see the *drawings*). A tap of a hammer or mallet from below raises it to working height for



Shorten the shoulder vise screw 2" with a reciprocating saw, and then grind the end of the screw to fit in the handle casting. A V-block holds the screw for grinding, and a drywall screw in an adjacent piece of plywood acts as a stop.

planing thin pieces of wood.

To make the mortise, drill a series of 1/4" holes with a brad point bit, and then remove the waste between them with a paring chisel. The mortise should slope about 2° from vertical, toward the right end of the bench. It's a good idea to make the mortise first, then make the stop to fit the mortise.

Frank likes to finish his benches with Waterlox® wiping varnish. A few coats at the beginning and a little more

from time to time keep the bench looking beautiful. Make sure to seal up the entire bench with the finish, including under the benchtop. This will equalize moisture that moves into and out of the wood as the seasons change.

If you build Frank's bench, you will have a friend forever. You may even ask yourself how you worked without this bench up until now. Many years from now, your children will thank you, too.