WORKSHOPS

Expert advice for designing a great woodshop in any space

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The Taunton Press

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ABOUT YOUR SAFETY: Working wood is inherently dangerous. Using hand or power tools improperly or ignoring safety practices can lead to permanent injury or even death. Don't try to perform operations you learn about here (or elsewhere) unless you're certain they are safe for you. If something about an operation doesn't feel right, don't do it. Look for another way. We want you to enjoy the craft, so please keep safety foremost in your mind whenever you're in the shop.

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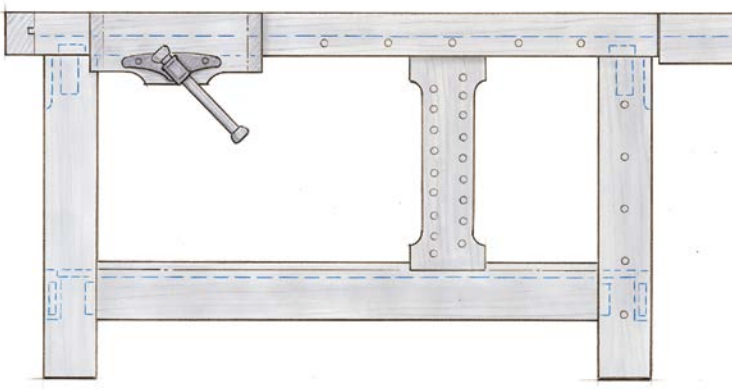

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Introduction

Unlike cutting dovetails, an exercise that inspires reams of regulations (all emphatically expressed if often contradictory), setting up a workshop isn't governed by rules. Every shop is unique, and that's the great pleasure and profit in exploring them. Every shop we enter, no matter how different from our own, offers solutions for storing wood, organizing hardware, displaying tools, laying out machines, bringing in sunlight and keeping out cold—ideas that make a shop more efficient, more personal, and more fun to use.

This book, in place of a strict protocol for setting up a shop, presents a jubilee of options and inspiration drawn from the pages of *Fine Woodworking* magazine, whose editors have the pleasure of visiting hundreds of shops each year.

If you're thinking about refashioning an old space to use for working wood, you might try a former church, an egg-sorting shed, or a firehouse—examples of all three will be found here (each of them, as it happens, inhabited by a well-known woodworker). Other makers in these pages set up shop in small garages, prefab sheds, renovated outbuildings, and freestanding, purpose-built structures. There's a bounty of workbenches here, too, along with tool chests, tool carts, accessory tables, and sawhorses.

You'll no doubt find much to admire and much to adopt as you read this book. The only question is whether you'll need to cut short your reading in order to head out to the shop to implement some innovation or other. Perhaps it would be best to start by building a small bookshelf for the shop.

—Jonathan Binzen,
Senior Editor, *Fine Woodworking*

PART ONE

The Quest for Shop Space

Fine Shop in a Former Garage

MIKE KORSAK

When my wife, Jen, and I moved to Pittsburgh in 2011, the property we purchased had several outbuildings, one of them a somewhat forlorn two-car garage. Despite its aesthetic shortcomings, the building was structurally sound and well situated, and it made sense that it would become my workshop.

Over the next year and a half, I did a gut renovation, stripping the building to its studs, moving and resizing window and door openings, and replacing everything from sheathing to drywall. I was careful in all my choices, because I wanted the shop to be reflective of the work that would be produced inside: functional, understated, subtly embel-

Comfort comes first. To contend with Pittsburgh's humid summers and snowy winters, Korsak buttoned the building up tight and heats and cools it with a mini-split heat pump.

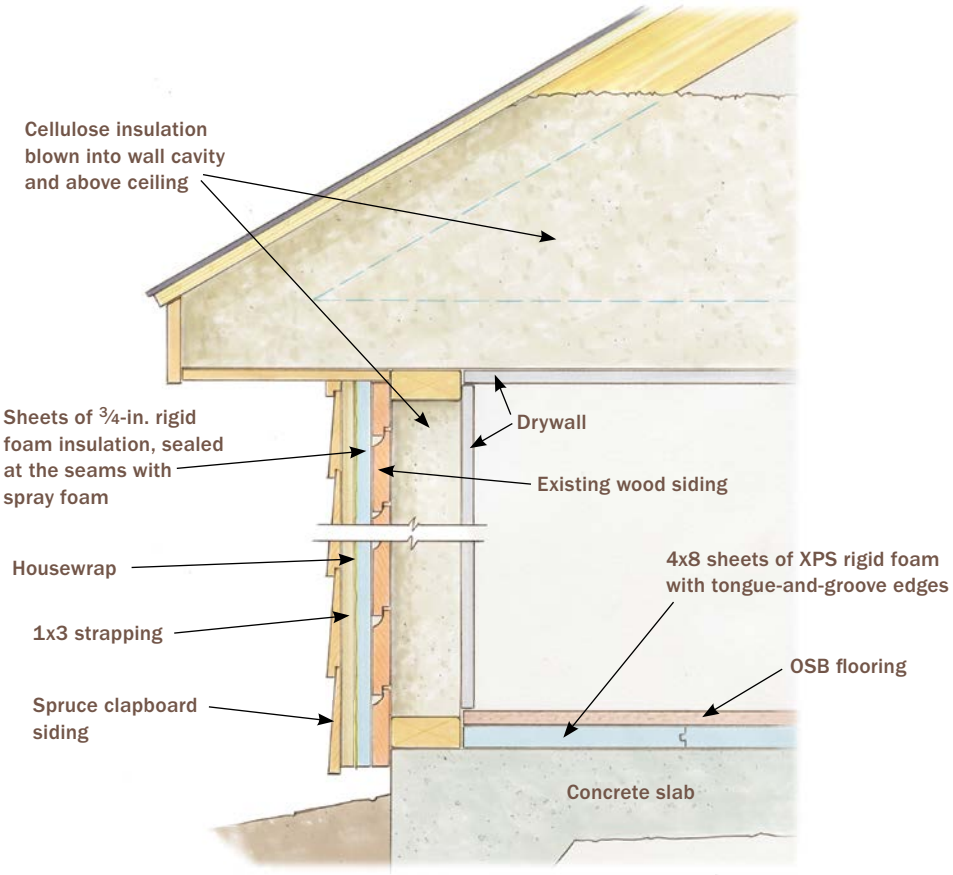
lished, and meticulously crafted with lovely materials. Drawing on my experience working in other shops, and on some research, I aimed to create a space that would be comfortable through Pittsburgh's muggy summers and frigid winters, have plentiful natural and artificial light, and make the most of the building's 20-ft. by 24-ft. footprint.

Working from the outside in

Since the building is fairly small and I was putting a lot of work into the renovation, it seemed justifiable to choose very nice materials. For the siding I used true quartersawn spruce clapboards sawn by Ward Clapboard Mill in Vermont. For the exterior trim I opted for MiraTEC, a pre-primed MDF product designed for exterior applications. I sheathed the soffits with clear, vertical-grain Douglas fir porch flooring, and I built the gable brackets of Douglas fir as well, but with a cabinetmaker's flourish: faceted sapele plugs over the screws. I built the entry door of Douglas fir also, and used sapele for the jambs and sill.

After some deep research, I decided to heat and cool the shop with a Fujitsu ductless mini-split heat pump (see "Heating and

A Buttoned-Up Shop



Cooling Your Shop," pp. 89–96), which has turned out to be a great decision. With this type of system it really pays to insulate well, and after I hired an electrician to upgrade the electrical service and brought in a drywaller, I had an insulation contractor blow cellulose into the walls and above the ceiling. To provide further insulation, as well as air sealing, I installed sheets of ¾-in.-thick polyisocyanurate rigid foam insulation over the existing siding, foaming all the joints and all around the perimeter. Over that layer went a layer of housewrap, followed by 1x3 vertical strapping as nailers for the spruce clapboards.

To insulate the concrete floor slab, I laid down 4x8 sheets of 1-in. extruded polystyrene (XPS) rigid foam with tongue-and-groove edges, and over them I laid a floor of ¾-in. tongue-and-groove oriented-strand board (OSB). I screwed the OSB to the slab with Tapcon screws, just a few screws per sheet.

Consider the layout

With the renovation nearly complete, I began to think about the layout of the space. I knew I wanted my bench to be on the south wall, which would receive the best natural light and provide a view toward the house. I located the jointer on the opposite wall,

roughly centered so the direction of feed is parallel to the long axis of the shop. On the other two walls I built long counters, one for benchtop machines, the other for a sharpening station. I put my cyclone dust collector in the far corner of the shop and I placed the lathe, which I use infrequently, behind the swing of the entry door.

That left the center of the space, where I clustered my tablesaw, planer, and outfeed/assembly table. This arrangement made for less dust-collection ducting and less electrical work, and it enabled me to use one outfeed surface for both machines. It also allowed me to keep a substantial area open on one end of the shop where pieces that are in progress can stand clear of traffic and kickback.

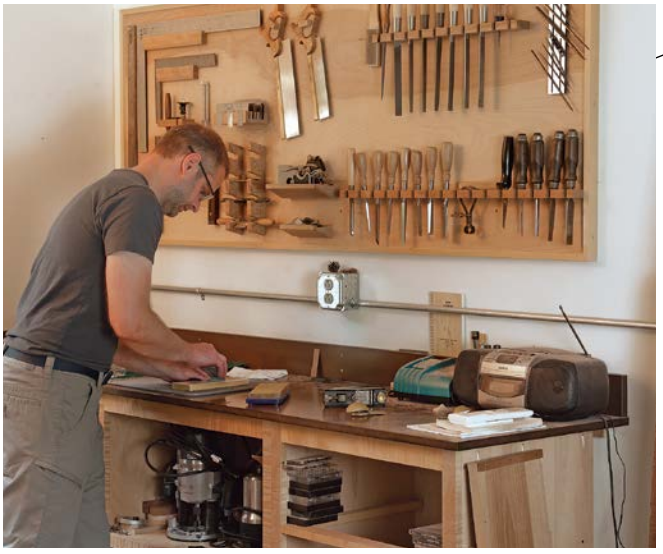
Hanging the hand tools

I love machines—and I've been gradually upgrading mine to heavy-duty vintage American models—but hand tools are just as pivotal in my work, and storage for them was a key consideration as I fitted out the shop. I built a wall-hung till to hold my handplanes, with extra room in case (!) I purchase more in the future, and mounted it to the wall adjacent to my bench. Most of the rest of my hand tools are organized on a piece of solid-edged plywood mounted with French cleats to the wall above my sharpening station. I made a variety of holders for the different tools, and attached them with screws driven through the back of the plywood so no fasteners are visible.

A smart layout

Korsak's shop layout provides efficient dust collection, best use of daylight, and an open space for assembly.

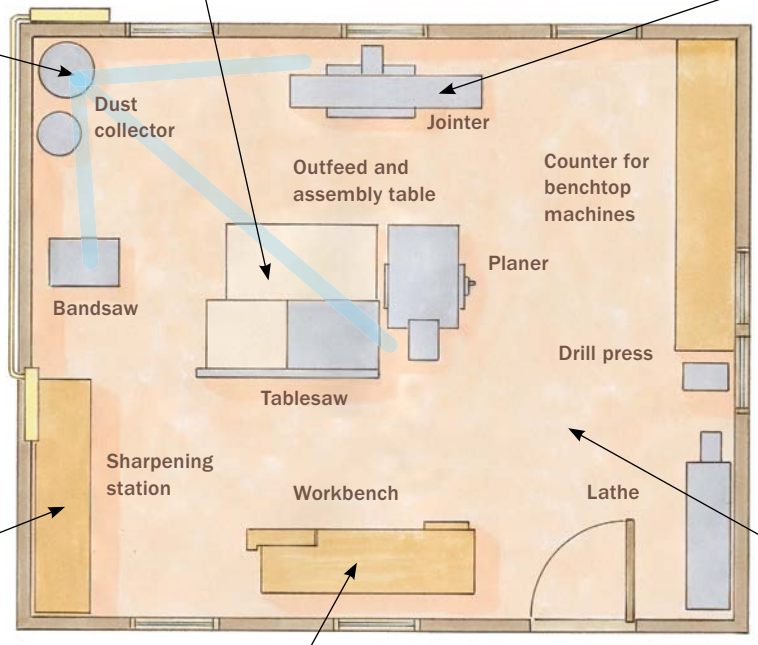
Collection in the corner. With the big machines clustered near the dust collector, only a small amount of ducting was required to serve the tablesaw, planer, jointer, and bandsaw.



A neat array of tools. Many of Korsak's hand tools are fitted in custom holders on the rack above his sharpening station.

Ambidextrous outfeed table. Korsak situated his tablesaw and planer so they share a single outfeed table, which also serves as an assembly table. A shopmade mobile base elevates the planer to make the shared outfeed possible.

New paint on old iron. Korsak has been replacing his machines one by one with vintage American behemoths. He disassembled and completely restored this 1943 Oliver 12-in. jointer.



Best spot for the bench. Korsak located his workbench along the south wall, where the natural light is best. He made a wall-mounted till to keep his handplanes within easy reach.

Upright assembly is out of the way. When projects are coming together, Korsak often sets them in the open end of the shop, which means they're out of primary traffic lanes and safe from kickback.

The Snug, Unplugged Workshop

DAVID FISHER

The little workshop at the back of our house has changed as much as I have since the day some 20 years ago when I first entered it. Today as I dive ever deeper into working green wood, it serves me perfectly. But its history reflects my own journey through the craft.

In 1996, my wife, Kristin, and I bought a century-old house in our hometown—a house showing its age and in desperate need of renewal. Fortunately, we were naïve about the amount of work that lay ahead; as we stood in the odd little attached garage that served as a vestibule, we focused on the potential and ignored the leaking roof.

From garage to home-improvement central

This quirky L-shaped space was 19 ft. deep and 10½ ft. wide, broadening to 15 ft. wide beyond a bump-out of the house. We agreed that our vehicle would stay outside—it was only a car after all. What few tools I owned were moved into this 250-sq.-ft. space that we were already calling the workshop.

For the first year or so, it remained unchanged but for some crude shelves and a cast-off chest of drawers I used as a workbench. It was the domain of chopsaws, caulking guns, paintbrushes, and utility knives as the infrastructure of the house took first priority. Rooms were transformed, floors were installed, and built-ins were built. As the list dwindled, my mind drifted to furniture and carving. It was time to outfit the shop.

A real workshop

I had worked in my high-school woodshop, in my dad's basement, and in the living room of my first apartment, where I clamped boards to the coffee table to carve them, but this would be my own dedicated workshop. I went with what I knew: a basic workbench, low cabinets as a perch for benchtop power tools, and lots of pegboard and metal hooks. The workbench and the row of low cabinets still serve me well.

I stumbled into building a workbench that is as solid as the workshop itself. Using dimensional lumber, I constructed the supporting framework and secured it to the wall studs. I bought two sheets of ¾-in. exterior plywood, ripped them lengthwise, and face-glued them into a four-layer sandwich of a benchtop. I drilled some dog holes and added a face vise and got to work.


THE WOODWRIGHT'S SHOP

I filled the shop with a tablesaw, drill press, router, and other power tools. I also added a ventless gas heater and a second-hand bathroom sink, both of which remain valuable assets. Within three years, our family had grown to four and I built furniture to meet our expanding needs: a changing table, toy chests, cabinets, patio furniture, and various other pieces.

With each new piece my skills and my tool arsenal expanded. Although I was doing some handwork on each project, the tablesaw, router, and orbital sander were still regularly screaming—and spewing a fine layer of dust all over the shop and me time and time again. For that reason and others, I began to consider unplugging my shop.

These reasons began to compound. Nap time had become precious, making the idea of a quiet workshop even sweeter. With many of the home requirements met, I was now able to focus on projects I wanted to explore, and I realized that none of them were facilitated much by a space-guzzling tablesaw. The latest gadgets in the tool catalogs had lost their appeal. I had no scorn for power tools; it just became clear that I wanted to move on without them. In a rare moment of decisiveness, I sold or gave them away.

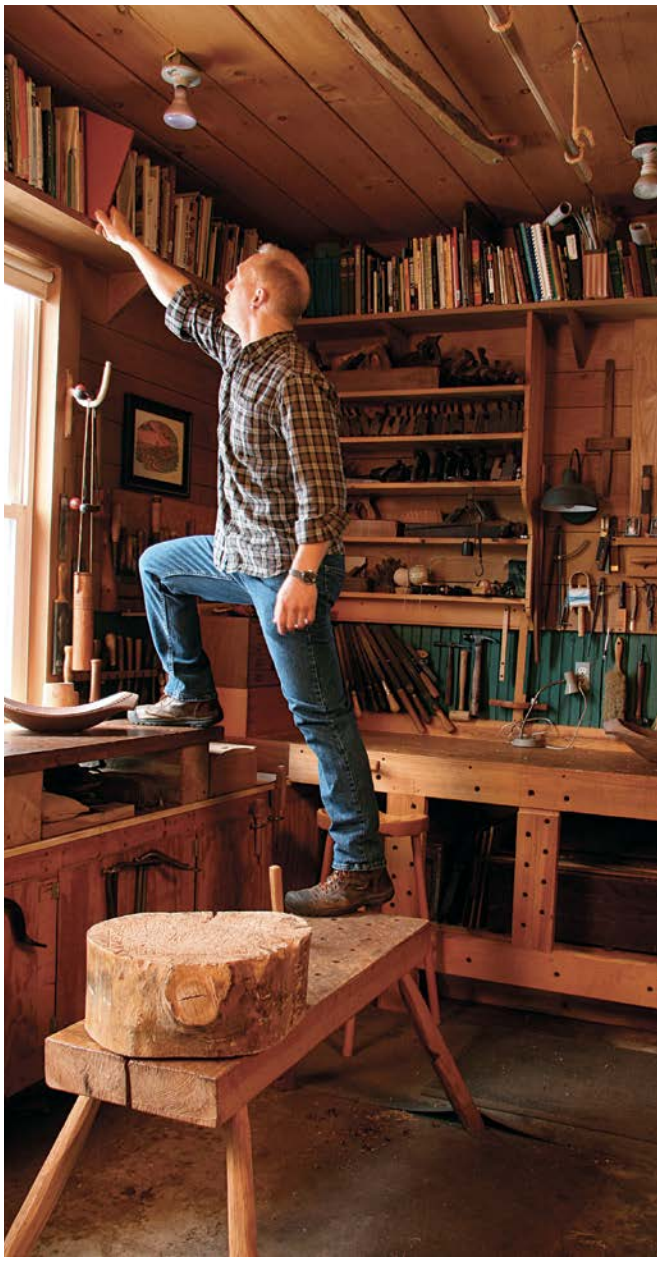
Fine shop furniture. Fisher's canted-leg low bench serves him for chopping (facing page, top right), carving, and for reaching his library of woodworking books (facing page, top left). His bowl horse (above), made from a stout log, pinions a workpiece from front and back.

From dust to chips

With the money from the sale of the power tools, I bought a slew of old hand tools in need of renewal. I focused more than ever on tuning my tools, and built a dedicated sharpening station. I had already been doing some handwork, but I felt incredibly energized by the new challenge and possibilities.

Work in my shop became even more interesting and fun. The pages of books by Roy Underhill and others were guides to adventure. I also continued to expand and stretch my carving skills with works in relief and in the round, and made furniture for our use in the house and lots of toys for the kids. Regardless of the project, there was no dust to settle, only shavings. And it seemed that there was always another exciting road to explore.

One thing I did that smoothed the transition from power to hand tools was to attach an assembly to the front of my existing built-in bench. Constructed from yellow pine dimensional lumber, it has a frame with a sliding deadman, a board hook, and holes for pegs, providing excellent work-holding options.



Rudimentary and rock-solid. Fisher's built-in bench, made years ago from construction lumber and exterior plywood, was upgraded for handwork with the addition of a frame with a sliding deadman.

Decorative tool storage. To make the shop feel more personal, Fisher purged it of store-bought containers. He uses every inch of wall space for storage and display.

Going green

A whole new dimension opened in my work and my shop when I discovered the writings of Drew Langsner, Jennie Alexander, Mike Abbott, and Peter Follansbee. These folks were making things from trees! The shop now became a laboratory for a pole lathe, chairs, shrink pots, shaving horses, riven oak boxes, spoons, timber framing, and especially bowls—I fell in love with carving bowls.

My interest in bowls eventually led me to build two features that have now been at the center of my workshop for well over a decade, a low bench and a bowl horse. The low bench is simply a thick, wide oak timber held at top-of-the-knee height by four splayed legs fit into round tapered mortises. It serves as a support for all sorts of operations, from sawing to boring to shaping with an adze. It even supports my portable chopping stump. Like my workbench, it is pierced by ¾-in. holes for pegs, and for those miracles of work holding, holdfasts.

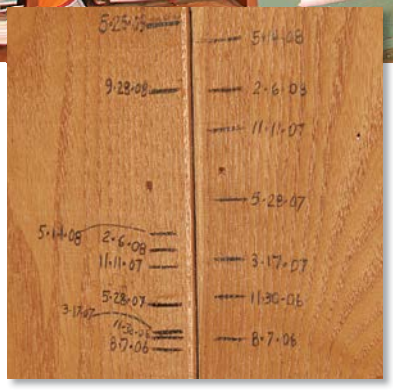
The bowl horse emerged from my desire to work on bowls with a drawknife. The concept was to adapt a traditional shaving horse so that a bowl would be supported by the bed and squeezed end-to-end between the dumbhead and a vertical stop.

The aesthetic movement

I had also come to the realization that this workshop was more than a place for me to make things. The space served as a foyer into our home, a mudroom, and my peaceful retreat. My children would often pop out to work on projects, and every so often we'd record their heights on the wall. One of the things I enjoyed most about the location of my shop just off the kitchen was this accessibility; I was in the shop and at home all at once. I began to pay more attention to the aesthetics of this room that we all at least passed through many times a day. I didn't want to create a showroom. I just thought that I, and my craftsmanship, might benefit from a reasonably attractive, pleasant, uncluttered space. I was after authentic, practical changes. Like a well-designed wooden spoon, a workshop can bring joy not only through its performance, but also by its appearance and feel.

I got started by closing in the ceiling joists with roughsawn pine boards from a local sawmill and insulating above them, making a ceiling with character that also kept the heating bills down. I got a deal on a big stack of sassafras boards and lined the upper walls with them, adding a high shelf running around the room to hold my ever-growing library of woodworking-related books, making use of what would have otherwise been wasted space. I decorated the walls with things I found meaningful and beautiful.

I got rid of plastic storage bins and containers, replacing them with wooden boxes and small chests that are more pleasing to the eye and just as effective at keeping clutter under control. Some I made and some I picked up at garage sales and auctions. Tools that didn't go in boxes I kept within easy reach on shelves or hung from the walls. Carved branch crooks serve as hangers for everything from tools to hats. And a couple of vintage file cabinets provide storage for paper, art supplies, records, and various odds and ends.



Home shop. Fisher's shop is also the main entrance to the house, and his family's coats and hats share space on the walls with his tools, his children's artwork, and a penciled record of their growth.

Change and continuity

Like us, the workshop has seen many changes over these two decades. It's still a humble little shop that has its limits, but limits often encourage resourcefulness and creativity. It has all I need to make what I want. I'm sure the metamorphosis will continue over the years as I continue to explore. Yet much of the character and the story will remain, like the growth chart scratched onto the wall.

Bring Your Shop into the House

MARSHALL FLETCHER

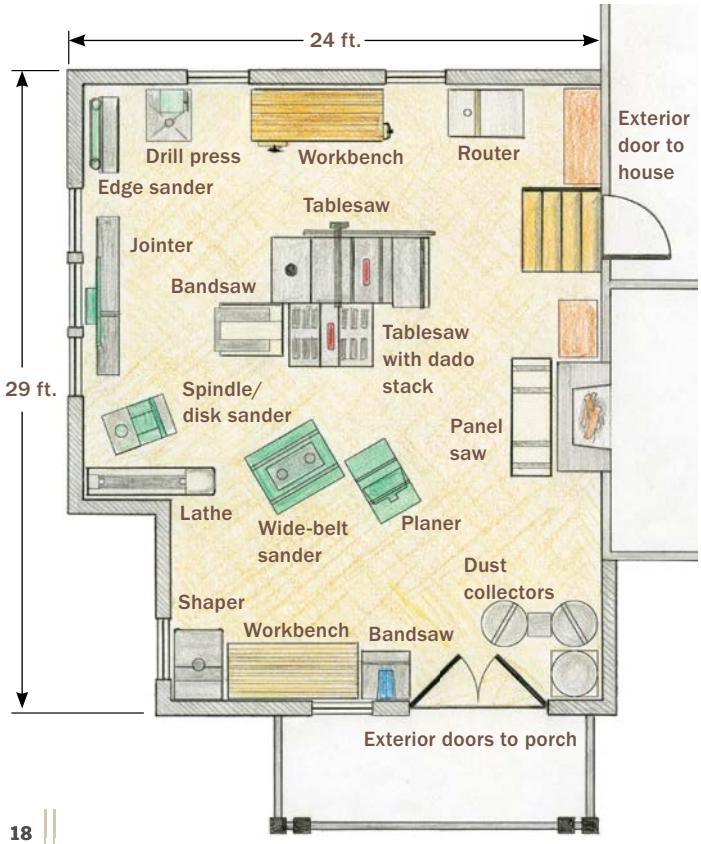
I have been a woodworker for almost as long as I have been walking, and I've been through many shops, starting at my parents' home and then my own, both in my native South Africa and here in the United States. I have renovated, insulated, electrified, floored, and added windows and doors to garages and barns alike. I've built new structures and added on.

The outcome in all cases has been the same: When it came time to sell, I left money on the table. In my experience, nobody cares about how fine your garage or shed or barn is.

So when it was time to start over outside Chicago, I decided enough was enough. I had a little meeting with my wife and sold her on a new approach. My simple plan was to build an addition on the non-garage side of the house and effectively create a utility room, one that can very quickly and easily be converted into a beautiful great room when it is time to sell, simply by applying a fresh coat of paint, swapping out the lights, and dropping down some carpeting.

The outcome has been a fantastic success, with many benefits. For one, we appreciate

Seamless addition. Fletcher's new addition is a roomy workshop for him but will likely be a "great room" for the next owners. He consulted an architect to make sure the addition blended nicely with the house and created bonus spaces for outdoor living.



the value added to the property, which made it possible to spend more and do the job right. By consulting an architect, we also improved the overall appearance of the house, for us and whoever follows. Second, the attached structure is far more energy efficient than a stand-alone space would be, because of the shared walls and also the shop's insulating effect on the rest of the house. There are lots of other upsides. My wife loves it because it is easy to visit, and I appreciate the tea and cookies. My tools are all mobile, so we can use the space in other ways when the need arises. And last but not least, it is an awesome, comfortable work-space in all seasons.

Spend plenty of time on design

I did the first floor plan myself, placing stakes into the ground with connecting tape so we could live with it for a while and be sure it would enhance the outdoor space and not compromise the existing dwelling. I then provided a basic layout to an architect, including suggestions for the placement of windows and doors. He gave expert input, enhanced the design, and produced the construction drawings.

There were key decisions along the way. One was the type of floor: wood frame or slab. A framed floor must be designed for the weight of the machines. It could give you the advantage of extra basement space, but that could also increase the cost, requiring additional excavation and concrete. I did not want to disturb our existing basement walls, as we live near a river flood plain and have no current water problems, so I chose to build on a slab.

I went for a single level, with a high ceiling that still leaves the upper windows of the house unobstructed and creates appealing roof lines. But there is no reason why you couldn't build a second floor above a shop like this, adding living space or shop space.

When it came time to submit the plans for a building permit, I categorized the addition as a "seasonal recreation room," but was up front about the fact that it would be converted into a great room at some point. My local zoning board OK'd the plans and was super-cooperative throughout the building process. Overall, it was comparable to building a garage or other structure.

How much you do yourself is a balance between speed and cost, and must take into account your skill level and what you are willing to try. I used a builder for the big stuff, but did a lot of the smaller jobs myself. By the way, I strongly suggest getting three prices before selecting a contractor, submitting the drawings to each one.

Make smart choices inside

For most workshops, power is a big consideration. I ran a new 220-volt feed to a subpanel in the shop. That saved me routing a lot of extra wiring through the existing structure.

One advantage of a great room over a basement shop is the ability to isolate noise and dust from the living space. Because this is an addition, you are dealing with fully insulated external walls and no sound channels into the rest of the house. That's why I highly recommend installing an exterior door at the entrance to the room, which seals tight against noise, dust, and temperature.

It's also a good idea to keep heating separate to avoid airflow from shop to house,

Roomy and well-lit. Fletcher built skylights and large windows into the design for plenty of natural light. High ceilings make the room more comfortable in the summer.

A Few Tips for Your Shop

Bring an exterior door inside. Used indoors, an exterior door's thickness and weatherstripping seals out noise and dust and prevents them from getting into living areas.

Install a separate subpanel. This lets you tie into the house's power supply with just one line, and ensures plenty of power for the shop.

Simple solution for slabs. DRIcore tiles are affordable, widely available, and easy to install. They include a moisture barrier (concrete tends to wick moisture from below) and have plenty of weight capacity for heavy machinery. Fletcher applied a floor finish to his.

eliminating another highway for sound and dust. For now, I heat the shop with a wall-mounted, gas-fired heater on a thermostat. It is an externally vented unit so I do not get the smell of burnt dust or volatiles such as oil and varnish in the workspace. Because of the high ceiling volume, the room feels comfortable even in summer. Before selling the house I would trade the gas-fired heater for a split heating/cooling unit. The separate subpanel will make it an easy retrofit.

If your HVAC system is large enough for the additional square footage, and if the ducting design permits, you could run a feed-and-return duct to the new addition and just cap it for later.

Freestanding Dream Shop

ELIA BIZZARRI

My first shop was under the hickory tree in my parents' yard. My bench was a picnic table. I made a woodpecker door knocker and a rabbit trap, but I caught no rabbits. My parents bought me my second shop when I was 16. A 10-ft. by 20-ft. prefab structure, it was mostly plywood and 2x4s, with a small window at one end and double doors at the other. It was plenty big enough for a chairmaker, and it served me well for 10 years or so. When I bought my own home four years ago outside Durham, N.C., I knew I'd be building a freestanding shop. In the meantime, the 10-ft. by 12-ft. spare bedroom became my workshop. I worked full time in that room for two years and, except for wood chips in the bed, it worked fine. But it wasn't my dream shop.

Two pieces of advice started me on my way to designing that dream shop. One came from my realtor and friend, Louise Barnum, who said, "I know you think you'll never sell your place, but if you do, a garage would make it easier to sell than a shop." The other came from Louise's husband, Peter Ross, who was the head blacksmith at Colonial Williamsburg for more than 25 years, and is the most observant, consummate craftsman I know. He told me, "If your shop isn't the nicest building on the property, you'll never want to go there."

Converts easily to a garage

Louise is right—I have no intention of selling. But, at 31, I'm not married, and I suppose a woman might conceivably convince me to move. With that possibility in mind, I decided to build the shop so it could become a two-car garage. That decision determined the footprint of the building. At 20 ft. by 28 ft., it is larger than I really need as a chairmaker, but the extra space is useful when I have a handful of students at the same time (and when I have my swing-dancing friends over). The potential conversion also led me to frame the front wall as if it would get two garage doors. I put double doors in one opening, but in the other I installed a

Shop now, garage later. Beautifully tailored for working wood, the shop can easily convert to a two-car garage down the road.

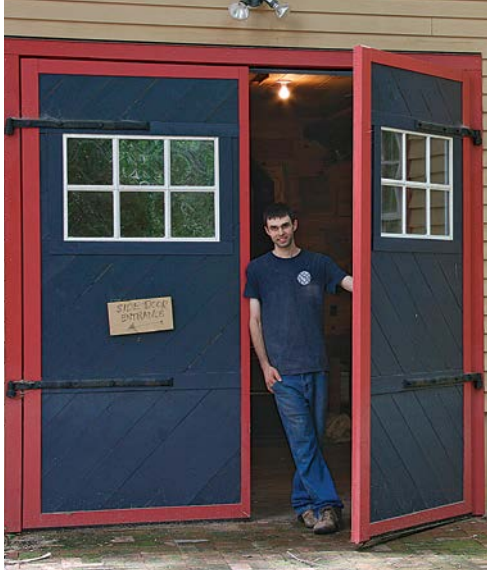
triple-sash window. The window and the framing around it as well as the section of the foundation below it could all be removed without too much fuss to create an opening for a second garage door.

A floor fit for cars and kind to calves

For the shop to convert to a garage, I needed a floor that was strong enough to drive a car on, yet made of wood for my comfort. My architect wanted to pour a concrete slab, put 2x4 sleepers on the slab, and put decking on the sleepers. This conformed with normal building practice, but seemed overkill to me. I considered a floor like the one in Peter Ross's blacksmith shop, which has 4x4 blocks of locust, 4 in. long, laid end grain up like bricks in a bed of sand. Many 19th-century industrial buildings had floors like this. The railroad museum near Atlanta has acres of old 4x6 pine blocks on the repair shed floors around its turntable. It is a gorgeous sight.

But I calculated I would need 2,500 board feet of lumber cut into 6,000 pieces to cover my downstairs floor with blocks. Even if I got offcuts from a pallet mill, this was going to be a lot of work. Peter Ross suggested an alternative: a base of packed gravel, then a vapor barrier, then 4x4 pressure-treated sleepers followed by decking. The building inspections department had never heard of such a thing, but gave the go-ahead since the floor floated inside the masonry walls and was not considered structural. I could make it as I chose, regardless of how crazy they considered it to be.

A local mill sawed 1,600 board feet of oak 2x6s for 50 cents per board foot. In hindsight, I should have gotten 2x8s. Wider boards mean fewer joints, and less wood and work lost in making them. I got a mix of red and white oak, though I would have preferred just the rot-resistant white. After attempting to air-dry the oak over the wettest



summer in human history, I sent it to a kiln to speed things up. Then two helpers and I spent a couple of days with a big planer and two shapers to mill the oak into tongue-and-groove flooring. Though the floor was never sanded, it milled so perfectly that when we unloaded my 600-lb. lathe and slid it across the floor, it didn't catch on a single board.

What for walls?

Aesthetically, my favorite building style is the timber frame. But after coming across a tempting disassembled 1820s timber-frame barn, I considered the amount of work involved in building with it and decided I'd rather put that energy into furniture. I chose instead to go with stick framing, which is very efficient with materials and fast to build.

For efficiency, tools need to hang on the wall near where they are most frequently used. But when I worked in my spare bedroom, the drywall foiled all but my most determined tool-hanging attempts. Plywood works fine for shop walls, but it's ugly. Painted plywood beadboard would look pretty good and, if thick enough, would support hanging tools. But at a nearby mill I found shiplapped white pine paneling for around 60 cents a square foot. This turned out to be ideal: it went up extremely quickly, looks beautiful unfinished, and you don't need a college education to hang a tool on the wall.

Double doors with a fiery finish

I loved building the big double doors, and they have proved unexpectedly attractive and useful. I can drive right into the shop to unload heavy things, roll a cart out into natural light for applying finish, and here in North Carolina, I can leave the doors open most of the year to increase airflow and light.

Based on doors at Mount Vernon, they are made of two layers of ¾-in. shiplapped boards, the inside layer running vertically and the outside layer running at a 45° angle. I screwed them together using nearly 5 lb. of screws. I cut through the outside layer with a circular saw to create a rabbet for a frame of 4/4 boards around the periphery. I also inserted 4/4 boards for the strap hinges. The 4/4 boards probably aren't necessary, but they sure make a nice-looking door, and they should help protect the end grain of the diagonal shiplapped boards.

The best part of building the doors was installing the pintle hinges. They're composed of two parts: the long strap, which attaches to the door, and the pintle, which attaches to the building. The pintle is basically a huge tapered nail, with a pivot for the strap on one end and a slot on the other end that accepts a wedge that keeps the pintle from pulling out of the wall. During framing I put extra 2x6s around the doorway, since the pintles need to go through solid wood. When it came time to hang the doors, I bored a pilot hole through the wall, then heated the pintle in a fire and used it to burn the hole to shape. Locking pliers help to steer the pintle, and a sledgehammer motivates it. If the pintle is hot enough, flames shoot out of the hole. Very exciting!

Well-placed windows. Large windows over the workbenches provide excellent natural light for handwork.

A few good machines. Much of Bizzarri's work is done with hand tools, but that hasn't kept him from acquiring some heavy-duty old machines, including a bandsaw, lathe, and planer.

Let there be light, and lots of it

In my opinion, the single most important feature of a shop is the most overlooked: light. The light in your shop should be as good as any light your work will be seen by once it leaves the shop. You need general lighting, but light coming directly from above tells you nothing about the surface of your work. Raking light, by contrast, shows every dent, tool mark, and scratch. Sometimes raking light is all you need, sometimes you want both. But you always need some raking light.

Natural light is best. I put 8-ft. windows on the north and east walls, and I placed my bench beneath them. In wintertime, from 8 a.m. to 4 p.m., sunlight is all I need. Leaves pose a problem come summer, so I occasionally resort to incandescent lighting. I'm trying to clear more trees, but sometimes it seems the entire forest needs to go—not an appealing prospect.

Fluorescent tube lights work well for general lighting, but I've never liked the color of light they produce. So for general lighting, following the example of my mentor, Curtis Buchanan, I put track lights on the ceiling. With ten 65-watt bulbs and a mix of spots and floods shining on my bench, I get passable lighting. But my ceilings are 10 ft. high, so I don't get good raking light from the tracks, and I could use more general light at night. It may be time to reconsider fluorescents.

I recently mounted a common swing-arm desk lamp on the wall behind my bench. I can instantly adjust the light source where I need it, and then it folds away. It cost a whopping $20.

When it comes to finishing, I rarely use my bench, since a workpiece placed there is backlit by the windows, a blinding situation. Instead, I use a finishing cart, which I can move around inside or out to get the best light.

Chair shop. Bizzarri specializes in building traditional Windsor designs, like this one developed by his mentor, Curtis Buchanan. Bizzarri also makes hand tools and sells chairmaking supplies.

A place to build . . . community

Working in a clean, uncluttered space increases my efficiency and enjoyment, but it also creates a welcoming environment. My shop has turned into a gathering spot, a place to have parties, concerts, and dances.

The place is intensely personal—built with my hands, it is a space in which I work, sweat, cuss, and laugh. In our modern society, work is most often separated from play. The act of making a living is isolated from the joys of family, friends, and neighbors. Where thousands of Facebook friends can become meaningless in their ubiquity, people seem to yearn for personal connection. Maybe my shop is a window to a world where that connection was part of daily life.

Put a Shop in a Shed

KEN ST. ONGE

Working as an editor at *Fine Woodworking* is a great job, and one of the best benefits to the job is access to an amazing shop. It's big, bright, heated and cooled, and full of great tools and machines. You could build just about anything in it.

After I left the magazine for a new job, I did all of my woodworking in my small two-car garage, but it was a struggle. Power, lighting, and temperature control were limited. And because I shared space with our cars I was always moving machines around, often while in the middle of a project. On top of that, my tool and machine collection had long since eclipsed the space. For all these reasons, fixing up the garage wasn't an option. My finished basement is a family room, so it was out, too. An addition to the home or a stand-alone building would have been too expensive. I had to find a better path to a shop.

Then, one day, I saw a flyer for a company that makes and delivers completed sheds to your property, and thought, "Could it work?" As I've since discovered, the answer to that question is an emphatic "yes." Because a pre-built shed doesn't need a cement foundation

and is completely constructed in a factory setting, it's much less expensive than building an addition or stand-alone shop on your property. These sheds can have taller ceilings than a garage and bigger doors than a basement, both big pluses for a woodworker. You can put a shed just about anywhere, which is a great thing if you want to avoid disturbing your sleeping family and neighbors.

There are some challenges. First, you need to do some site work to make way for the shed. And sheds aren't typically built to handle heavy machinery such as tablesaws, bandsaws, and jointers, so I needed the manufacturer to beef it up. It also needed to be outfitted with electricity and insulated against the heat and cold. In the end, I spent around $9,000 to get a shed ready to become a shop. Any site or electrical work you need done will cost extra. I'll tell you about my experience, which should help you decide if this is the right option for you.

Before buying a shed, decide where to put it

The prospect of a new shop is exciting, and I was tempted to pick out the shed right away, but I discovered that I first needed to figure out where in my yard I could put it. It turns out that there are four things that determine the size and location of your shed: local building codes, how level the site is and how accessible it is for delivery, and then figuring out how to get electrical power to the shed.

My town requires a shed to be at least 5 ft. from any property line, and smaller than 1,000 sq. ft. I picked a shed that was 14 ft. wide by 24 ft. long, plenty big enough to hold all of my machines and benches, and well within the town's square footage limit.

Now I had to find a spot for it. Keeping the local codes in mind, I looked around my backyard for an area that was fairly flat and level. If your yard is like mine, there is no spot that's both level and flat, so the next best thing is an area that can be made that way without too much work. Aim for a location with no more than a few inches of elevation change, because you'll need to dig deeper into the high areas to create a level area.

Then I had to lay out the exact spot for the gravel pad that will support the structure. Most gravel foundations need to be at least a foot larger in each direction than the shed, so I marked out a pad slightly larger than 16 ft. by 26 ft.

Before digging, you should verify with the shed company that there are no obstructions

Get the Yard Ready

There is some site prep to do before the shed arrives, some of it requiring special equipment and serious labor. However, many shed manufacturers will do the work for an additional charge.

You might need to take down some trees. Being a woodworker, St. Onge painted the ends of the logs and set them aside for future turning projects.

Firm, level foundation. The crushed stone used to support the shed is easy to level, but the ground beneath needs to be level, firm, and flat, too. That's where the hard labor is.

Path for electricity. To satisfy local building codes, St. Onge had to bury the shop's electrical supply from the main house. Check for other pipes and wires before digging.

Delivery requires a lot of space. A shed might be small for a building, but the manufacturer needs a wide path to get a truck into your yard to off-load the shed onto the gravel pad.

—trees, rocks, fences—that can interfere with delivery of the shed or entry to it. Prebuilt sheds are typically delivered by trailer, so you'll need enough room for the truck and trailer to maneuver, and a grade that's not too steep for them to back over while they're placing the building. Prior to delivery, I had to take down some trees and level my yard's grade.

After you have all of that sorted out, you can get to work on the gravel pad for the shed. Check with the manufacturer for requirements on how deep to make the pad, and what type of gravel to use.

I was hoping the shed would be close enough to my house that I could wire it for

electricity without needing a subpanel in the shed. My electrician said that 100 ft. is the tipping point. Mine was just a bit farther away, so I'd need a subpanel. Per local codes, I also had to dig a trench for conduit and the electrical wires.

Customize the shed for shop use

When I was picking the size and model of the shed, I spoke with the manufacturer about its future life as a woodshop full of machinery. They advised me to reinforce the floor, spacing the 2x4 joists 8 in. on center. This would prevent the floor from sagging under the weight of my tablesaw, bandsaw, lathe, bench, jointer, and planer. The additional joists, it turned out, also made it easier for me to bolt the machines to the floor.

I was planning to heat and cool my shop, so I sprang for the best doors and windows I could afford. The better insulated and easier to air-seal they are, the less expensive it will be to heat and cool the shop. Also, make sure the door is big enough to get machines in and completed projects out. I also had the manufacturer install housewrap between the sheathing and siding (not a standard option) to help prevent water vapor from penetrating the walls.

Add the Comforts of Home

Nobody wants to work in a stark storage shed. Add electricity, insulation, and drywall first, then hang lights, and heat or cool your new shop as needed.

Install the wiring. St. Onge hired an electrician to ensure that all the work was done to code and that the supply was adequate for his machinery and power tools.

I planned to use a wall-mounted air conditioner for cooling, so I asked the manufacturer to frame out an opening for it. The upcharge was less than $100, and it saved me from having to retrofit the opening after the shed was delivered. The shop is heated with a 240-volt wall-mounted electric heater that I installed near the door.

Electricity and insulation complete the transformation

After the shed was delivered, I hired an electrician to install the subpanel and run circuits for lighting and outlets. I had worked out where I was going to put all of my tools beforehand, so I gave the electrician a map identifying where I wanted the outlets and boxes for the lights.

When the electrician completed the wiring, I got to work on sealing the walls, around the windows and doors, and between the floor sheathing. After that, I insulated the walls. I then hung drywall, mudded the seams, and painted the walls.

When I finally used my shop for the first time, it was glorious. I built a hanging till for my handplanes, and it was much more enjoyable than working in my garage. I couldn't be happier.

No matter where you live, seal and insulate. Spray foam along the studs (above left), and caulk between the floor joints (left) minimizes air movement between the inside and outside, while insulation (above) helps keep the shop cool in the summer and warm in the winter.

Hang drywall. Then paint the walls and ceiling a bright color, which will reflect light and brighten the space.

PART TWO

A Gallery of Workshops

Visionary Workshop

JONATHAN BINZEN

It takes vision to design furniture. And to build a shop. When Florida furniture makers Carl Johnson and Kate Swann were looking for a site for their dream shop in 2008, they came across a building in downtown Tampa that was a bit of a nightmare. Built in the 1920s and first used as an auto parts store, it had long been vacant—as had many neighboring buildings. Its blond brick storefront had been infilled with concrete block, the skylights had been roofed over, and there was no power or plumbing. They had to inspect the dank interior by flashlight. As they peered around, though, what they both instantly saw was its potential. A year and a half later, after a thorough restoration, so could everyone else, including the National Register of Historic Places, which put the building on its list, and a number of other businesses that have since renovated buildings on the block. "We wanted a place with a great vibe," Johnson says, "the kind of place that makes you want to go inside." That vision seems to have succeeded. "I can't wait to get to work in the morning," Johnson says. "If I weren't married, I'd probably live at the shop."

Planning the perfect shop

Light and visibility were pivotal in the renovation of the shop. Carl and Kate wanted natural light to be plentiful, and they

Outside: tear down the walls. Removing the concrete-block infill and replacing it with glass transformed the space. Once the glass was in, Johnson and Swann installed solar shades made with a mesh fabric that reduces heat gain without blocking the view.

Inside: open up the space. A load-bearing wall in the middle of the space (1) was replaced with 8x8 pine columns topped with a Parallam beam (2). Johnson and Swann encased the beam in heart pine, mitering the corners so it appears solid. Wanting to run dust-collection ductwork and electrical wiring under the floor, they installed a flooring system of 2x6s on edge on top of the concrete slab (3). Then they screwed down two layers of ¾-in. plywood.

wanted the workings of the shop to be visible from the sidewalk. When they knocked out the concrete block filling the façade and replaced it with large-pane custom windows, daylight flooded in. They augmented that by uncovering the four original pyramidal skylights and having replacements made. And they supplement daylight with a combination of ceiling-mounted fluorescent lights and halogen bulbs in pendant fixtures.

Before they began the renovation, Carl and Kate spent many hours mapping out the workflow and optimum machine placement for their new shop. To represent potential layouts of tools, benches, materials, and machinery, they used chalk on the concrete slab and cardboard cutouts of the major machines, then play-acted their way through various woodworking processes to test the arrangement.

Amazing Shops in Unexpected Places

After seeing the beautiful storefront shop Kate Swann and Carl Johnson created by renovating a 1920s auto parts store in Tampa (see pp. 31–32), we decided to put together this portfolio of more great shops we've seen in spaces converted from other uses.

Reverence for wood

In 1973, Hank Gilpin's woodworking teacher at Rhode Island School of Design, Tage Frid, tipped him off that a Baptist church just north of Providence was about to go on sale. When Gilpin saw the lower-level space where Sunday school, church suppers,

and shuffleboard matches were held—a 30-ft. by 50-ft. single room with a 10-ft. ceiling and no obstructions—he thought it would be perfect for a shop. Forty-one years and thousands of pieces of custom furniture later, he still thinks so. He turned the main part of the church into living quarters for his family. In the shop, beyond adding a window, some lights, improved electrical service, and a woodstove, there was virtually nothing to be done but get to work building furniture.

Furniture in a firehouse

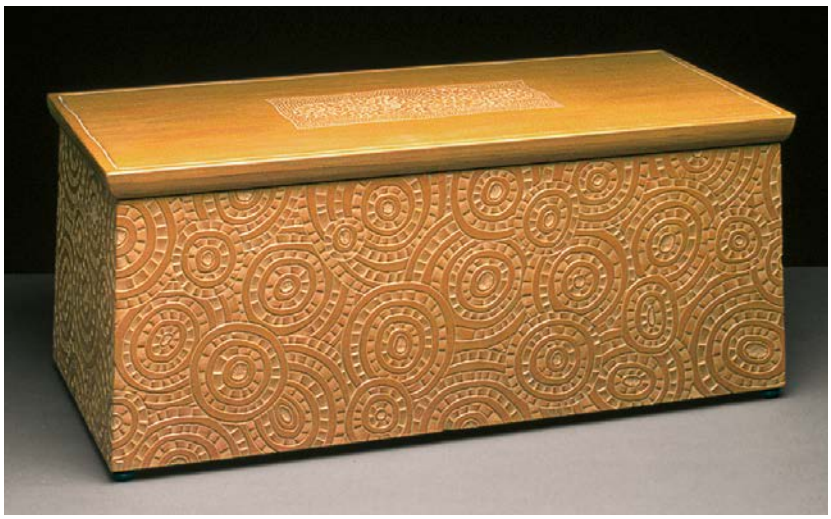
Jeff Johnson, a furniture maker and sculptor in Poughkeepsie, N.Y., was in need of a place to live and work 15 years ago when he came upon this neo-Gothic 1909 fire station. He knocked on the door and asked if he could rent the third floor, which appeared to be vacant. The owner, an electrical contractor using the building for storage, said no, he wasn't looking for a renter; he wanted a buyer for the whole building. With help from the city, Johnson bought the firehouse and renovated the third floor for his home and shop. His brother Jeep, a glass artist, lives on the second floor and has his studio on the ground floor. Jeff, who teaches woodworking and furniture design at SUNY New Paltz, says he chipped away at the renovation bit by bit "as time and money permitted." Asked how long the renovation took all told, he said, "I think we're still renovating."

From hens to handmade furniture

When Johnny A. Williams decided to ditch his marketing job in Manhattan and pursue woodworking as a profession, he found an ideal shop space right behind his mother's house on an old apple orchard and poultry farm in Newtown, Conn. The little red barn, built in 1944 as a henhouse, was a rudimentary structure, with cinder-block walls below and plywood above, and no insulation or power. But working alongside the carpentry crew, Williams soon helped turn the ground-floor space into a snug shop and the loft into a gallery for his mother, Katherine, an antiques dealer. Along with a selection of vintage glassware, ceramics, and furnishings, the gallery also features some contemporary furniture made right downstairs.

Fresh work in the egg shed

Petaluma, Calif., is a small city big into chickens—the poultry population there once topped 1 million. It also has a vibrant art scene, with many craftspeople and artists. The confluence makes for some interesting studio spaces. Furniture maker Michael Cullen has had three shops in Petaluma over the past 25 years. The first was in a former chicken coop, a long, narrow, low-ceilinged wooden structure. The second was in a concrete building with 18-ft. ceilings and drains in the floor that was built as a chicken slaughterhouse. And then there's his current shop, in a former egg-sorting shed, a 40-ft. by 60-ft. corrugated-tin building on an old chicken ranch. The ranch next door has 80,000 free-range birds on the prowl. The shed may lack post-and-beam, rippled-glass, crackling-fire romance, but once Cullen gave the disused space an industrial-strength cleaning and upgraded the electrical system, it made for a terrific shop, where he turns out custom furniture embellished with carving and milk-painted finishes.



Furniture mill

"I always wanted to live and work in the same place," Andy Peklo says. For the last 35 years he's done just that in this 1835 mill built by a wool merchant on the Pomperaug River in Woodbury, Conn. When Peklo, an architect and furniture maker, bought the mill in 1979, "it was a rundown shell," he says, without heat, power, or water, and people had been camping in it. But the building had great bones: a chestnut timberframe on a stone foundation and lots of light from its dozens of windows. Peklo lived there alone for many years as he designed houses, built custom furniture, and worked away on the mill. These days, his shop, which occupies the first floor, remains a one-man operation. But he shares the living quarters upstairs with his wife and son.

Municipal marquetry

In the late 1990s, the town of Easthampton, Mass., built a new municipal facility for its police and fire departments and put its handsome 1885 firehouse up for auction. Only one bid met the minimum. It was made not by a real estate speculator, but by marquetry expert Silas Kopf, who was looking for a shop. When he realized he'd just bought the building, with its footprint of 2,400 sq. ft. and its 65-ft.-tall tower, Kopf came down with a severe case of buyer's remorse. But once he converted the first floor, with its 13-ft. ceilings, to a workshop, glassing in the garage bays and adding heavily insulated stud walls inside the brick ones, that bid seemed brilliant. Upstairs, where the firefighters' living quarters and offices were, Kopf created rental apartments, doing much of the carpentry himself on weekends. As for the tower, it wasn't built for a bell, but for hanging canvas firehoses to dry before they were rolled up for storage.

Factory for craft and art

In the pantheon of ambitious renovation projects, Brandon and Amy Phillips's 65,000-sq.-ft. factory building in Geneva, N.Y., may rank right at the top. When they bought the former straight-razor factory, which dates to the 1880s, all the windows had been boarded up outside and sheetrocked over on the inside. The original 16-ft. ceilings were obscured behind multiple dropped ceilings added one after another over the years. For the first couple months of the renovation, they and a crew of 20 filled a 40-yard dumpster each day. As soon as the building was habitable, the Phillipses got their woodshop up and running and continued the renovation on the side. Much of the factory's first floor is devoted to shop and storage space for their company Miles and May, where they and four employees design and build furniture for houses, hotels, and restaurants. The second floor is home to a nonprofit organization they founded that hosts art exhibits, concerts, poetry readings, dances, letterpress printing workshops, and performance pieces. The third floor? They are still renovating that—in their spare time.

Workshops in the City

JONATHAN BINZEN

Around the world, the boom in group shops is a boon for urban woodworkers. Here, we take a look at what's happening in New York and California, as well as in China and Scotland.

Woodwork in a warehouse: Brooklyn, N.Y.

Canadian furniture maker Reed Hansuld has seen all the advantages and difficulties of group shops up close. He worked in six such shops—in Toronto and New York City—before he and three friends founded Liberty Labs, a collective workshop in the Red Hook section of Brooklyn. Joined in the venture by former publishing executive John Koten, who provided a no-interest loan and a dose of financial savvy, the group formed a corporation with nonprofit status and a mission to provide affordable shop space to emerging designer-craftsmen. Then they spent three months converting raw space in a warehouse on the waterfront into what Hansuld hopes will be "the best place in the city to make this kind of career happen."

In addition to a collection of superb machines, Liberty has six bench rooms for its 16 craftsmen, a kitchen and dining area, office space, and professional photo gear available to anyone in the group. All members pay the same fee, and it covers use of the space, utilities, Internet service, and maintenance of the machines. Routine tasks in the clean-as-a-whistle shop are divided into discrete jobs, which are rotated among the members weekly. For all the amenities the shop offers, one of its biggest assets, Hansuld says, "is just having other people around doing the same thing. We help and critique each other—and feed off the creative energy."

A group shop grows in Brooklyn. Brooklyn's Liberty Warehouse, named for a certain statue just offshore, is home to a multitude of craft shops, including Liberty Labs (top), a 16-person collective. Members there include Pat Kim (rockets, above left) and Jon Billing (textured cabinet, above right).

Toward a new dynasty: Beijing, China

According to 28-year-old Chinese furniture maker Li Chen, in his country, despite its long history of exemplary furniture making, "people don't think of woodworking as something happening in the present. They think it ended in the Ming or Qing dynasties." Chen hopes to change that. After studying furniture making at Rochester Institute of Technology for three years and then spending a year assisting John Sheridan in his San Francisco Community Woodshop, Chen returned to China, where he joined forces with Wu Wei, an accomplished furniture designer who had been conducting woodworking classes for five years in Beijing.

In 2016, Wei and Chen renovated a space in Beijing where they design furniture and also offer short courses in the basics of woodworking. Drawing in part on Chen's experience at the San Francisco Community Woodshop, they plan to introduce a membership system, renting bench space and access to the machine room to individuals and small businesses, making something of a hybrid school and collective shop. In a city with such high rents, it will be satisfying to offer more affordable access to a full shop. But there's more to it than that for Chen, who says, "the ultimate goal is to popularize woodworking in China."

Craft in China. Li Chen (teaching below left) and his partner Wu Wei renovated a space in Beijing where they design furniture and teach introductory woodworking. They also intend to create a membership system for individuals and small businesses.

Scots shop. Set in the heart of Edinburgh and in the shadow of a soccer stadium, the Albion Business Centre houses a wide variety of small creative businesses. The collective woodshop above is home to a dozen makers, including Isabelle Moore (rocking bench and stool, below left) and Namon Gaston and Alasdair Campbell (table, below right).

Creative corner: Edinburgh, Scotland

In 1995, when Isabelle Moore graduated from Parnham College, the English woodworking program founded by John Makepeace, she returned to her native Scotland in search of shop space. Then as now, workable spaces for furniture making were scarce and expensive in Edinburgh, but she found a home in a group shop at the Albion Business Centre, a former soda bottling plant in the center of the city. The building's imposing neighbors include a 20,000-seat stadium for the Hibernian Football Club, which accounts for "the chorus and stamping of fans in the stands that reverberates through many a weekend working in the shop."

Twenty-three years on, Moore, who travels frequently for residencies and teaching, still maintains studio space there, though in a different shop. In the years since, development in the area "has gone bonkers," she says. The Albion is filled with small creative companies, and in addition to more than a dozen furniture makers, there are other shops with leatherworkers, jewelers, glassworkers, guitar makers, even a gin distiller and a taxidermist.

Elevated craftsmanship: Los Angeles, Calif.

When Laura Zahn moved back home to Los Angeles after spending a year studying furniture making at the College of the Redwoods in northern California, finding a place to work wood in the city was a struggle. She eventually rented bench space at Offerman Woodshop and enjoyed her two years working there so much it prompted her to found a group shop herself: "I wanted to be able to offer other furniture makers what I was looking for when I moved back to L.A.—quality tools, a bench to call my own, and a community of furniture makers."

She's done just that with her Allied Woodshop, a well-equipped collective shop on the 10th floor of a downtown building with a broad view of Los Angeles. Zahn owns the machines and sublets space to six other furniture makers. Not content to provide shop space for a handful of furniture-making colleagues, Zahn has also set up a program of monthly workshops for beginning woodworkers, taught by members of the collective. The idea behind them, Zahn says, "is to share our love of the craft, to increase exposure to what we're doing, and to educate people about what it means to make custom furniture."

Going up. Laura Zahn's Allied Woodshop is a collective workspace on the top floor of the Allied Crafts Building in L.A.'s garment district. The shared machinery is geared toward fine furniture making, and the space is home to seven woodworkers.

Belt-Driven Beauties

JONATHAN BINZEN

When Bob Berghorst, of Zeeland, Mich., went looking for equipment to create a woodworking shop as it might have appeared in 1900, he didn't have to go very far. In that era, nearby Grand Rapids was the hub of the largest concentration of furniture factories in the country, all of them stocked with robust cast-iron machines driven by line shafts.

Berghorst, who built prototypes and models for the furniture industry and then ran a business making custom plywood, had acquired and restored many old machines over the years. But when he decided to turn back the clock on one section of his metal-clad, pole-built shop, he began frequenting old factories and salvaging shafts and pulleys, belts and beams, lights and windows. Working amid the whirring belts is transporting, he says: "It's an amazing feeling." He invites others to visit the shop (blberghorst@hotmail.com).

PART THREE

Laying Out Your Shop

Make Better Use of Your Space

ASA CHRISTIANA

Since workspaces vary so widely—from cavernous lofts in industrial buildings to the corners of basements and garages, down to hallways and closets (I've seen it!)—it's hard to make definitive statements about shop layout. Except one: It matters, a lot.

Just like having a workspace that is too hot, too cold, or too dark, a disorganized floor plan means woodworking won't be as much fun. With too much fussing between every task, your frustration level will mount. Ever wonder why you are hesitating to head out to the shop? If it's not plain laziness, it might be one of the culprits noted.

I can't help with chronic lassitude, but I can give some advice on shop layout, with help from a few of my friends. To fathom the feng shui of an efficient shop, I reached out to a number of *Fine Woodworking* authors with well-organized workspaces and settled on three that reflect the most common situations.

I discovered a number of familiar themes. For one, while shop spaces range widely, most of us end up with a similar set of equipment.

Large shop. Even if you have a roomy shop space, thoughtful organization will save you some walking, make dust collection easier, and leave open areas for lumber handling, assembly, and more.

Medium shop. Most of us fall into this category, with roughly the space of a two-car garage or less. With a smart layout, good storage solutions, and a ruthless eye for superfluous tools, this is all the space a serious hobbyist needs.

Most also need some storage space for lumber, power tools, and other supplies; a router-table solution; and at least one other waist-high work surface, aside from the workbench.

Another common theme is that each of these woodworkers took the time to think about how he works and what he uses most often. In all cases, the tablesaw and workbench were placed first, since they are used the most and require the most elbow room. But after that, these guys came up with a variety of smart layout solutions. Also, space needs vary for hobbyists vs. professionals. That's because time is money for the latter. The rest of us can live with a bit of shuffling to make things work.

One last note: If you choose to work with hand tools only, many of these rules don't apply. Even if you make exceptions for a jointer and bandsaw to speed things up, you'll be able to work comfortably in much less space, with only a workbench and tool cabinet to accommodate.

Small shop. Even if you only have a single room in your house or a corner of the basement, you can be very happy and productive. The keys are choosing your compromises wisely and maximizing every foot of vertical and horizontal space.

Working pro needs extra space, but layout still matters

Chris Becksvoort built his shop in the early 1980s out of lumber from the local sawmill. He did most of the framing and installed the floor, which is 1½-in.-thick hemlock. A few friends helped with the main support beam down the center of the shop and with the roof shingles. An electrician did the 120/240 wiring. In 2014 Becksvoort updated the roof to standing-seam metal, and reports that "snow slides off in a hurry."

Chris Becksvoort
professional furniture maker
New Gloucester, Maine

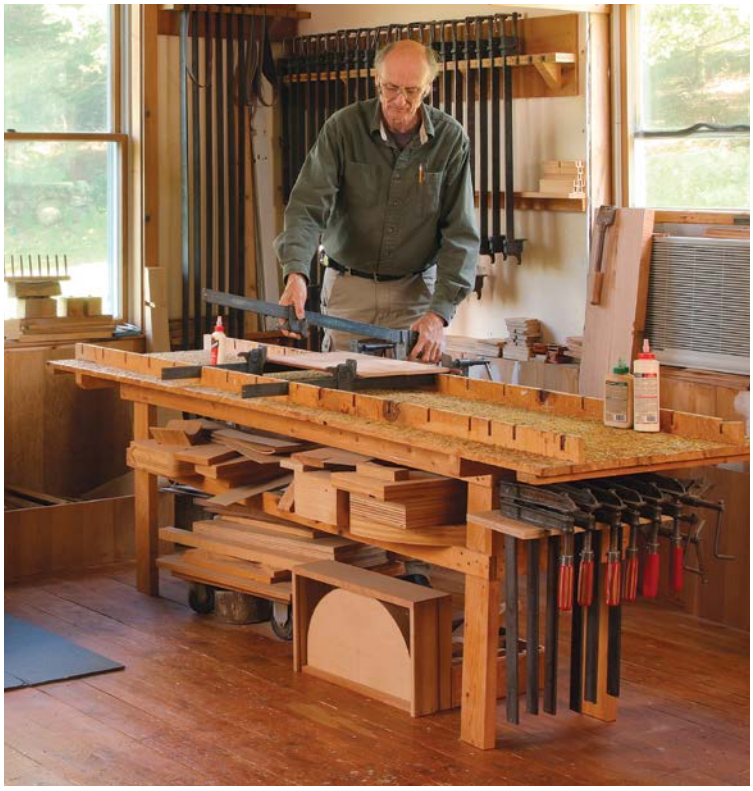
Outbuilding, 24 x 40

Hand tools within easy reach. One corner of Becksvoort's shop is dedicated to benchwork. His custom-height bench is located near his wall-mounted tool cabinet. And counter-height cabinets along the wall provide ample storage for handheld power tools.

The center of the shop is obstructed by a support post and a set of stairs, which lead up to his lumber loft and can be folded upward if necessary. But Becksvoort has never had to do that. Instead, he parked three machines around the stairs, and tucks scrap bins and other items below.

Becksvoort keeps his big Lie-Nielsen workbench out in the open, and most of his work happens on or around it. Nearby is a long counter with storage for routers and bits, sanders, clamps, fasteners, a Bose audio system, and the phone ("It's a dial phone with a really loud bell I can hear when machinery is running"). Above the countertop and close at hand for benchwork is his big wall-mounted tool cabinet.

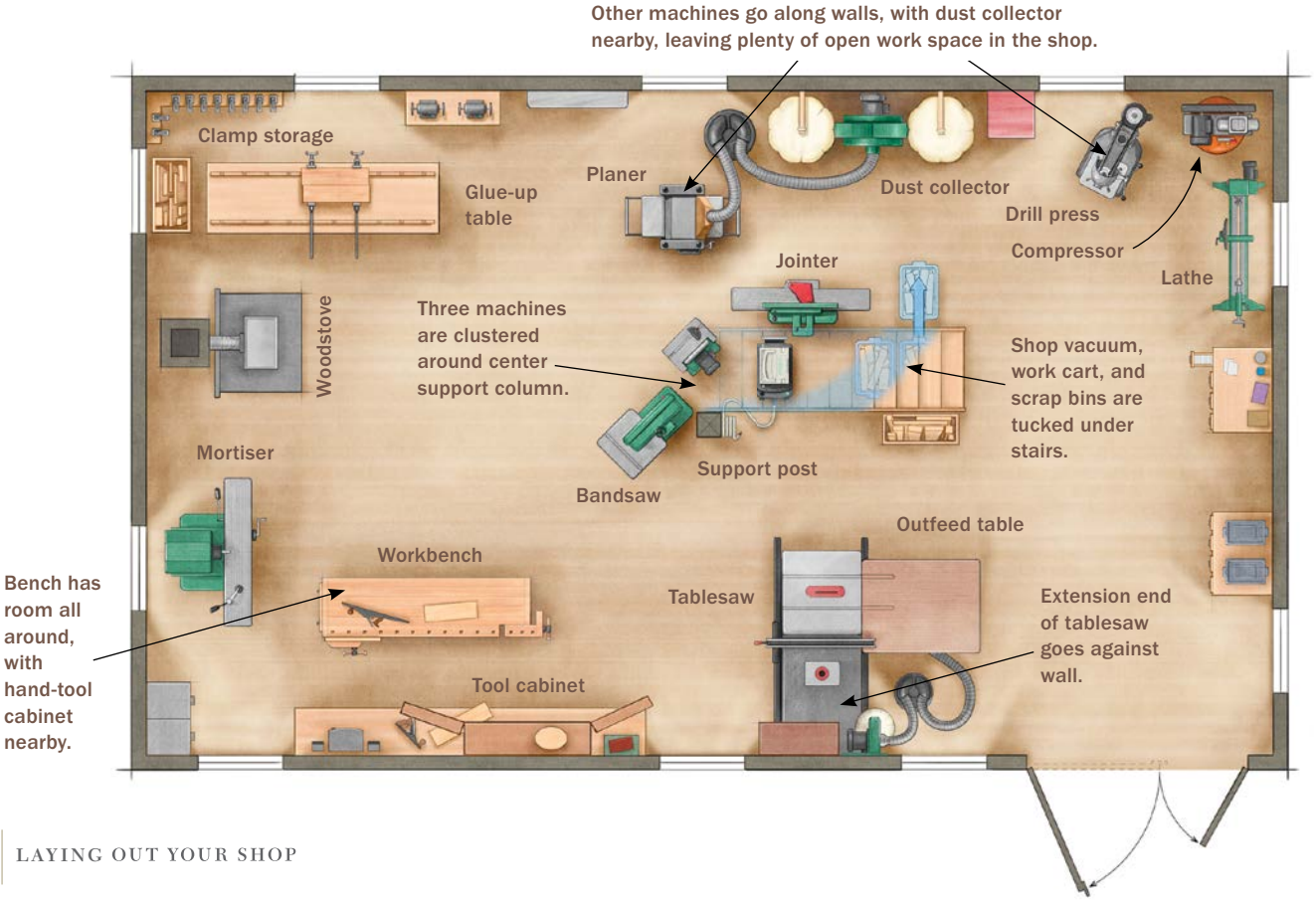
The other dedicated workstation that juts into the shop is Becksvoort's 7-ft. glue-up table with slotted rails for bar clamps. Most everything else in this shop is along the walls, leaving plenty of assembly and work space in the middle, critical for a working pro. Like many woodworkers, Becksvoort realized that his tablesaw doesn't need any extra room on the extension end, so he parks that against a wall, leaving plenty of room for



A corner for glue-ups. Becksvoort's solid-cherry Shaker furniture usually starts with glued-up panels, so a dedicated clamping table is a worthwhile investment in floor space. He assembles doors there, too.

Little island at the support post. Becksvoort turned an obstruction into an asset by attaching power outlets to it, and clustering his bandsaw, jointer, and sander nearby. Related accessories hang on the post, too.

No space goes to waste. Longer scraps find a home in bins along the attic stairs, with bins for smaller scraps tucked under the staircase. The ceiling beam holds clamps and sawblades.



Michael Pekovich
hobbyist/part-time pro
Middlebury, Conn.

Garage, 20 x 20

infeed and outfeed on both sides. His lathe sits in front of an east-facing window, which offers wonderful light for morning turning sessions.

A small garage can pack a punch

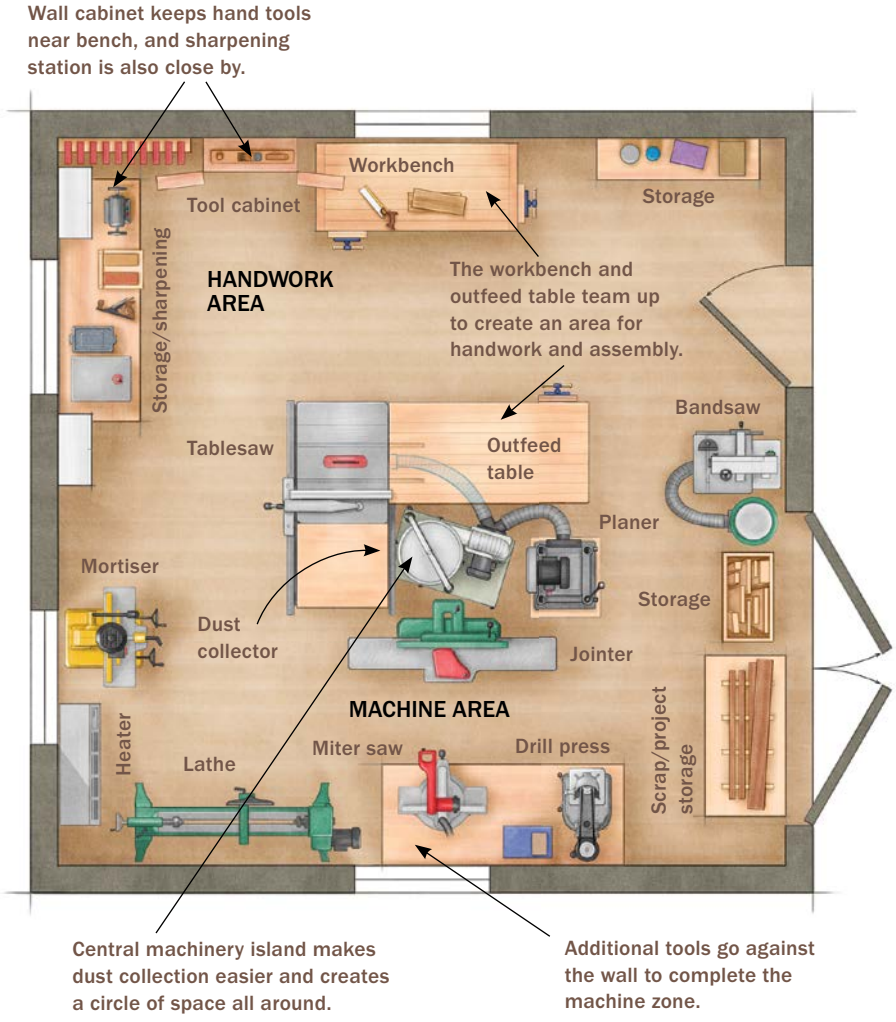
Fine Woodworking creative director and frequent contributor Mike Pekovich also makes furniture professionally, at least part-time, in his vintage two-car garage. The 20 x 20 building was small to begin with, but after insulating the cinder-block walls, the usable space was reduced to a cozy 18 x 18. "I knew that I had to make every inch count," Pekovich says. "That meant I had to give up on the idea of storing lots of lumber in my shop. A lumber shed is in the plans, but for now, I buy stock as projects come along, and when scraps build up too much, they go

Double-duty outfeed table. Pekovich built his tablesaw outfeed table with a sturdy trestle base and solid maple top. Outfitted with a cast-iron vise, the table serves as a second workbench and an assembly table. On large projects, even the tablesaw top lends a helping hand.

into the woodstove. Finally, anything that is used only on occasion goes up to the attic and out of my way."

Pekovich has never been a fan of mobile machines and not just because he doesn't want to have to stop working to rearrange them. "The rolling bases I've used are too wobbly, and once the shop gets cluttered up, it's difficult to move things at all." His solution is a central machinery island, an idea favored by many woodworkers. He says the "doughnut of space" around the island serves as infeed and outfeed for the machines and offers easy access to everything else in the shop.

But the heart and soul of the shop is the hand-tool area, Pekovich says. He is not the first to center his workbench under a window, both for the visibility and the view. And a wall-hung tool cabinet is another common touch. But his tablesaw's outfeed table, which has a solid maple top and cast-iron front vise, is innovative. "I use it both as a workbench and assembly table, and it's the smartest move I made in my shop." Also near the bench is a 15-drawer cabinet that holds a variety of fasteners and power tools, with the top serving as a sharpening station.



Storage, storage, storage. Hand tools are stored in a wall cabinet near the workbench. A 15-drawer cabinet, which houses hardware, router bits, and power tools, also serves as a sharpening station. Most of the wall space is taken up by hanging cabinets, shelves, and plywood backboards for hanging up jigs.

Machine central. The tablesaw, jointer, and planer are clustered in the center of the shop where a dust collector can easily pick up the chips. A shopmade stand raises the planer to allow infeed and outfeed clearance over the jointer bed in front and tablesaw outfeed table behind.

Long boards, no problem. Pekovich's miter saw and bandsaw are centered on separate walls, allowing for maximum infeed and outfeed clearance. For additional support at the miter saw, Pekovich slips a board rest under the lathe bed.

Rob Porcaro
hobbyist/part-time pro
Medfield, Mass.

Spare room, 11 x 17

Smart tool choices. Porcaro stores his hand tools in a large floor-standing cabinet. Even so, space is limited and he says that any new tool must be an upgrade for an existing one.

In the smallest spaces, plan vertically and horizontally

Rob Porcaro is "quite proud of his little workshop," which is in a spare room of his house. That gives him the benefit of hardwood floors, climate control, and a very short commute. Acoustic paneling on the doors keeps the family happy.

To make the space work for the usual mix of hand and power tools, Porcaro has engineered almost every inch, both horizontally and vertically, the latter by closely matching infeed and outfeed surfaces, letting him place tools much closer together, and building a number of smart racks for clamps, lumber, and parts in progress. He has enjoyed fine-tuning the space and has covered the process extensively in his blogs at RPWoodwork.com/blog.

Porcaro began his layout like most people do, by locating the workbench. His first thought was to put it under the windows,

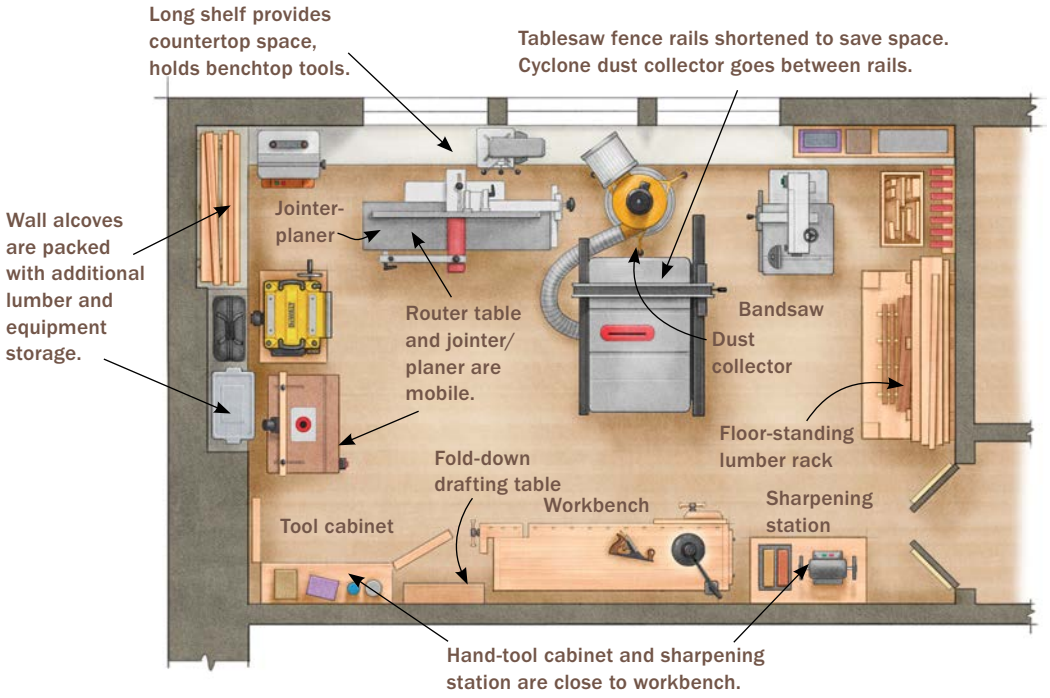
Flexible lighting. A desk lamp attaches to the left side of the workbench (above) for the sharpening station and to the right for the small fold-down drafting table (left).

but he decided to place it along the opposite wall for a number of reasons particular to his space. For one, he anticipated that the baseboard heater element under the windows would get packed with chips from the bench. Also, he wouldn't have as much wall space for placing his tool cabinet nearby. And last, his electrical outlets were on the window side. So it made more sense to park his machines there.

Porcaro took a calculated risk with his tablesaw, cutting down the rip-fence rails to the maximum capacity he tends to use, just over 24 in. That allowed him to create more room around the other side of the saw for infeed, outfeed, and crosscuts. He says he has rarely had to move the saw. A small cyclone dust collector is tucked in near the wall between the saw's rails. One 4-in.-dia. dust hose reaches all the machines, with a simple press-fit connection. No blast gates needed. This is where having a small shop is a good thing, Porcaro points out.

He is able to keep his bandsaw in place most of the time, but his router table and 12-in. jointer/planer must be moved to work. He stores an additional thickness planer (with a Shelix cutterhead) on top of a secondary tool chest. When needed, it goes atop a Workmate stand that normally hangs on a wall. Similarly, he "muscles" a benchtop drill press and an oscillating sander onto the Workmate from their storage places on the long shelf.

To make his cozy workshop work, Porcaro keeps only what he needs: "It's like the salary cap on a pro sports team—every tool has to perform with value."



Dust collection is simple but effective. A portable cyclone with a single hose and slip fitting can service the tablesaw, bandsaw, and jointer/planer without being moved.

Chopped saw. Porcaro cut down the rip fence rails on his tablesaw to save floor space. The resulting 24-in. capacity is more than enough for the type of work he does. Instead of a dedicated outfeed table, he breaks out a tilt-top support stand only when needed for long rips.

Jointer/planer packs a lot of milling into a small footprint. The 12-in. machine can handle heavy milling tasks but rolls neatly out of the way. Porcaro makes sure to tackle all of the milling tasks on a project at one time, and doesn't see the mobile machine as an inconvenience. "It forces me to really think through a project before I begin, which has increased the efficiency in my work."

Tools Drive the Design

JONATHAN BINZEN

Jim Tolpin spent 30 years working wood to the buzz and whine of routers, sanders, tablesaws, and other implements essential to the efficient operation of the small production cabinet shop he ran in Port Townsend, Wash. Eventually, though, the noise and dust took the pleasure out of the profession, and Tolpin quit. It was a reacquaintance with hand-tool skills, which he'd first tasted during his days as a boatbuilder in the 1970s, that rekindled his desire to work with wood.

The new pleasure also revived an old idea: "For years," he says, "I'd carried it around in my head that one day I'd have a shop that was quiet and clean and freestanding." That's just what he has now in his leafy side yard: a shop built expressly for using hand tools, with dedicated stations for sawing, planing, boring, and chiseling, and no space for power tools.

Abel Dances, a carpenter who teaches at the Port Townsend School of Woodworking, where Tolpin is a co-director, built the shop with help from Tolpin and some recent graduates. They did much of the work with hand tools, right down to planing the exterior moldings with hollows and rounds. Since moving his tools into the shop, Tolpin has built, along with some furniture projects, the divided-light shop windows as well as the Dutch door, which he made with a stash of prime Honduras mahogany and a porthole, both remnants of his days building boats.

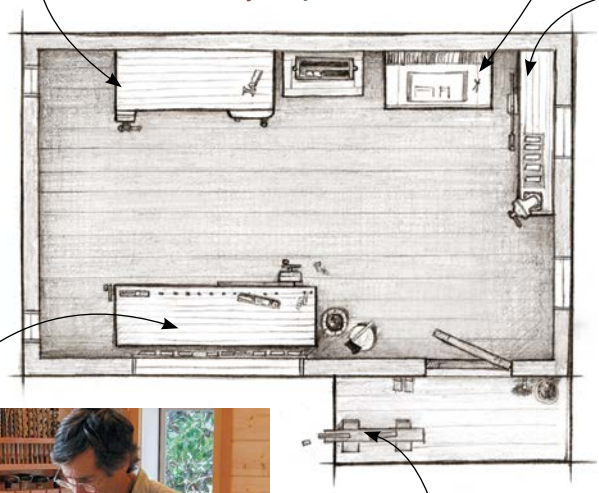
Haven for hand tools

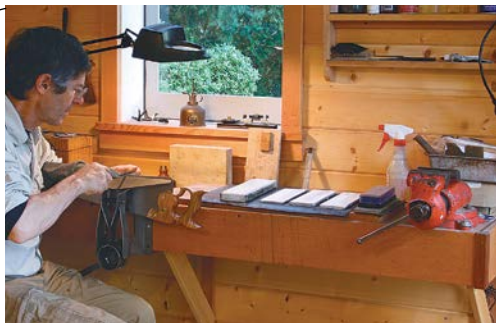
Tolpin designed his 18-ft. by 11-ft. shop, he says, "to create the most efficient workspace possible for hand-tool woodworking." He divided the snug shop into workstations—planing and boring on one bench, fine joinery on another, sharpening on a third—customizing the height, size, and work-holding devices at each bench to their intended uses, and creating storage for the appropriate tools within arm's reach.

The shop's design was inspired in part by many visits to Colonial Williamsburg, where, Tolpin says, "I was always impressed by the beauty and simplicity of the shop buildings—and of the work the craftsmen were doing." He also noted that four traditional craftsmen could work efficiently in a very small space.

Finer work at a greater height. The tall shoulder vise at Tolpin's joinery bench brings fine work up close. The benchtop is also elevated to suit joinery work.

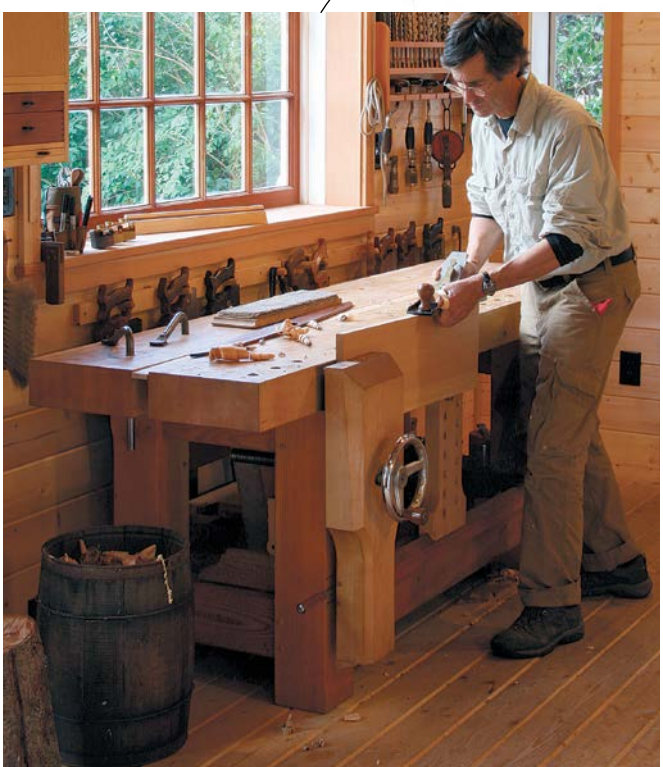
Draw and drop. To conserve space, Tolpin built a stand-up drafting table that folds down when not needed.





Get sharp. Along with his ceramic stones and diamond plate, which live on a rubber mat, Tolpin's wall-mounted sharpening bench features a saw-sharpening vise and a task lamp with a magnifying lens.

Perfect height for planing. Tolpin placed his heavy-duty workbench, with its low height suited for sawing, chopping, and planing, beneath the large front window for maximum daylight on the work. By setting the bench away from the wall, he gained hanging space for a range of handsaws.



Outdoor sawing. A saw bench on the porch is where Tolpin cuts raw stock to rough size before taking it into the shop. The bench is also useful for roughing stock with a hatchet.

Organize Your Shop with Smart Carts

ROBERT O'BRIEN

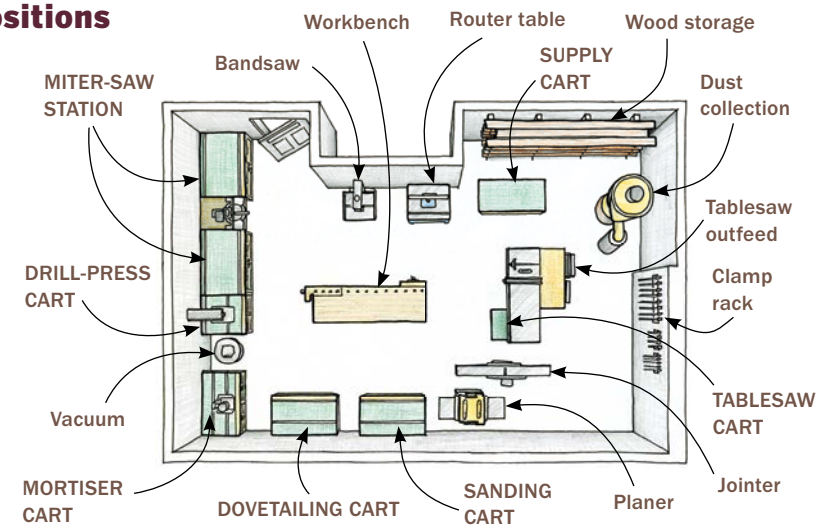
Cart smart. Dedicated tool cabinets make this shop versatile, organized, and efficient.

For a long time I was an armchair woodworker; I had always wanted a woodshop, but never had the space. So when I designed a new house for my wife and myself a few years ago, I included a shop. It started out modestly, with just a Sjöbergs bench in the middle of the space. Then I began fitting it out with tools and machinery. As I bought each machine, I built a dedicated station designed to hold all the accessories, tools, and hardware used with that machine. I could have built a big, central storage cabinet, but that would have meant a lot of walking back and forth; with dedicated stations, I'd have what I needed right where I was working. I decided to make the units mobile, allowing me the flexibility to change the configuration of the shop. That also made the carts more versatile, permitting me to use them as auxiliary work surfaces and as temporary infeed and outfeed tables.

Although I was a novice woodworker when I started work on my shop, learning new joinery and techniques with each cart I built, I am an architect by trade, and I've had decades of experience organizing spaces. I

Starting Positions

Nearly all the storage units are on wheels, so they can travel to provide an additional work surface or infeed/outfeed support.



Tough and slick on top. The tops of all carts are ¾-in. phenolic plywood, with a nonstick surface that looks and wears like plastic laminate. A layer of ¾-in. MDF below adds mass. The tops are lipped with long-wearing solid maple.

brought all that training to bear as I worked out the design of the carts, and they've proven to be a pleasure to use, almost automatically keeping my shop organized and making the workflow efficient. Looking back, I'd say the thoughtful use of space in carts like these is more important than any specific construction approach.

Fundamental features

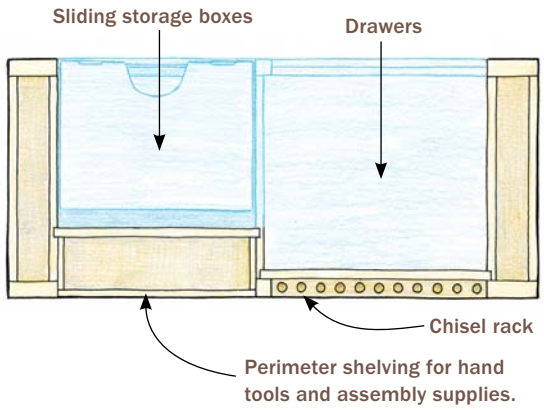
Although details changed from one cart to the next as I tailored them to the different machines, a number of features and materials remained constant. The main cabinet structure is a solid-wood frame with plywood panels and partitions. I used hard maple—solid and plywood—as my primary material, because it is hard, light in color, and easy to work. For extra weight and stability I gave each cart a double-thick top and bottom—a

Mobile below. 5-in. double-locking casters with urethane wheels roll beautifully on a concrete shop floor. The positive double-locking system prevents the wheels from rolling and the casters from swiveling.

A cart for hand tools and hardware. With spacious drawers for hand tools, slots for hardware-organizer trays, and shallow shelves for glue-up supplies, this cart is designed to be used in tandem with the workbench. The plastic organizer trays slide on waxed maple runners and can be pulled right out of the cart.

Perimeter shelving. The cart has shallow shelves on three sides for frequently used tools.

Drawers Wrapped in Shelving



layer of ¾-in. plywood with a bottom layer of ¾-in. MDF. To make the tops extra tough, I used phenolic-surfaced plywood, which provides a smooth, glue-resistant surface that has proved to be quite durable. In most of the carts I set T-tracks flush into the top, giving me a way to clamp machines, fences, and workpieces firmly and quickly to the cart surface.

To make the carts mobile, I used 5-in. double-locking urethane casters, which roll smoothly and lock down securely. I finished the carts with two or three coats of satin polyurethane wiping varnish.

First cart was a general storage unit

My first cart was a place for hand tools, hardware, and small supplies. Since I anticipated using the cart while at my workbench, I made it the same height as the bench so a workpiece could span the two. I had room for two banks of drawers, but I liked organizing my hardware in Stanley

Sanding and sharpening cart. This cart brings together machines and supplies for sanding and sharpening and also serves as a planer infeed surface. A dedicated shop vac handles sanding dust.

Easy access. Shallow drawers on heavy-duty slides make it easy to store and remove the sander and grinder. The top left drawer holds waterstones and sharpening supplies.

storage boxes, so I incorporated them into the design in lieu of a second bank of drawers. It's great to have lidded containers for hardware that can go right where they're needed. One drawback, however: If you design around store-bought organizers, you're at the mercy of the manufacturer. In my case, Stanley discontinued some of the boxes.

Most of the cart's space was devoted to the drawers and storage boxes, but instead of having blank panels on the ends and back of the cart, I added shallow shelves that provide quick access to glue-up supplies and frequently used bench tools.

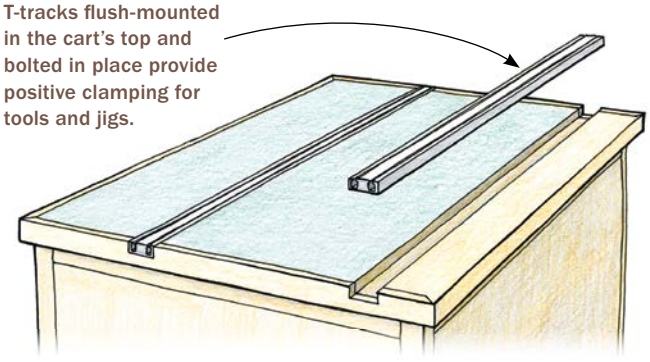
Next cart had specific tools in mind

I housed all my sharpening and sanding equipment and supplies in one cart. The cabinet has two main compartments with slide-out trays. On the right, I needed the full depth and height of the cart to accommodate my spindle sander. But on the left, where I store a slow-speed grinder below my waterstones and other sharpening supplies, the trays only required half the depth of the cart. I utilized the extra space behind them for a bank of drawers that pull out on the left side of the cart.

Lock down. Using the aluminum T-tracks, it's easy to secure the grinder anywhere along the cart's length.

T-Tracks Add Versatility

T-tracks flush-mounted in the cart's top and bolted in place provide positive clamping for tools and jigs.



Side storage. A bank of drawers tucked behind the grinder cabinet holds stacks of abrasive disks and other sanding supplies.

And one more thing. With the machines tucked neatly inside and a row of ball-bearing work rollers locked to the T-tracks, the cart provides infeed support for O'Brien's planer.

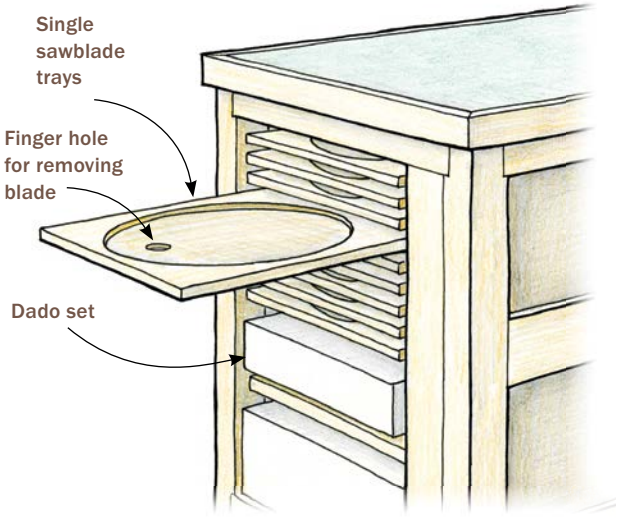
Storage tailored to the tablesaw. O'Brien's tablesaw cart, which holds measuring tools, jigs, and saw accessories, slips beneath the side extension table and keeps saw supplies within easy reach.

Two for the tablesaw

I built two units to make my tablesaw more functional. The first was a small cart with drawers to hold accessories like setup tools, featherboards, push sticks, and, in the deep bottom drawer, a tenoning jig. I designed this cart to tuck neatly under the saw's side extension table. I made slide-out trays in the rear of the unit to hold sawblades, a dado set, and manuals. Small side shelves hold cleaning supplies and lubricants. Pulled out from underneath and with rollers clamped to the top, the cart can serve as an infeed or left-side support for the tablesaw.

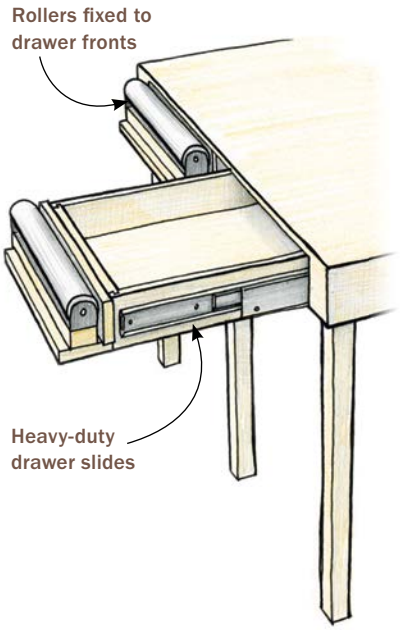
The second unit was an outfeed table that is fixed to the saw and doesn't roll. It is a shallow box attached to the rear of the saw table and on the other by 1½-in.-square legs. I built two drawers into the back to store throat plates, blade brakes, and other accessories. I fitted the drawer fronts with rollers so that when you pull the drawers open, you extend the outfeed range of the table.

Sawblade Storage



The blades are in the back. Trays for a half-dozen sawblades slide in grooves in the back of the cart. A dado set is stored below, and cans of cleaning and lubricating products fit in the shallow side shelves.

Extra Outfeed Support



Hybrid drawers do double duty. The drawers in O'Brien's short outfeed table not only hold throat plates and other saw accessories but also extend the range of support. He attached rollers to the drawer fronts and used extra-heavy file-cabinet drawer slides to prevent sagging.

Custom cart for a dovetail jig. O'Brien sized the lower drawer in this cart to fit his Leigh dovetail jig (top), which clamps into the T-tracks on top (bottom). The other drawers contain routers, clamps, bits, and wrenches.

Drill-press cart. The cabinet height is low enough to keep the drill press's base from interfering with long boards being cut on the adjacent miter saw table.

The rest are dedicated

While some of my storage units serve several purposes, these last four are dedicated to single machines.

Dovetail jig needs a cart

The dovetailing cart is identical in size and detailing to the sanding/sharpening cart, but it is divided into full-width front and rear compartments. The front contains a slide-out tray across the bottom that holds a Leigh D4R Pro dovetail jig and drawers above for routers, router bits, guide bushings, and jig accessories. When the dovetail jig is deployed, its base is flush with the front of the tabletop. I secure it with Woodpecker Universal clamps in the T-track. When not used for dovetailing, the cart provides another good surface for assembly and clamping.

Drawers for the drill press

A drill press accumulates scores of bits and accessories, and I wanted them well organized and easily accessible. The cart I built for my drill press has a shallow top drawer for drill-speed and drill-size data sheets, two drawers fitted with racks for bits and accessories, and deeper lower drawers for hole saws and hole cutters, plug cutters, drill sets, and jigs. I bolted the drill press to a flush-mounted aluminum T-track.

Every bit in its place. Shallow upper drawers provide ample storage for many sets of bits, most displayed flat for easy access and organization. Deeper drawers below contain plug cutters, hole saws, and other large accessories for the drill press.

Miter-saw station. A pair of cabinets with a lowered shelf between them provides a home for the miter saw. The fence system, which fastens in the T-track, can be quickly removed. O'Brien has French-fitted the drawers to hold some of his hand tools.

Both the drill press and the miter saw are connected to shop vacs. Because I use these machines intermittently, I thought having local, small-volume systems would be more practical than energizing the main dust collector.

Miter saw gets an immobile home

The miter-saw station is the only fixed-base cabinet in my shop; the saw's need for long, accurate fences made mobility impractical. The unit is composed of two wide cabinets with a lower surface suspended between them. I supported the lower surface on 1½-in. aluminum angles with hex-cap leveling bolts, which make it simple to ensure that the miter saw's table is perfectly flush with the tops of the side cabinets. A dedicated shop vac sits below the saw, connected to it with an automatic vacuum switch. The Kreg system extended fences are easy to remove when the counters are needed for another purpose.

Custom Tool-Fitting System Is Fast and Easy

FastCap's Kaizen foam inserts (fastcap.com) offer a very simple and quick way to custom-fit your tools. The foam, which comes in various thicknesses, is made up of multiple layers. To make a cavity for a tool, first trace around the tool with a permanent marker. Then use a utility knife to cut on the lines. For the blade of a tool, taking out one layer of foam might suffice (1). To make a deeper cavity for the handle, cut again and remove another layer or two. To make removing the tool easier, create finger holes by heating a copper pipe and pressing it to either side (2) of the handle cutout.


1


2


3

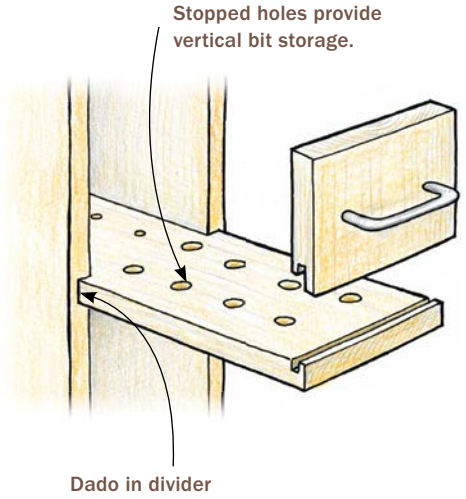
Retrofit a router stand

I bought my router table and fence as a package that included a Kreg metal stand. To achieve effective dust collection, I enclosed the stand, building a cabinet secured with screws through the predrilled holes in the steel frame.

I built the top and bottom drawers to hold small parts like router chucks, throat plates, and the height-adjustment crank. The middle two are trays that hold router bits. To top off my organizational effort, I identified all the bits with labels I created on the computer and printed on pressure-sensitive clear film address labels.

Router-table retrofit. To improve dust collection and provide a place for all his bits, O'Brien built a cabinet to fit inside the stand of his router table. The center section of the cabinet, which encloses the router, has a dust port at the back. Bits in pull-out trays are stored vertically and labeled.

Pull-Out Trays



Clever Countertop

DOUGLAS CAMPBELL

In a woodworking shop, counter and storage space are a lot like clamps: You can never have too much. That's why when I built my new basement shop, I reserved an entire wall for a long work counter with storage beneath it. I intended to build and install this counter by myself, so I designed a countertop and base that I could make and install without help. My other goal was to minimize the amount of material needed to build them.

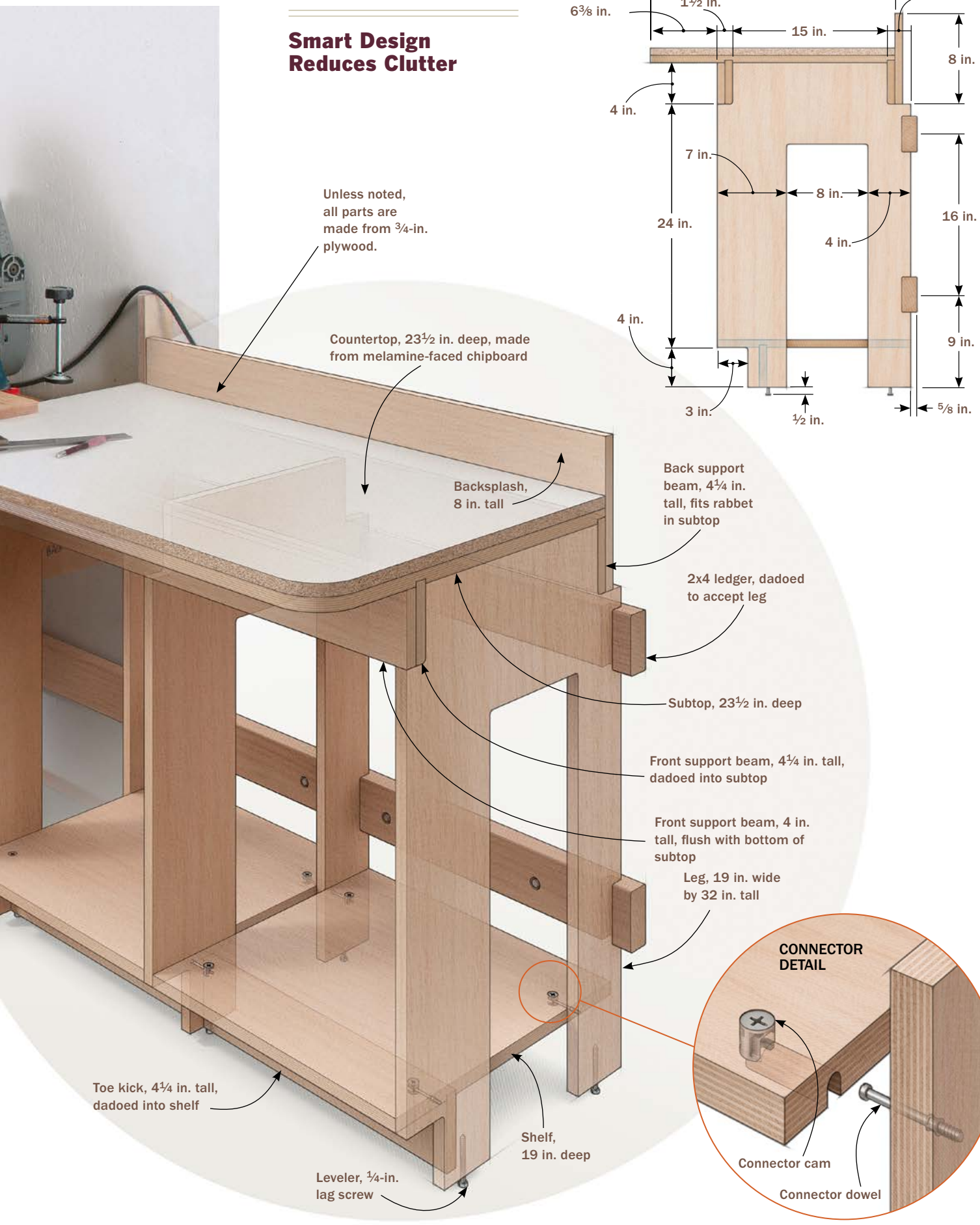
This counter was not going to be built like the floor cabinets in a kitchen. The big plywood boxes used in kitchens require a lot of plywood and are heavy and cumbersome—a bad combination for a one-man crew. So instead of boxes beneath the counter, I decided to use legs. But legs carry their own problems: They can be tricky to level on a sloped floor (and many shops have one), and they need aprons to support the countertop, which requires joinery of some sort.

To overcome these challenges, I devised a simple plywood leg shaped like an inverted U. This shape works because it gives you a pair of legs with a horizontal edge to support the countertop without the need to cut any joinery. Hex-head lag screws driven into the bottom of each foot allow the legs to be leveled individually.

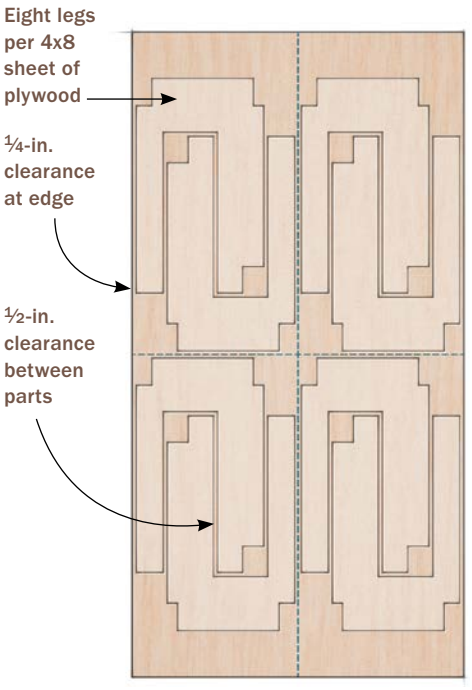
The bays between the legs are the perfect blank canvas for storage. You can add shelves

Smart use of plywood. Beneath a spacious top, a clever leg design maximizes the yield from a sheet of plywood and minimizes how much muscle it takes to install the countertop.

Smart Design Reduces Clutter



Nesting layout saves material



Screw the template to the plywood. This guarantees the template is in the same location when you trace it and then rout the leg flush to it. Inset the template ¼ in. from the edges of the plywood.

Double up to reduce waste. Each pair of legs comes from a 2-ft. by 4-ft. section of plywood. Mark the first leg (top), remove, flip, and reattach the template (above). There should be ½ in. separating the two legs.

or drawers to them, or even leave them open to make room for bins, tool cases, and other bulky items. On top of it all is a dead-simple countertop made of melamine-faced chipboard—a tough but affordable surface.

Make legs quickly and accurately with a template

The U-shape of the leg is advantageous when it comes to materials, too. The shape allows you to get two legs out of a piece of plywood 24 in. wide by 48 in. long with very little waste. That's eight legs from a full sheet, and a smart way to maximize your materials.

For the countertop to go together easily, square, and level, it's important that all the legs beneath it are identical. Variations in the notches for the subtop support beams, for example, could throw the top out of level or make it wavy instead of flat. This is why I used a template to lay out each leg (screw it to the plywood before tracing).

After laying out the legs—two nestled in each quarter sheet of plywood—you can cut them out with a jigsaw. The template helps with the cutting, too. Just split the waste between legs, screw the template back to the leg, and rout it flush to make identical legs.

The rest of the countertop components are straightforward to make. But note that the hole and slot for the cam-lock hardware in the shelf must be cut precisely so that the hardware goes together smoothly during assembly. Take your time when setting up the drill press for the hole and the router table for the slot, and you'll be fine.

You should also take care when cutting the dadoes for the toe kick and subtop support beams. Dadoes that are too wide will affect the assemblies' overall strength. Plywood is always slightly thinner than its nominal thickness, so adjust your dado set accordingly.

Split the difference. Cut down the middle between the two legs. Holes drilled at the inside corners allow you to cut out the leg with a single, continuous jigsaw cut.

Trim them flush. After reattaching the template, rout the leg flush with a pattern bit.

Make Way for Shelf Fasteners

Shelves that drop in after the legs and subtop have been installed make construction less complicated. Knock-down hardware makes this possible.

A hole for the cam lock. Use a Forstner bit (15mm) and a drill press—and its depth stop—to get flat-bottom holes of the correct depth (left). Rout a slot to fit over the pin using 3/8-in.-dia. core-box bit (above). It needs to be centered on the cam lock's hole. You also need to drill a hole in the leg to hold the pin (right).

RTA Connectors
wwhardware.com
Titus Series 5 cam (T5653 ZN)
Dowel (T9424 ZN)

Simple Leg Levelers

Installing the leg levelers is a two-step operation. First, drill a pilot hole for the bolt, centered on the leg's bottom edge, using a block of wood over the bit as a depth stop (large photo). Take care to keep it square. Then drive in the bolt with a socket wrench (inset). A drill or impact driver might strip the threads.

Hang the ledgers. After cutting dadoes for the legs, drive lag screws (with washers under the head) through pilot holes and into the studs. Counterbores allow you to sink the screw heads beneath the ledger's surface.

Installation is a one-man show

After making all of the individual parts, you can begin building the countertop. This is where the leg and countertop design really pays off. Because the countertop is assembled in place, one piece at a time, you don't need to call a friend for help and you won't strain your back, either.

Start by making and hanging the ledger boards, which attach to the wall studs and help support the counter. After they are in place, stand up the legs in the dadoes cut into the ledger boards, leaving them loose so that they can be adjusted for level.

The subtop is supported by two beams. The front one is made from two layers of plywood, glued and screwed together. Attach the beams to the subtop, then place the subtop assembly on top of the legs. Put a level on the subtop and adjust the legs with the lag-screw levelers. Check for level front to back and along the subtop's length. Now use drywall screws to secure the legs to the ledger boards and the subtop to the legs.

Stand the legs in place. Do not attach them at this point. The dadoes will hold them up for now.

Drop on the subtop. Screw the backsplash and front support beam to the subtop, then place the assembly on the legs.

Level the legs. Turn the lag screw with a wrench, keeping an eye on a level resting on the subtop.

Screw the legs to the ledger. Campbell uses drywall screws, toenailed through the ledger, to lock the legs in place.

The shelves go in next, and this goes quickly because all you have to do for each shelf is rotate four cam locks a quarter-turn with a screwdriver. After rounding out the corners on the melamine countertop, put it in place and screw it to the subtop from below. Finally, rout the corners of the melamine countertop flush to the subtop below.

Now you can load up the bays with power tools and storage bins, or even make and hang drawers (screw the drawer slides directly to the legs). Then you can go right to work.

Put the shelf in place. The toe kick and cam locks are already in place. The four dowels should fit into the router slots, supporting the shelf.

Lock it in. As you turn the cam in the shelf, the pin and leg are pulled tight, creating a rigid base for the top.

Add the countertop. After roughing out the corner radius of the countertop, screw it to the subtop from below, then rout the chipboard top flush to the subtop.

Outfeed Table Doubles as a Workbench

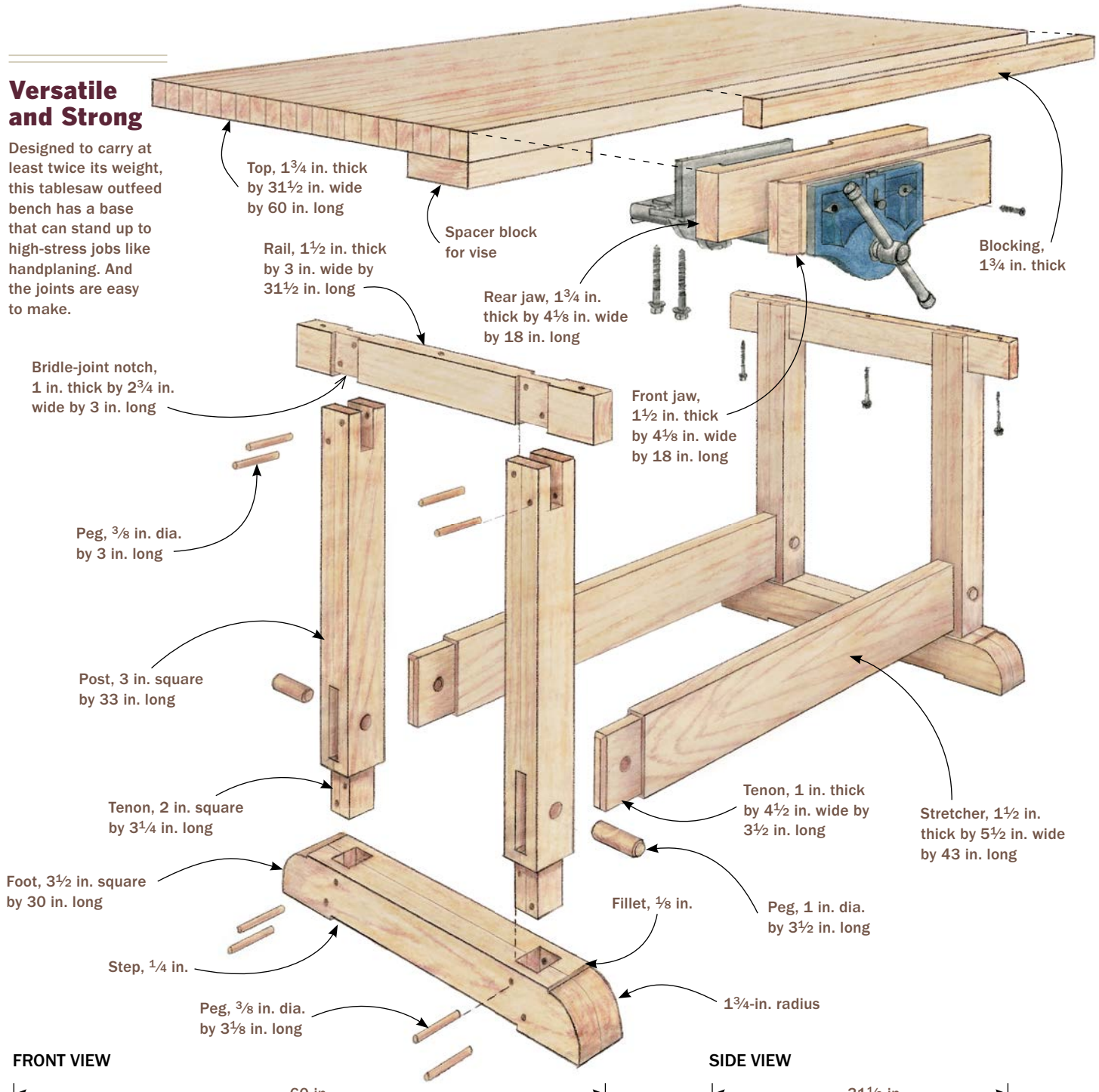
KELLY J. DUNTON

I have a small shop on the second story of a barn. When I needed a new outfeed table for my tablesaw, I saw it as a chance to squeeze one more work surface into the small space. So I designed the outfeed table to double as a workbench. Made entirely of soft maple, the table has a hefty top with a large cast-iron vise. Mortise-and-tenon joinery, along with a few bridle joints, makes for a rigid base. Construction is not difficult. I'll show you how to build this table from the bottom to the top.

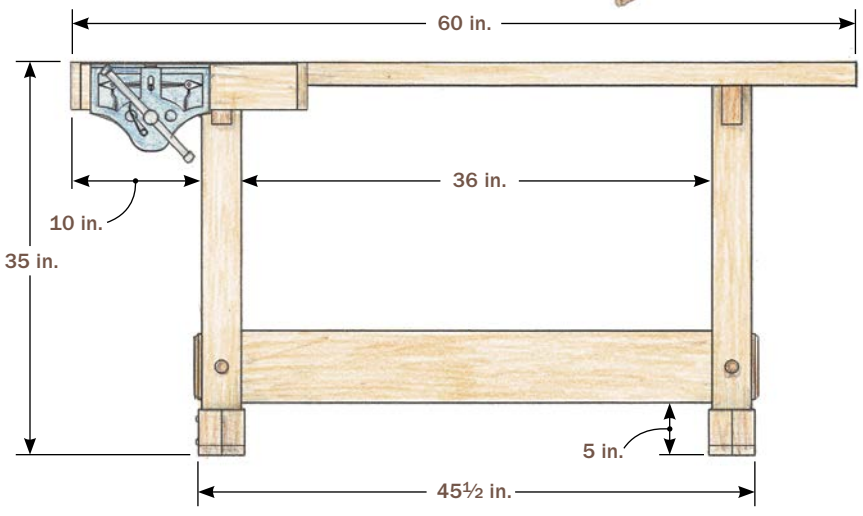
Work surface for a small space. With a big top and vise, this easy-to-build table gives you more space to work.

Versatile and Strong

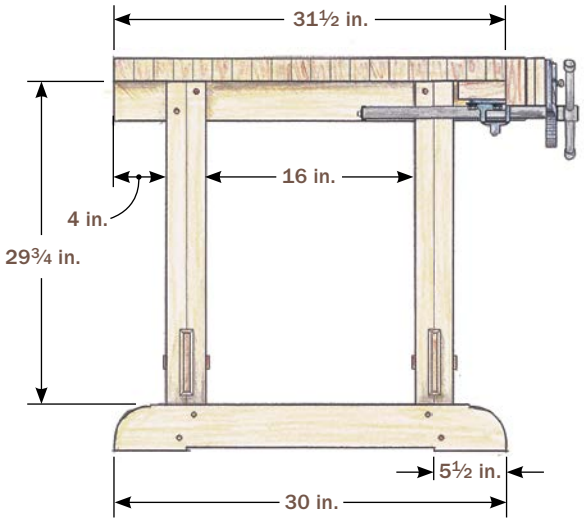
Designed to carry at least twice its weight, this tablesaw outfeed bench has a base that can stand up to high-stress jobs like handplaning. And the joints are easy to make.



FRONT VIEW



SIDE VIEW



Cut mortises in the posts. Stop blocks on the miter gauge fence ensure that the mortise's length and location will be the same on every post half (above). Do the ends first and then hog out the waste between the ends (right). The ¾-in.-wide dado set eats through the meat of the mortise in just a few passes.

Make the base

Regardless of the technique you use (mortiser, router, or drill press and chisel), deep through-mortises like those in the trestle feet and posts of this table can be difficult to make. I get around all that work by cutting the mortises on the tablesaw.

Here's the wizardry behind my method. The feet and posts are made by gluing two pieces together, so I cut the joinery before assembling these parts. Start with the stretcher mortises in the posts. Mill the two halves of the post to their final dimensions. You only have to lay out the mortise location on one half of the post. Stop blocks on a miter gauge guide the work from there.

Put a dado set in your tablesaw—a ¾-in.-wide stack works well. Now attach a long auxiliary fence to your miter gauge. You'll need two stop blocks to control the mortise's width and location. To set the stop blocks, place the workpiece against this auxiliary fence and slide it to the right so that the left end of the mortise is aligned with the left side of the dado set. Clamp the block to the fence, snug against the right end of the post half. Slide the post back to the left until the right end of the mortise aligns with the right side of the dado set. Clamp the other stop block to the fence, tight against the left end of the post.

Cut one end of the mortise. Slide the post half against the other stop and cut the other end. Cut away the waste between these two cuts with the dado set. Repeat the process for the remaining mortises.

Clamp the halves together. A filler block in the mortise keeps the halves properly aligned, while a set of cauls keeps them aligned side to side. After the clamps are set, knock out the filler block.

Cut the bridle joints for the trestle rails. Cut the cheeks first, setting the fence to cut the cheek nearest to it. Flip the post over to make the second cheek cut to center the joint.

Clean out the waste, too. The bandsaw handles most of it, but you'll need to pare the baseline with a chisel.

Cut the tenons next. A stop block determines the length.

To keep the post halves properly aligned during the glue-up, I put a filler block in the mortise. It should be the same thickness and width as the mortise, but make it several inches longer so that you can knock it out after clamping the halves together. Don't leave it in while the glue dries.

Next up is the bridle joint at the top of each post that houses the rail. Start at the bandsaw, cutting the cheeks and removing as much waste as you can with diagonal cuts down to the bottom corners. Clean up the remaining waste with a chisel.

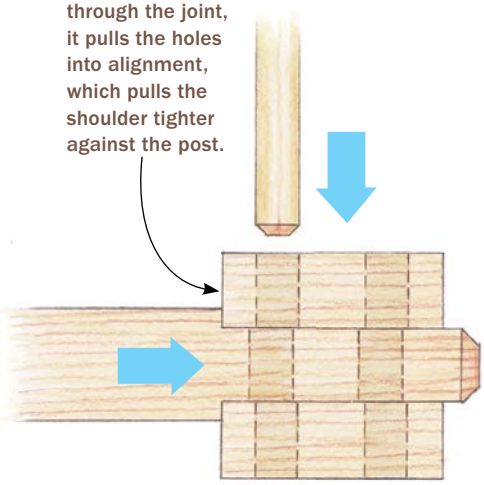
Now make the feet. They also need mortises for the post tenons. Make them the same way as the stretcher mortises in the posts—on the tablesaw, before gluing the halves together. After gluing up the feet, cut their profile at the bandsaw.

Now you're ready to drill all of the peg holes at the drill press. Most Forstner bits are too short to make it all the way through the posts and feet, so use a brad-point bit instead. Also, slide the filler block that you used to align the mortises during the glue-up back into the mortise before you drill the hole. This prevents the bit from blowing out the grain inside the mortise.

Notch the rails. Use two stop blocks to control the notch's location and length. Leave the joint a bit thick, so you can plane it to fit the open mortise in the post.

Drawboring the Joints

The big advantage of the drawbored joint is that the peg pulls the tenon shoulders tight to the posts, helping to create a rigid and strong assembly without the need for clamps.



Transfer the hole. Use the same bit you used to drill the peg holes. Just give it a tap.

Offset the mark. Use a punch to move it slightly (1/32 in.) closer to the shoulder.

Now drill. Any movement during drilling can prevent the drawbore from working properly, so clamp the post to the drill-press table.

With all of the mortises completed, begin the tenons. I cut all of the tenons at the tablesaw with a dado set and miter gauge, using a stop block to ensure consistent shoulders. I do the tenons at the bottom of the posts first.

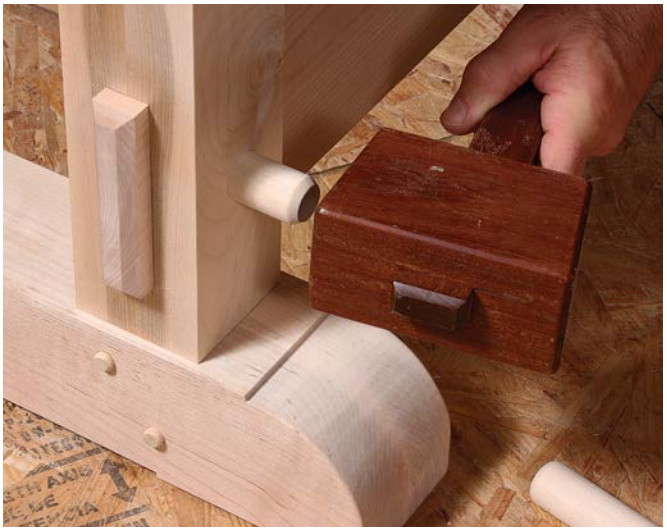
Next up are the stretchers and rails. The stretchers have through-tenons that stick out ½ in. beyond the post. After fitting the tenons, cut them to length and chamfer the ends with a block plane.

The end rails are notched on both faces to fit into the bridle joints. Cut the notches with a dado set. After fitting the joints, I chamfer the ends of the rails with a block plane.

No clamps needed for assembly

Now that all of the joinery is cut, you can assemble the base. Start with the trestle ends. Its joints are glued, but they are also drawbored—including the bridle joints—to ensure that the tenon shoulder is pulled tight. To set up the joint for drawboring, dry-fit the tenon in the mortise. Now grab the bit you used to drill the peg holes. Slip it into the hole and give it a light tap, just enough to mark the tenon. Pull apart the joint and use the punch to offset the mark about 1/32 in. closer to the shoulder. Drill a hole through the tenon at this new mark.

Assemble the base. Begin with the posts and feet. After spreading glue on the joint, slide the post into the mortise. Because the peg hole in the tenon is offset toward the shoulder, the tenon is pulled into the mortise and against the shoulder when you knock in the pegs.



No glue for the long stretchers. Slide the tenons in dry (above left), then knock in the big drawbore pegs (above right). This joint won't work loose, but you'll still be able to take it apart should you need to move the bench.

Big top, less work. Glue up the top in sections small enough to joint and plane. After jointing a face, run the sections through the planer (above), then joint the edges square to the faces. A caul across the width and clamps over the gluelines at the ends keep the three sections aligned (left).

Spread glue on the joint, insert the tenon, and drive the peg into the hole. As it passes through the hole, the peg forces the tenon deeper into the mortise and pulls the shoulder tight against the post. No need for clamps.

After the end assemblies are together, connect them with the two long stretchers. These don't get glue, so just put them together and knock in the drawbore pegs. Just like that, the base is done. Now on to the top.

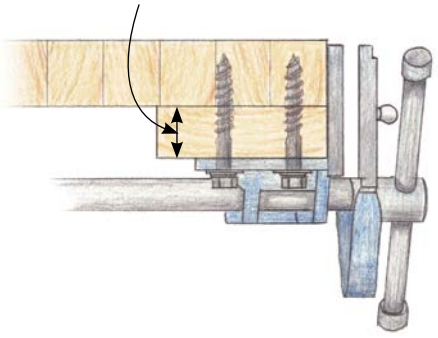
Make the top and install the vise

The top is laminated from strips of maple. This means you'll need plenty of glue and a bunch of clamps. To avoid a lot of flattening after the glue-up, I use a proven technique that ensures a dead-flat top. Glue up several sections of the top first. Each section needs to be narrow enough to fit across your jointer and through your planer after the glue has dried. Because I have a 12-in. jointer and planer, that means three sections. If your machines are smaller, you'll need to break the top into more sections.

Bolt on the vise. A spacer block lowers the vise so that the top edge of the back jaw sits just below the surface of the bench.

Spacer Block Positions Jaws

Size the block so that the vise jaws sit just below the benchtop after installation. This way, you don't have to worry about accidentally hitting them with a plane or saw.



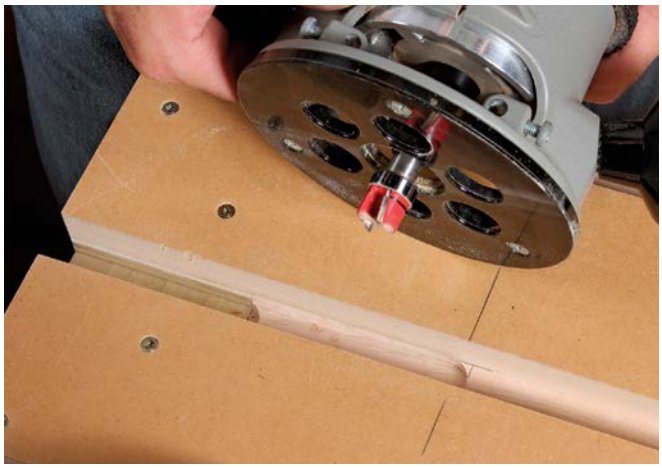
After the sections have been rejointed (including edge jointing) and planed, glue them all together at once. Take care to ensure that they're aligned end to end and top to bottom. Doing this carefully should eliminate any need for flattening afterward.

Cast-iron vises are strong and easy to install, but their metal jaws can mar and damage workpieces, so cover them with thick, shopmade wooden jaws. To install the vise, you'll need to attach a spacer block between the bench and the vise to position the top edge of the vise's rear jaw flush with the top surface. This makes the vise much more useful for cutting joinery and planing boards on edge. Now mill up a piece of maple that's as thick as the rear jaw, as wide as the top is thick, and long enough to run from the vise to the opposite end of the bench. Glue it to the benchtop. This brings the benchtop in line with the vise's rear jaw and makes clamping boards in the vise much easier.

Add the rear jaw. Notch it to fit over the metal jaw. Screw through it and the holes in the metal jaw to anchor the screws in the benchtop.

Block out the top. This brings the front edge in line with the wooden rear jaw, which makes it easier to clamp wide and long boards in the vise.

The front jaw is last. After screwing it in place, plane the top edge of the wooden jaws flush to the benchtop.



Rout clearance slots. At 5 in. to 6 in. long (depending on the miter gauge you use) and just wider than the slots in your saw's table, these give miter bars a place to go so that workpieces can clear the back of the blade.

Put the top on the base. Attach it with six lag screws, three at each end. Put the table in place behind your tablesaw. Mark where the miter slots in the saw's table hit the benchtop, then widen it just a bit. Slide the table away from the saw, and rout slots in the benchtop to create clearance for miter bars. I do this with a flush-trimming bit and a template that has a notch slightly wider than the miter-gauge slot in the tablesaw.

Now the table is done. Apply some oil to the base and top, slide it place, and get to work.

PART FOUR

Comfort and Safety

Heating and Cooling Your Shop

BARRY NM DIMA

A freestanding building can be a fantastic place for a woodshop. But you can't usually hook it up to the heating and cooling systems in your house, and if you live where winter days regularly fall below freezing or humid summer days linger above 90°F—or both—the shop will be uncomfortable or unusable for chunks of the year. Plus, weather swings can wreak havoc on tools and materials. If you need to heat and cool a freestanding shop—or a garage that's attached to your house but not to its heating and cooling system—a mini-split or PTAC (packaged terminal air conditioner) may be the answer.

These ductless air conditioners or air-conditioner/heater combos are easy to install compared with ducted systems, don't take

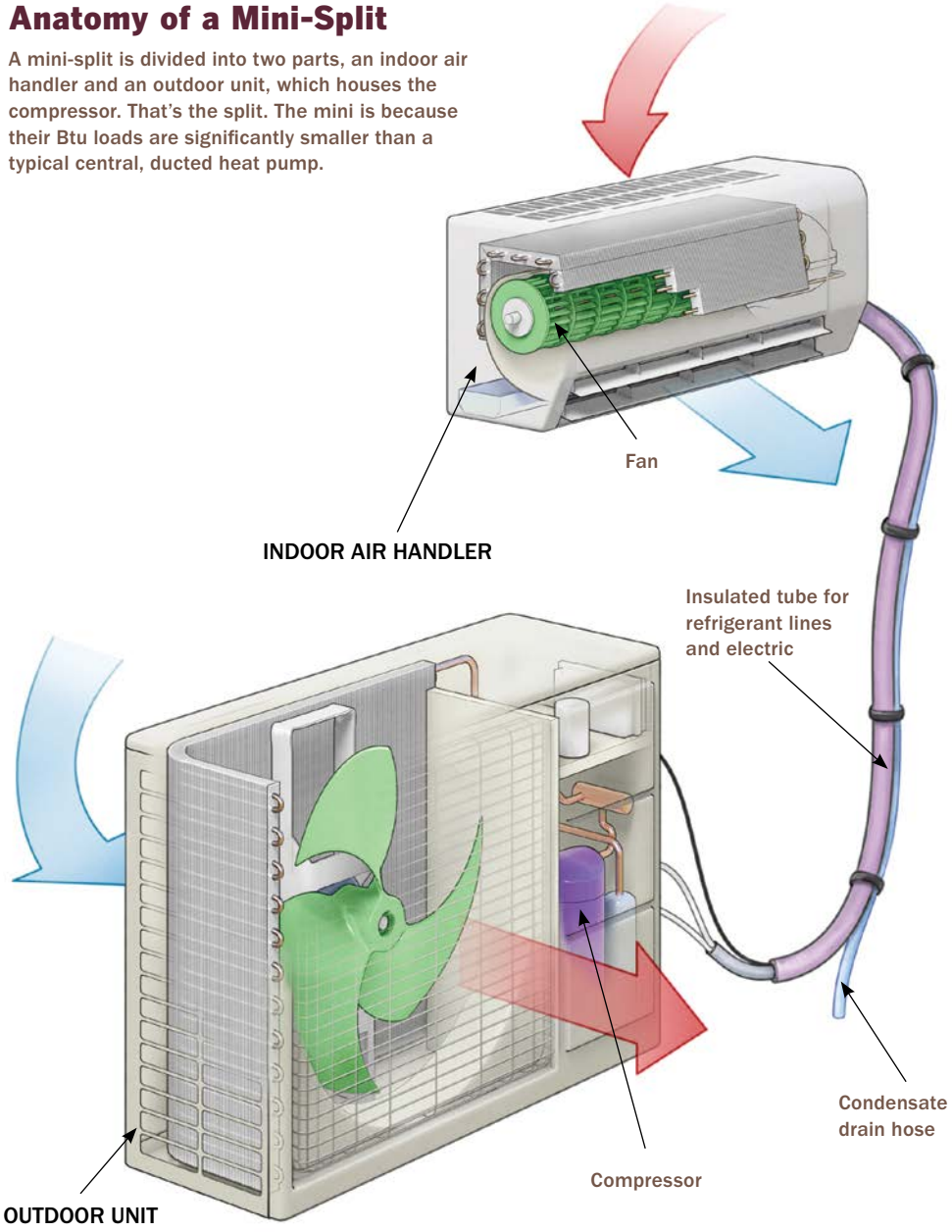
Comfort Year-Round

Ductless HVAC systems ensure that the weather doesn't limit your shop time.

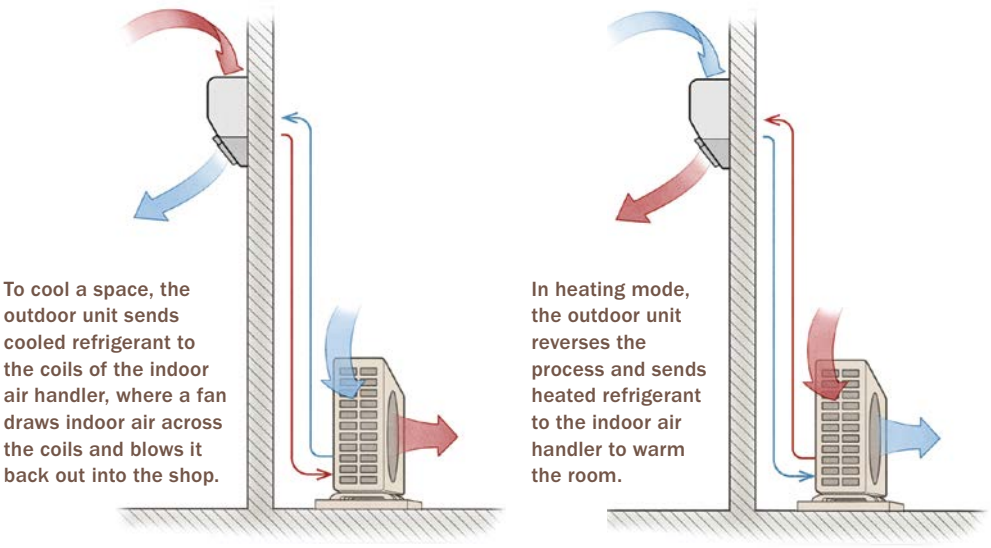
up much space, and require only a 220-volt circuit. Plus, they can come with you if you move. Both mini-splits and PTACs are heat pumps. For cooling, they extract heat from a room and send it outside. If they can heat as well, they flip the operation, pulling warmth from outside and bringing it in (both are thanks to the seeming magic of refrigerant). Because heat pumps move heat rather than generate it, they can be more efficient than other heating methods, such as electric resistance and, generally, fossil fuels. Some heat pumps have limits: PTACs have trouble drawing warmth from the outside below 35°F to 40°F. They turn to electric resistance heat in colder temperatures. Mini-splits can handle much colder weather; some as low as –15°F. However, they cost a lot more up

Anatomy of a Mini-Split

A mini-split is divided into two parts, an indoor air handler and an outdoor unit, which houses the compressor. That's the split. The mini is because their Btu loads are significantly smaller than a typical central, ducted heat pump.



How a Mini-Split Heats and Cools



To cool a space, the outdoor unit sends cooled refrigerant to the coils of the indoor air handler, where a fan draws indoor air across the coils and blows it back out into the shop.

In heating mode, the outdoor unit reverses the process and sends heated refrigerant to the indoor air handler to warm the room.

front, in part because it's advisable to use a pro for installation. Still, they can keep energy bills lower thanks to their efficiency. To get the most out of either type, your shop should be well insulated and well sealed. (For tips on insulation, see "Fine Shop in a Former Garage," pp. 5–9.) If the building is leaky, you might as well slip the dollars through the cracks in your wall instead.

Mini-splits: More expensive up front, but more efficient

They are still catching on in the United States, but mini-splits have been popular in Asia and Europe for decades, and they're familiar to many woodworkers. Although the up-front cost is high, these units will transform a shop into the most desirable space in your house. And thanks to their efficiency, the energy bill won't short-circuit your budget.

Mini-splits typically don't have ductwork. Instead they pair an indoor air handler with an outdoor compressor via two refrigerant lines, a condensate line, and a power cord. A mere 3-in.-dia. hole, which is later weatherproofed, is all that's needed to feed the connections through a wall. Plus, mini-splits are whisper quiet. While they come in a variety of configurations, the version with a wall-mounted air handler is the most popular.

People in especially cold climates should take extra care selecting a unit, since not all mini-splits are rated for use at extremely low outdoor temperatures. Look into units designed for cold climates, such as Mitsubishi's Hyper-Heat models.

Top-notch efficiency

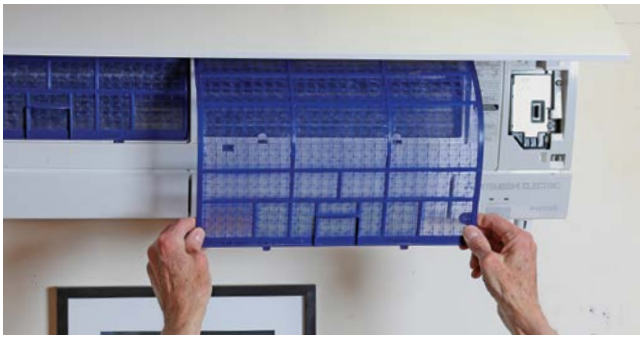
Mini-splits are incredibly efficient. They typically use inverter compressors—not rotary compressors—to regulate temperature. Inverter technology makes small adjustments to maintain the set temperature within a narrow range. Rotary compressors, on the other hand, cycle on and off, meaning big swings in temperature that require lots of extra energy.

This efficiency means a mini-split should keep utility bills down. Martin Holladay,

Up and away. Wall-mounted mini-splits, like this one in contributing editor Christian Becksvoort's shop (far left), go high on the wall, so they don't take up valuable shop space.

Strategically placed. Because of the outdoor compressor, the air handler is best placed on an exterior wall to simplify installation (left). Also, since the outdoor unit is exposed to the elements, it needs to be off the ground. If it snows in your area, the unit must be above the anticipated snow level and under a roof that still allows for ventilation. If it gets buried, it could stop functioning.

Easy to live with. In the three years since buying his mini-split, the only maintenance Becksvoort has done is to blast the filter with compressed air every Saturday (below).



a senior editor at *Fine Homebuilding* and *Green Building Advisor,* says that while generalizations can be tricky because energy costs vary by region, heating with a mini-split is typically cheaper compared with propane or fuel oil and can be up to a third cheaper to run than electric resistance heat. Consult your local energy prices to determine what to expect for your area—especially considering how cheap natural gas has been recently.

How much for a mini-split?

The cost for the units themselves and their installation is another consideration. For a 400- to 600-sq.-ft. space, expect to spend $1,000 to $1,500 for a unit that only cools. Tack on at least $300 for one that heats as well. Installation costs can vary depending on the space—how complicated it is to run the hoses, for example.

We invited Dean DeMague, president of Connecticut's High Performance Energy Solutions, a company that installs Mitsubishi mini-splits, to visit a well-insulated two-car garage shop in Connecticut and assess the cost of a mini-split system. DeMague estimated all-in installation—meaning parts and labor—for an 18,000-Btu unit would cost $3,500 to $4,500. Thanks to their efficiency, though, mini-splits may qualify for state and

federal refunds and tax credits. To check, go to dsireusa.org to check.

According to DeMague, although you can do some of the installation yourself, it's likely not worth it. "Our track record with self-installations is that we spend a lot of time and money fixing them," he says. The issue is that beyond the simpler installation tasks, the risk greatly outweighs the reward. "If you get the refrigeration part of the install wrong, lights out. You might as well start over." Plus, you could void your warranty if you're not a certified HVAC professional.

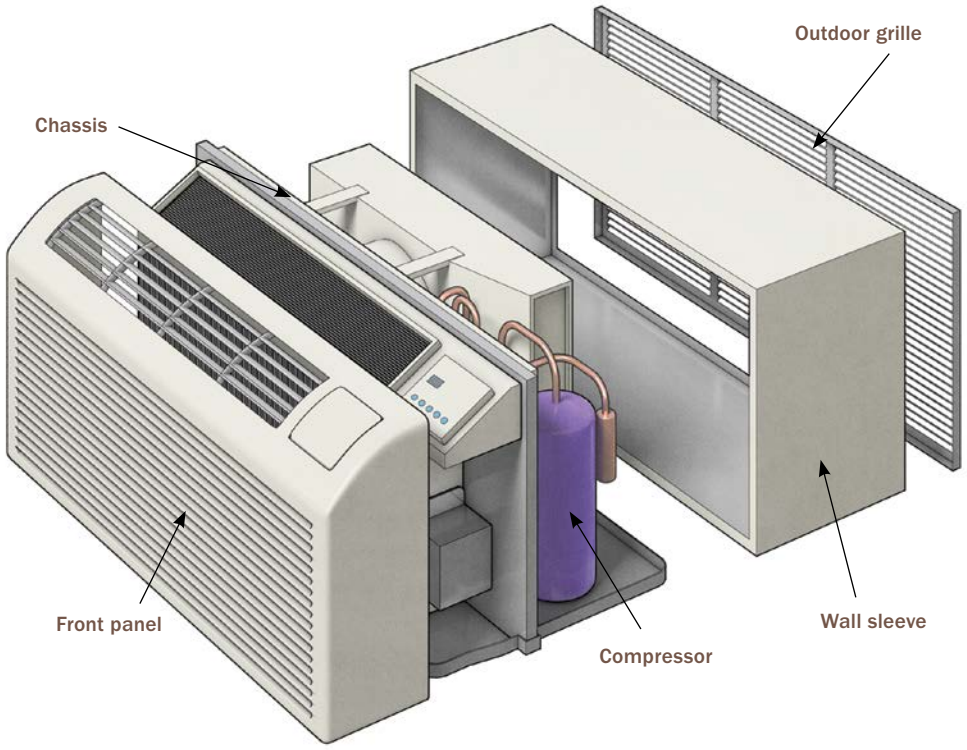
Holladay agrees: "For one person installing one unit, hire a pro." Also, a professional can pick the appropriate size mini-split for your shop and choose where to put it—both important factors affecting a mini-split's performance. Lastly, you must keep combustible vapors away from the indoor units. Considering possible finishing regimens, hiring a pro is an important step in keeping your shop safe.

When choosing an installer in the United States, Wood Whisperer and mini-split user Marc Spagnuolo advises, "Find an HVAC person who doesn't hesitate to install it" since the technology still isn't as prevalent here as traditional, ducted systems. Spagnuolo also advises buyers to pick a trusted brand.

PTACs: Not just for hotel rooms

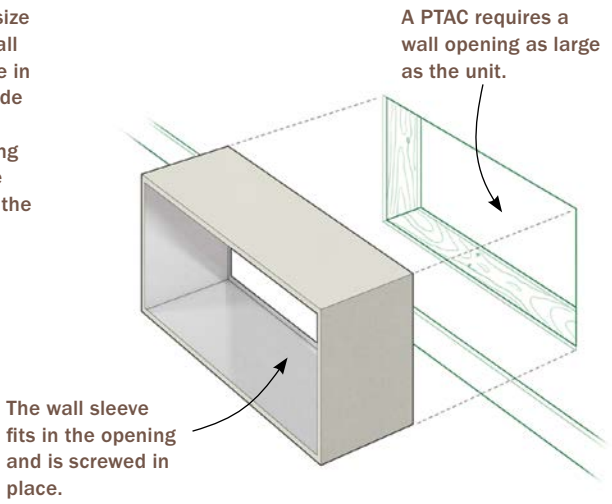
For some, the up-front cost of a mini-split may be too much to bear even considering the back-end savings. If that's you, look into a PTAC. Unlike mini-splits, these units aren't at all novel in the United States. If you've stayed in a hotel, you're familiar with them.

A Typical PTAC Unit

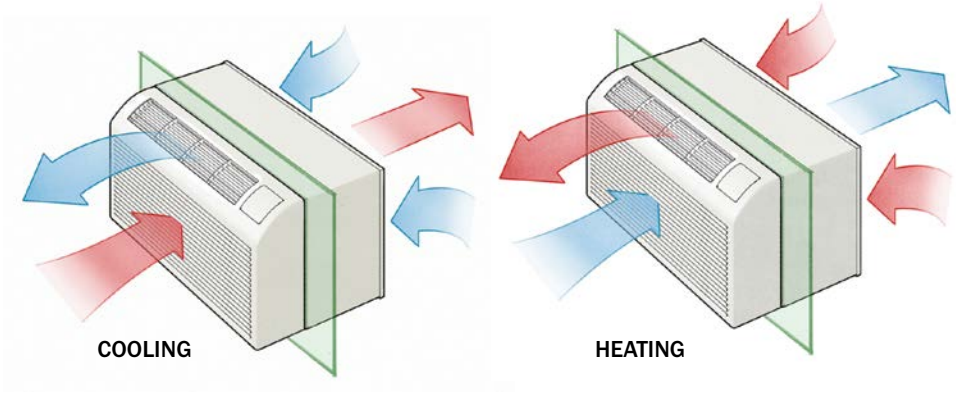


PTAC Installation is Simple

Cut the appropriate-size hole in an exterior wall and mount the sleeve in the opening. Then slide in the chassis. A few screws hold everything in place. Just be sure the wall can support the PTAC's weight.



How They Work



Since they're also heat pumps, PTACs transfer heat in and out of a space the same way a mini-split does. The technology is a little less advanced, though, as they lack compressors with inverter technology and fall off faster as the temperature falls.

In cooling mode, these heat pumps operate just like mini-splits. But for warming a room, PTACs rely on electric resistance heat. People in chillier climates may want to invest in a PTHP model—a packaged terminal heat pump—whose heat pump can both warm and cool. It uses electric resistance heat only when temperatures drop too low for the heat pump to operate well.

The knocks on PTACs are that they are considerably less efficient overall than mini-splits—sometimes by half—and require an opening about 42 in. long by 16 in. tall through the wall so they can vent. The unit will probably stick out into your shop at least 8 in., and since they have to be mounted low, the space lost will likely be more valuable. Also, some people find them frustratingly noisy. PTACs have one big advantage,

though: They'll likely run you about $1,000 or less, including the necessary components beyond the unit itself, which are a sleeve to support it in the wall and an exterior grille.

Do it yourself to save dough

Maybe the biggest place you can save money on a PTAC is if you install it yourself. Just like with a mini-split, a pro can help you choose the appropriate unit for your space—possibly saving you money and headaches—but you can stop there. PTACs are literally plug and go, so all you have to do is get one through the wall.

The process is a lot less fussy if you settle on a PTAC before the shop is built, since the plans can simply account for the proper opening and support. Ray Finan, a furniture maker in Vermont, did just that when building his very well insulated, freestanding shop two years ago and hasn't looked back since—even in the state's severe winters. His PTHP model, made by Gree, cost about $800, and having his electrician run a 220-volt circuit for it was a bit extra. Finan, whose 624-sq.-ft. shop has 9½-ft. ceilings, says the electricity bill for his shop increases by about 50% during February and March, although he admittedly doesn't run the unit much from late May through late October.

Retrofitting a PTAC or PTHP in an existing space is a bit more difficult, but still "easier than installing a window," says Matthew Teague, a woodworker in Nashville, Tenn., and a former managing editor with *Fine Woodworking*. He should know. He started with one in his shop, replaced it after about 10 years, and added one to his basement in between. Teague notes you'll probably want a buddy to help with the installation, though. The units weigh around 100 lb. or more, and because of their size, they can be unwieldy.

Space stealer. You'll have to work around a PTAC, because the units are typically mounted low on the wall and extend about 8 in. into a room. Ray Finan placed his as out of the way as possible while still keeping it effective. Wall-mounted clamp racks make good use of the space above the unit.

All in one. A PTAC's controls are a part of the chassis, making the most of its low placement.

Choose your cover. The outdoor grille is an accessory, meaning you have to buy it separately. Frustrating, maybe, but this allows you to pick the grille that looks best.

He had a friend support one end while he drove the two screws to secure his Amana 15,000 Btu PTAC to the sleeve, which houses the unit in the wall. Just be sure you know what you're doing when you choose the location, and make sure it's an exterior wall that can support the unit's weight. Chopping into a wall without having a sound plan is definitely not advisable. If doing the installation at all disquiets you, consult a qualified professional for at least some guidance.

As for the 10 years Teague got out of the first unit, he thinks he came out on the right side of that deal. His unit was about $700, so he concludes he paid about $70 per year for a machine that kept his shop comfortable year-round. And as he points out, shop conditions are tough on any appliance, and he had his on 24/7. Plus, he went from cleaning it daily for the first five to six years to almost never after that. Cleaning, Teague notes, is nevertheless simple and fast: Just vacuum the filter.

Shop time is precious. Luckily, mini-splits and PTACs are viable solutions, albeit with key differences, that can keep Mother Nature from limiting your shop time. If one fits in your shop and your budget, you've cleared a big hurdle to getting your projects done.

Dust Collection for the Small Shop

ANATOLE BURKIN

The importance of dust collection cannot be overstressed in woodworking. But it's tough to get excited about spending money on tools that collect dust. These machines just don't have the cachet of sleek hand tools or powerful machines that cut and shape wood.

The good news is that a basic kit of dust-collection products won't cost a fortune. And whether you're doing woodworking in a basement or garage, building projects large or small, the essentials are the same. In my case, I'm remodeling a house—trimwork, cabinets, and built-ins—and working out of a two-car garage. The materials I'm using range from rough lumber to sheet goods.

To make things more difficult, I live in a community with strict homeowners' association rules that prohibit turning a garage into a permanent workshop. So at the end of the day (or a few days running), I need to be able to park the motor vehicles back in the shop . . . er, garage. And to keep from tracking lots of dust into the house, I've gotten into the habit of keeping the garage pretty clean with minimal effort.

In the end, no matter what size shop you're in, a three-pronged approach is the best way to attack dust before it settles on you and everything around you. Use a dust collector for bigger, stationary machines and a shop vacuum for handheld tools, and round things out with an overhead air filtration system combined with a dust mask.

Keep your collector close to the dust. When using a small dust collector, typically a machine with about 1 hp, use a fairly short hose, about 10 ft. long. Too long a run of hose reduces the airflow, and the result is ineffective dust collection as well as possible jams.

Three-Pronged Approach

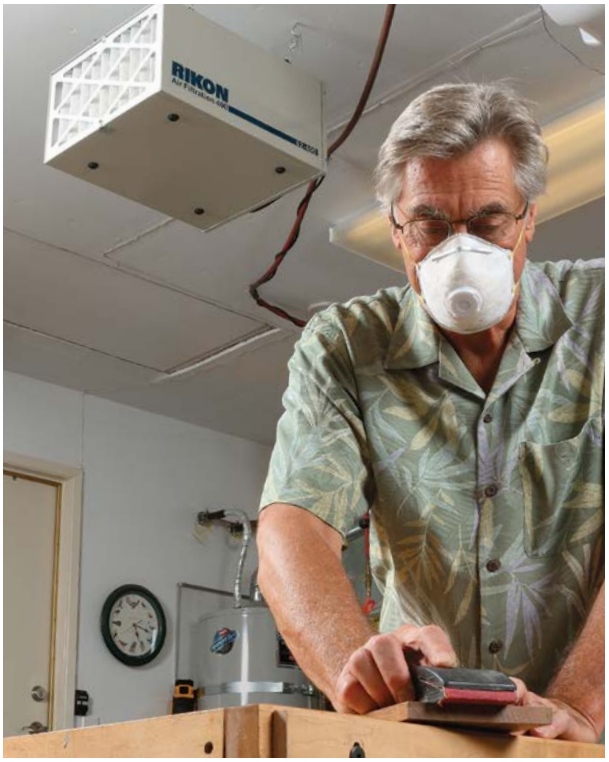
When it comes to managing dust, treat the various machines and tools in your shop differently based on how much dust they create. For stationary machines like the jointer, planer, tablesaw, and bandsaw, use a dust-collection system. But for smaller, handheld tools like the circular saw or orbital sanders, a shop vacuum will do the trick. Round up whatever's left circulating with an overhead air filter.

SHOP VACS

The smaller volume of fine dust created by miter saws, routers, and sanders can be handled by a shop vacuum.

DUST COLLECTORS

The wider diameter hose and large air volume created by a dust collector make it the right choice for big machines that create a lot of large, heavier sawdust particles and chips.



OVERHEAD FILTRATION

A ceiling-mounted air filter can grab the finest particles that end up suspended in the air. A dust mask is a good idea, too.

When floor space is tight. Though it can weigh about 65 lb., a wall-mounted dust collector can be moved quickly (it just hangs on a bracket) and stored elsewhere if needed. Get an extra wall bracket or two and move it around the shop where it's needed.

Go big for bigger machines

It's tempting to think that a good shop vacuum can solve all dust-collection issues. That might be true when working with only small benchtop tools that don't include a jointer and planer. But if your woodworking involves milling rough lumber, a jointer and planer (or a combo machine) are absolutely essential, and so is a dust collector. Jointing and planing wood produces large, heavy sawdust particles. To move them, a fairly large amount of air volume (about 350 cfm) as well as a 4-in.-dia. hose are required. Shop vacuums aren't suitable for a job that big.

A dust collector is also more capable of grabbing sawdust from a tablesaw and bandsaw, again because of the large volume of airflow. That said, I've had pretty good luck

TIP Don't let the bag get too full. Empty the bag before it's completely full (shoot for about 1/3 from the top of the bag) to prevent clogging and to keep the dust from spilling out during the change-out.

Toolless clamps and fittings. Whether they're spring loaded or the thumbscrew type, they're immediately accessible using only your fingers. The thumbscrew type hold a bit tighter than the spring clamps, but the latter are the fastest to get on and off when switching between tools.

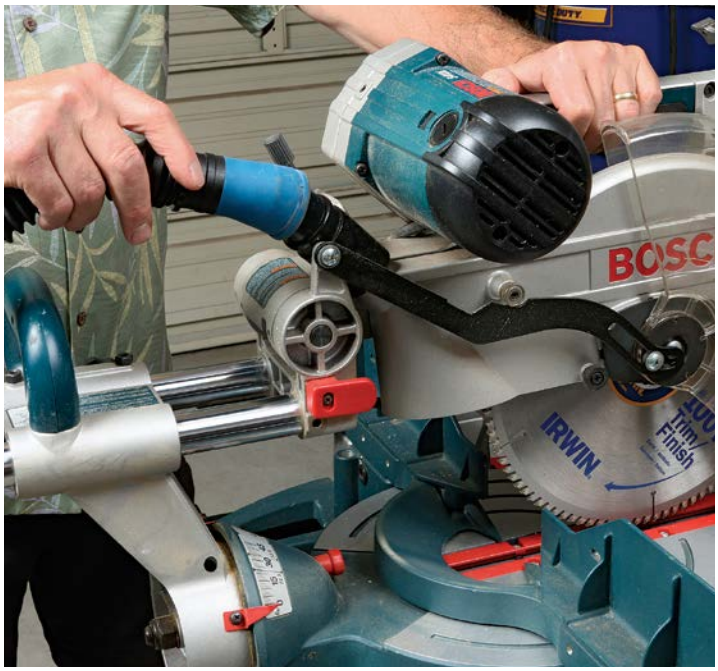
using a shop vacuum hooked up to a 14-in. bandsaw and a benchtop tablesaw that has a built-in dust housing under the blade. For larger machines, and especially if you plan to do a lot of resawing or dadoing, the dust collector would do a better job than a shop vacuum, whose hose can sometimes clog when taking big cuts.

For this article, I tried two 1-hp dust collectors that would fit my small space: a mobile tool (General International model No. 10030CF M1) and a wall-mounted machine (Grizzly Industrial model No. G0785), each with pleated filters. Both were up to the task and handled every situation presented in my shop.

To keep the costs down and get the most cfm at the tool, forget about ductwork and blast gates. Just hook up the dust collector to one machine at a time.

Quick and easy change. Rockler's Dust Right handle and tool ports speed up swapping a 4-in. hose from machine to machine. Once the ports are installed on each machine, the handle slips snugly over the open end, requiring no tools or clamps.

From a workhorse basic to bells and whistles. While a sturdy, no-frills model is great to have, a handy feature on higher-priced shop vacs is the auto-start function. When a power tool plugged into the vacuum is turned on, the vacuum starts automatically.



Narrow hose works better. The 2½-in.-dia. hose that comes with a typical shop vacuum is too large in diameter for easy hookup, plus it is stiff and bulky. Invest in a smaller-diameter hose, which allows for easier hookup and more freedom of movement (top, above, and right).

Downsize for smaller power tools

Power sanders create very fine dust and are good candidates for a hookup to a shop vacuum. Miter saws, routers, and biscuit joiners also can be handled by a shop vacuum, which can generate close to 100 cfm. Finer and fewer dust particles don't require as much air volume. That said, miter saws are pretty messy no matter what's hooked up to them because most have not been designed with highly effective dust-capturing capability.

When using hand tools such as chisels and handplanes, the chips and shavings produced are relatively large and won't get airborne. A broom and dust pan can handle the job just fine, although I've become fond of a floor sweeper that attaches to a dust collector. It captures both the large chips and fine sawdust left behind from other tools.

Adapt and connect. Most shop vacuum manufacturers have dedicated adapters that make changing from one tool to another easy. Get a brand that fits your vac.

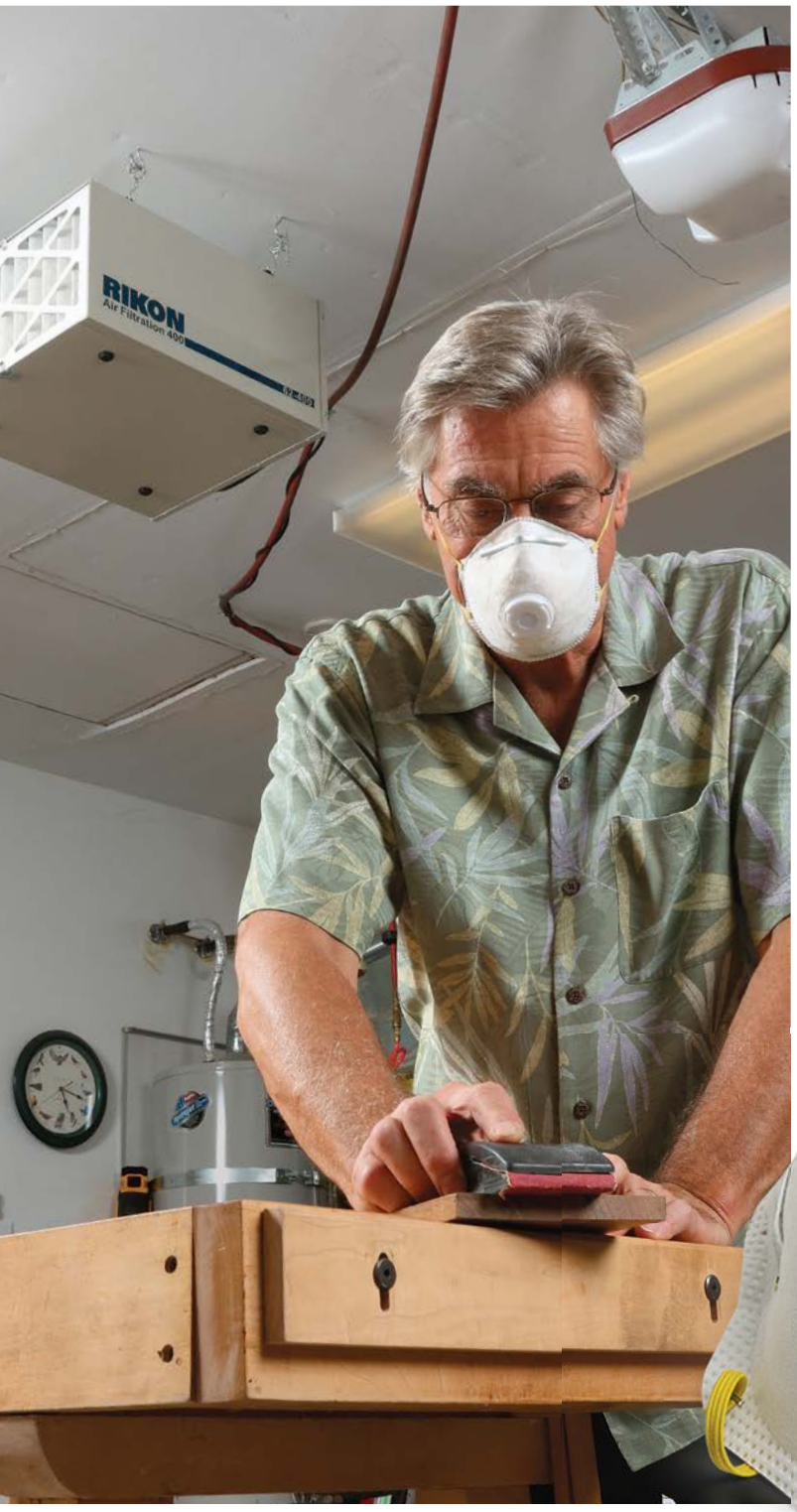
Powered air filters finish the job

In spite of one's best attempts to control the mess, some dust always escapes and the finest particles can end up suspended in the air. For that, I recommend a ceiling-mounted air filter. Now, some experts say that these machines circulate dust particles while they are running, a time during which your lungs may be exposed to more dust (vs. quiet air, when dust tends to settle). So to be really safe, it makes sense to wear a respirator or dust mask when dust is in the air. Or, run the air cleaner during a break when you're not in the shop.

A note about dust collectors and filters

There's a lot to learn about the types of dust collectors and filters, but to cut to the chase, here are the key points:

- For respirators, use one rated for fine particles (N95 rating) as the last stand against sawdust.
- Use high-efficiency filters on all dust-collection devices (dust collectors and shop vacuums) that capture particles down to 1 micron or less. These small particles can enter deep into the respiratory tract past the body's natural defenses.



- The cartridge-style filters you see pictured on the single-stage dust collectors in this article are a big improvement over the bags typically supplied with budget dust collectors. Cartridge filters have a large surface area, which allows the machine to breathe better (improving airflow) and include internal flapper arms, which allow the user to brush off dust inside the cartridge, keeping them operating more efficiently.

Basic Dust Collection Kit

1-hp dust collector	$300–$400
14-gal. shop vacuum	$100
Air cleaner	$190
Accessories	$100

For the dust that remains. Use an air-filtration system. These machines circulate dust particles while they work, so to be really safe, wear a respirator or dust mask when dust is in the air.

Work at the Right Height

CHRISTIAN BECKSVOORT

Everybody has an optimum height for their workbench. Standard benches are usually 36 in. tall, but some folks prefer one that's a bit shorter or taller, depending on their own size. The rule of thumb is that the bench should come up to about your wrist. That's great for 90% of all bench work, but it's not perfect for every operation. For example, planing requires more upper body strength, so a lower bench is better. Jobs like carving or sawing dovetails are both easier on your back if the bench is higher.

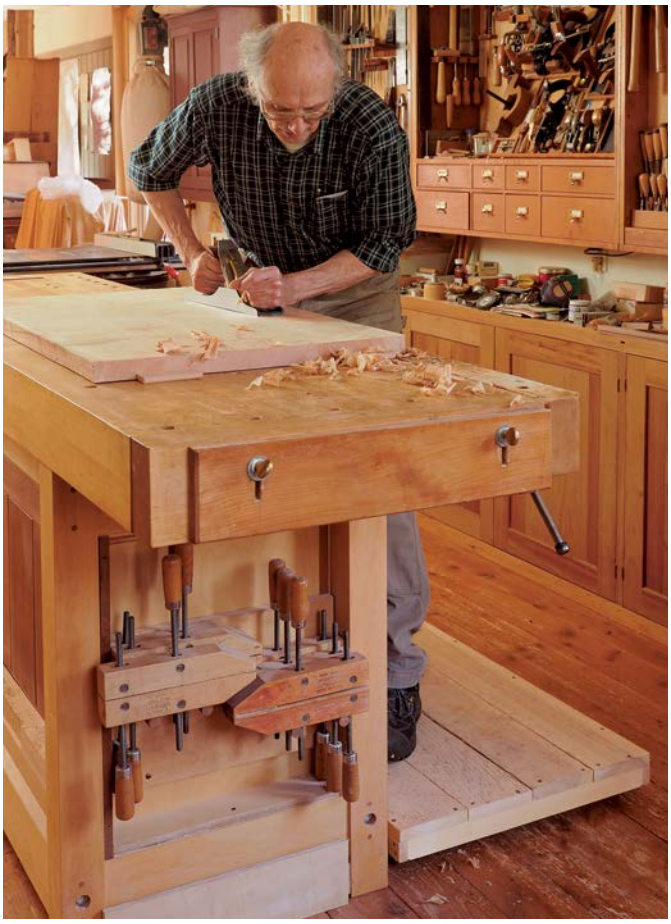
I have two methods for making my bench higher or lower, and as a result more user-friendly. With a little up-front work, both are quick to implement. I have a platform that lives under the bench that I can pull out and stand on in a minute. I also have an auxiliary bench that I keep close at hand; when I want to do some high work I simply lift it up, clamp it in place, and get to it. Both add-ons to my main bench have made me a more comfortable and efficient woodworker.

Medium, high, or low? Standard workbench height is great for most hand- and power-tool tasks (facing page), but sometimes it pays to gain a higher stance (left) or to elevate the workpiece (above).

Is Your Bench Comfortably Sized for Common Tasks?

If you stand next to your bench with your arms at your sides, the top should be at wrist height. This general rule should see you through most tasks at the bench—chiseling, belt-sanding, planing, layout, marking, drawing, etc. My bench, like its owner, is on the tall side.

Tucked away until you need it. Becksvoort built a platform to store perfectly between the legs of his bench. Limited by the clearance beneath the bottom rail of the bench, Becksvoort added a lift system under the platform. Once he pulls the platform out, he can add to its height by folding down hinged risers.



More height means more power. The platform allows Becksvoort to work at a height that's most effective and ergonomic for planing a wide panel.

Lower bench puts you on top of the work

My workbench is 39 in. tall, which is great for the vast majority of my work, even a lot of planing tasks. However, when I need to plane or flatten an entire panel or when I want to sand or plane tabletops or large panels held vertically in the vise, a lower bench surface would really help. Since I can't make my bench lower, I keep a 2¾ in. platform under it, fitted between the legs. I pull it out and stand on it, giving me a work surface that's effectively 36¼ in. high. If that's still too high, the platform has two hinged 3-in.-wide boards underneath that I can brace open with long spinners. Fold them down and the bench is 35 in. high, and I can really get into my work.

When returning it to its home under the bench, I found that the platform tended to bind if not pushed in straight. So I added strips between the legs to ensure that the platform slides in straight. If you have a European-style bench with sled feet, the guide strips won't be necessary. If you want a platform the full length of your bench, you'll have to store it elsewhere. The platform can be made out of leftovers or cheap wood and can be built in just over an hour. It's an hour well spent, since it will make your work much easier. I also included a small nylon handle to make the platform easy to pull out.

A benchtop bench puts the work where you need it

Making a higher work surface can be more complex, but it's worth the effort since it greatly improves the ergonomics of sawing tails and pins for case sides, and of letter carving. Unlike planing, which usually takes 5 to 10 minutes, carving can last for hours. Spending that much time hunched over is tough on your back. The high surface is also useful for fussy jobs such as inlay, where you need to be close to the work.

I have a 12-in.-high auxiliary bench that I clamp to my workbench. Its top surface is 51 in. off the floor, so I can rest my arms comfortably on it, and it is perfect for carving. No more backaches. The front edge has a 24-in. Lie-Nielsen chain-driven vise. That makes it easy to clamp case sides for sawing dovetails. The vise doesn't rack, since both spindles turn at the same consistent rate. The 12-in., 18-in., and 24-in. vise hardware is all priced the same, so go for the big one.

You really don't need an auxiliary bench as complex as mine, and you may not need the full 12-in. height. Use your imagination to come up with a solution that satisfies you. You can buy a variety of vises and carving tops suitable for auxiliary benchtop benches from Lee Valley, Tools for Working Wood, and Lie-Nielsen. Prices range from $69 to $890.

Bring the work up. With the smaller bench clamped to the main bench, Becksvoort can work at a level that will be comfortable for extended periods of time and allow him to use his body position productively.

Same features as the main bench. By adding a vise to the auxiliary bench, Becksvoort keeps his usual methods intact while working at the optimal height.

Woodworking Wisdom

JERRY C. FORSHEE

It was 25 years ago that I took my first hands-on woodworking class. In the years since, while developing my skills, I have discovered that woodworkers are an amazing class of people. They're almost always eager to share their knowledge, experiences, and tools with those less experienced. It's often like they have no secrets. Since so many have shared their time and wisdom with me during my woodworking journey, I've tried to do the same. In this article I will talk about the pieces of woodworking wisdom I've learned along the way.

Safety first

There is often more than one way to accomplish a given procedure, but the best method always puts safety first. No matter what you're doing in the shop, your well-being should always be the priority.

Hands at 3 in.

To protect your hands and fingers, keep them at least 3 in. away from all blades, cutters, and guards.

Stock at 12 in.

If your workpiece is less than 12 in. long, pause to consider if the process or machine you've chosen is safe for this operation. Every machine and tool has inherent limitations. For example, attempting to plane a board that is shorter than the distance between the infeed and outfeed rollers could cause serious kickback. In this case, either keep the stock overlong while planing or turn to hand tools to thickness it.

Know when to stop

If you begin to feel tired, don't hurry or work past your peak efficiency; that's when accidents are likely. Take a break. The work will be there when you come back.

Take time for safety

Never hesitate to spend the time and money to protect yourself. Use safety glasses for your eyes, earplugs or muffs to protect your hearing, and a dust mask and/or point-of-origin dust collection to protect your lungs. Use push sticks, push paddles, and featherboards—unlike your fingers, these are expendable. Finally, trust your gut. If an operation doesn't feel right, consider using a different tool, jig, or fixture, or ask a more experienced woodworker for assistance or advice.

The right mindset

One's mindset and knowledge are essential and come before the ability to execute. Staying in the right frame of mind will help you every time in the shop.

Work with what you have

To do great woodworking, it is not necessary to own all the latest tools, aids, jigs, and gizmos. Instead, be creative: Find a way to accomplish your goal with what's at hand. Successful problem-solving is an essential skill in woodworking.

Learn from the experiences of others

We all learn through our own experiences. But most important, we learn from the experiences of others, whether through books, magazines, videos, woodworking classes, or other avenues. Take advantage of others' experiences to expand your woodworking knowledge and save yourself from making blunders.

Your time's more precious than your wood

The most valuable resource in woodworking projects is the time you put into them. So work smart to manage your projects efficiently. Don't aim for economy by skimping on wood; you may end up paying with your time. Mill extra stock in case flaws show up as you build or you make a mistake. And always save mismachined parts and cutoffs for testing machine setups and finishing processes.

The material

Each species and each board has its own characteristics, so it's important to know how to work your stock without it fighting back. Trust me: The wood will win every time.

Wood always moves—deal with it

It's crucial to understand that wood forever takes on and gives up moisture, causing it to continually expand and contract. In other words, wood's always moving. Learn how the tree grows, as well as the properties of the different types of grain (flatsawn, riftsawn, quartersawn) and how they move. This will allow you to design and construct your projects to cope with wood movement.

Boards know how big they are

You can't make a measuring error if you don't measure. Use an existing part to set up a machine rather than measuring the part and then using the measurement for setup.

Fibers tear out when not backed up

Try to avoid tearout, which not only creates surface blemishes but also can leave gaps in joints. When routing around the edges of a panel, rout the end grain first so that you remove any tearout when routing the long-grain edges. Similarly, when trimming stock, crosscut first so subsequent ripping can remove any blowout. Also, use a zero-clearance throat plate to help limit tearout. When cutting a rabbet or dado, use a push stick or pad to back up the cut.

Procedures

With safety at the forefront, your mindset honed, and an understanding of your material, you're ready to get the most out of your shop time. Just make sure you don't get in your own way.

Use reference faces

To keep parts organized, keep track of which face, edge, or end is your reference surface, and use the same surface for all similar pieces. If you switch reference surfaces, parts may not fit or you may have too many pieces of one type and not enough of another. For example, if you are cutting offset tenons on table aprons, ensure that the offset is always on the same side of the apron. When milling parts, take the time at your bench to label each one, then stack them in the order and orientation they'll be processed at the next machine. This way, you'll be able to mill the parts quickly and accurately without having to find the reference surface on each one.

Rehearse glue-ups

Make your glue-ups more successful and less stressful by practicing with dry-fits. Lay out the parts, decide where you'll apply glue, map what clamps go where, plan how clamps will be supported, and organize cauls—and then make sure they're handy. If the assembly is particularly daunting, don't hesitate to rehearse the same glue-up more than once.

Sneak up on it

Woodworking is a subtractive process. Once wood is removed, it's difficult and time-consuming to restore, and sometimes the only option is throwing out the mistake and starting over. Thus, as you fit the joint or machine the part, proceed cautiously and slowly, regularly checking for fit or size to ensure that you don't remove more wood than necessary.

Finally, to be a better woodworker, do more woodworking

Don't be discouraged with your results; woodworking skill is learned and increases with experience and practice. Your success will ultimately depend on finding what safety practices, techniques, and procedures work best for you given your talent, experience, tools, stock, and project. Each project you make will be better, in some regard, than the last because of your increased experience. Learning from your own mistakes can be powerful, so reflect on and embrace them.

PART FIVE

Workbenches and Accessories

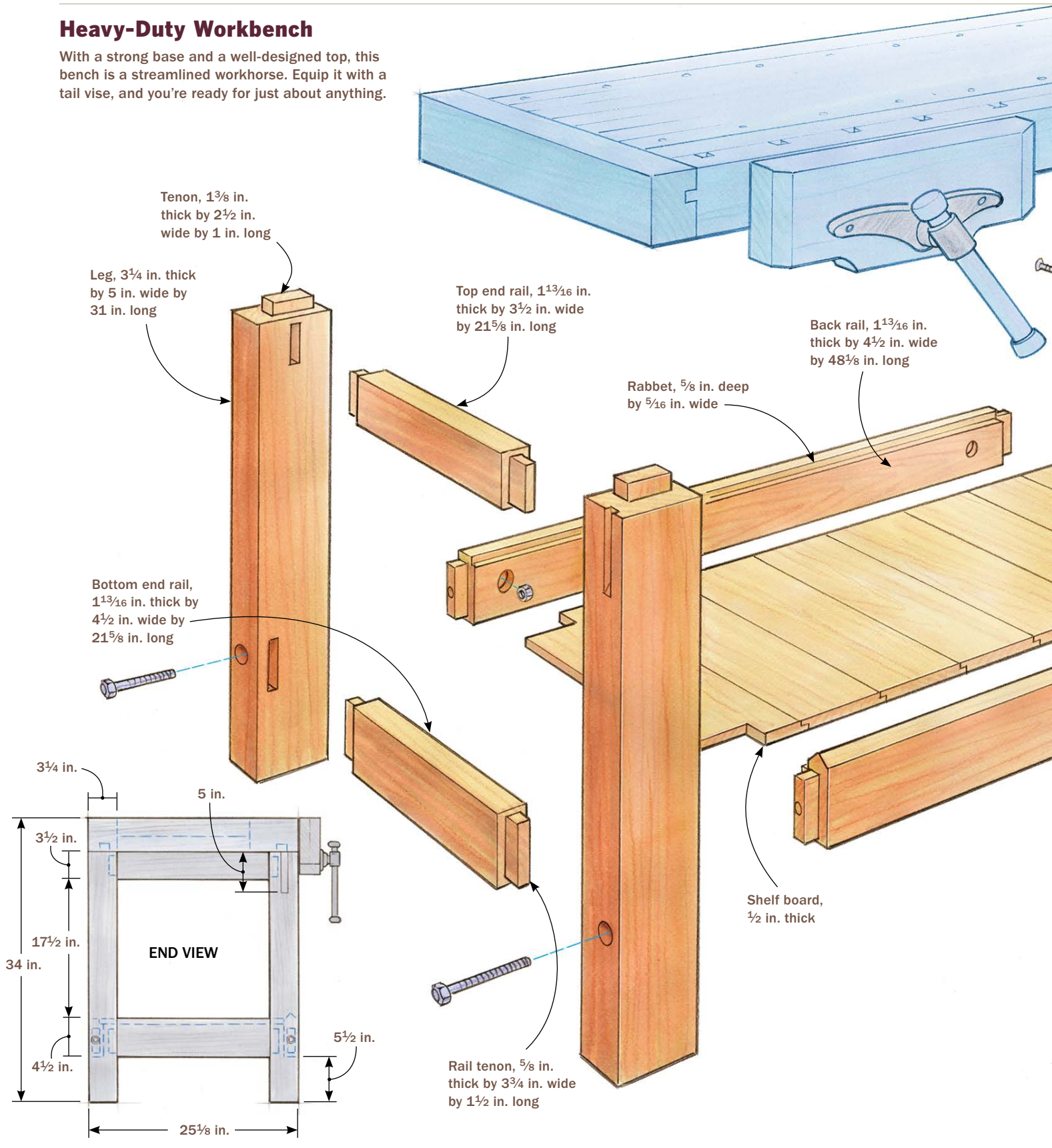
Build a Stout Workbench

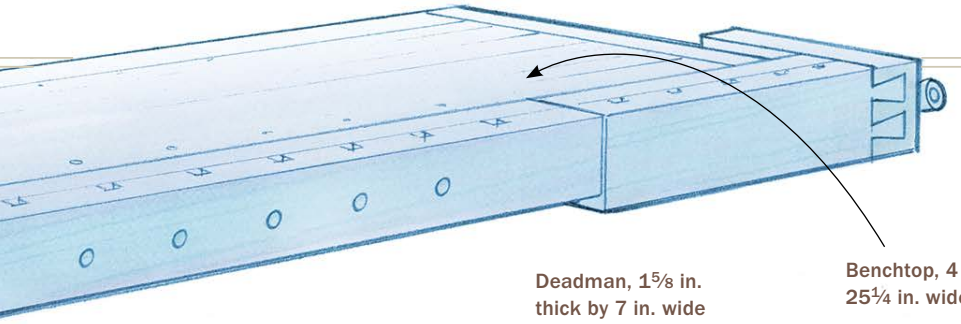
CHRIS GOCHNOUR

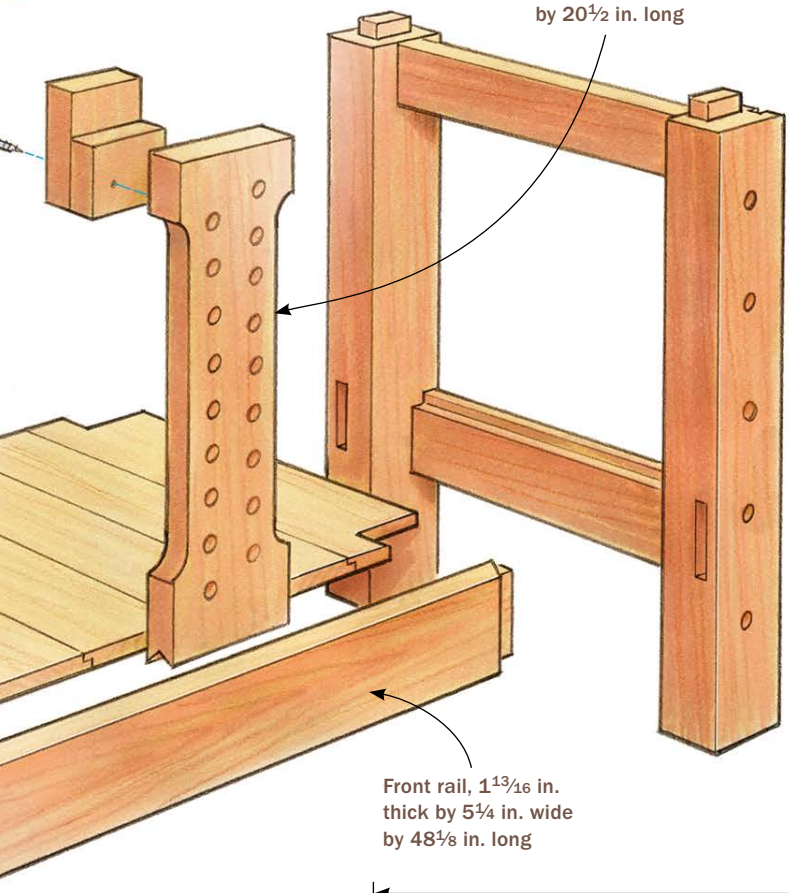
I've done a fair amount of handplaning during my 32 years as a professional furniture maker, and I've found that the best way to secure a board for face-planing is between two benchdogs, which can be set below the board's surface so you can plane without hindrance. Clamps and holdfasts, by contrast, seem always to be in the way. And unlike a planing stop, dogs have no trouble holding the board in place when you plane diagonally or across the grain.

Heavy-Duty Workbench

With a strong base and a well-designed top, this bench is a streamlined workhorse. Equip it with a tail vise, and you're ready for just about anything.

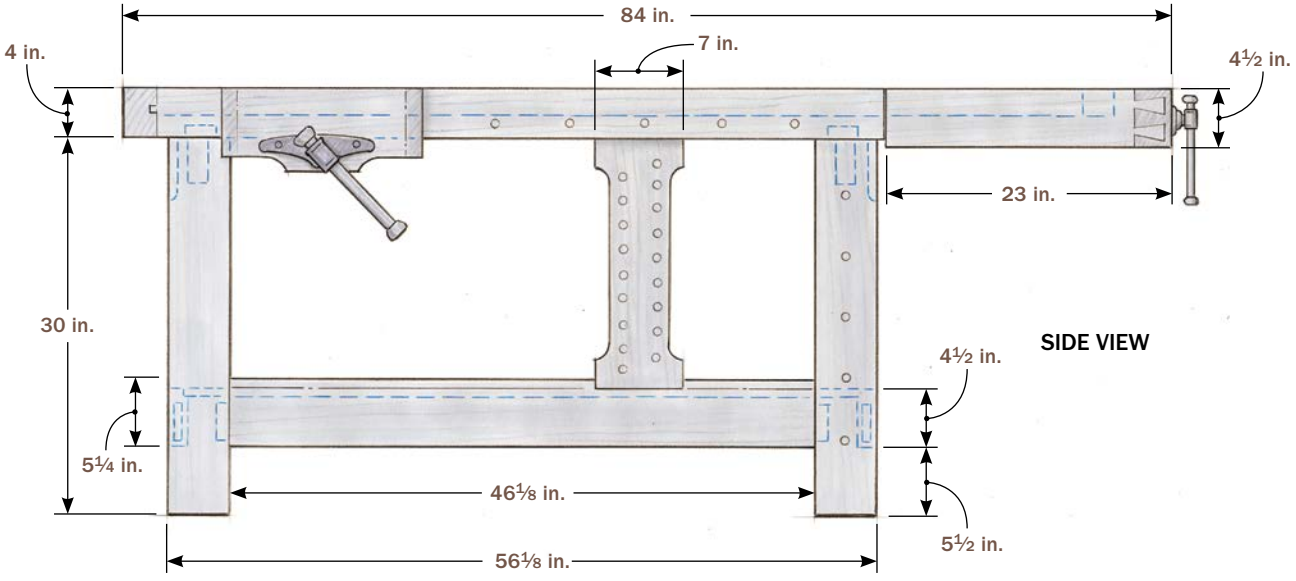






Sources of supply

Veritas quick-release front vise
leevalley.com
WoodRiver large end vise slide
woodcraft.com



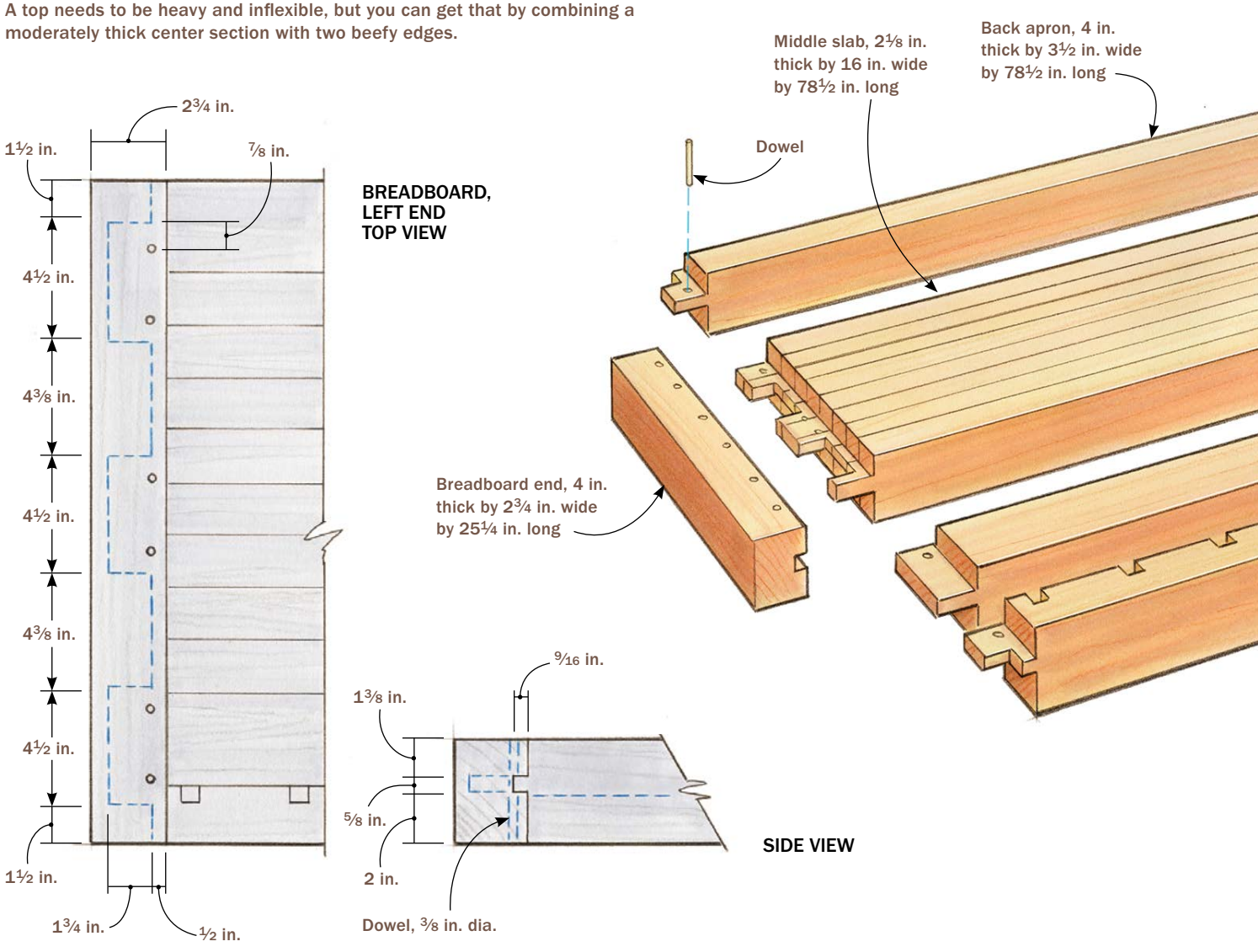
SIDE VIEW

Versatile and effective. A traditional tail vise excels at everything from face- and edge-planing to cutting tenons, a range that other end vises can't match.

Benchdogs require a vise, and when I build a workbench, I like to locate that vise on the end. There are four options for an end vise: a traditional tail vise, a wagon vise, a metal face vise mounted on the end, and a twin-screw vise. All four can be used for face-planing boards, but the tail vise has several advantages over the others. With a tail vise, the dog holes can be placed very close to the bench's front edge, which makes it possible to plane narrow boards with a plough plane or similar plane that has a fence that hangs below the

Build a Better Benchtop

A top needs to be heavy and inflexible, but you can get that by combining a moderately thick center section with two beefy edges.

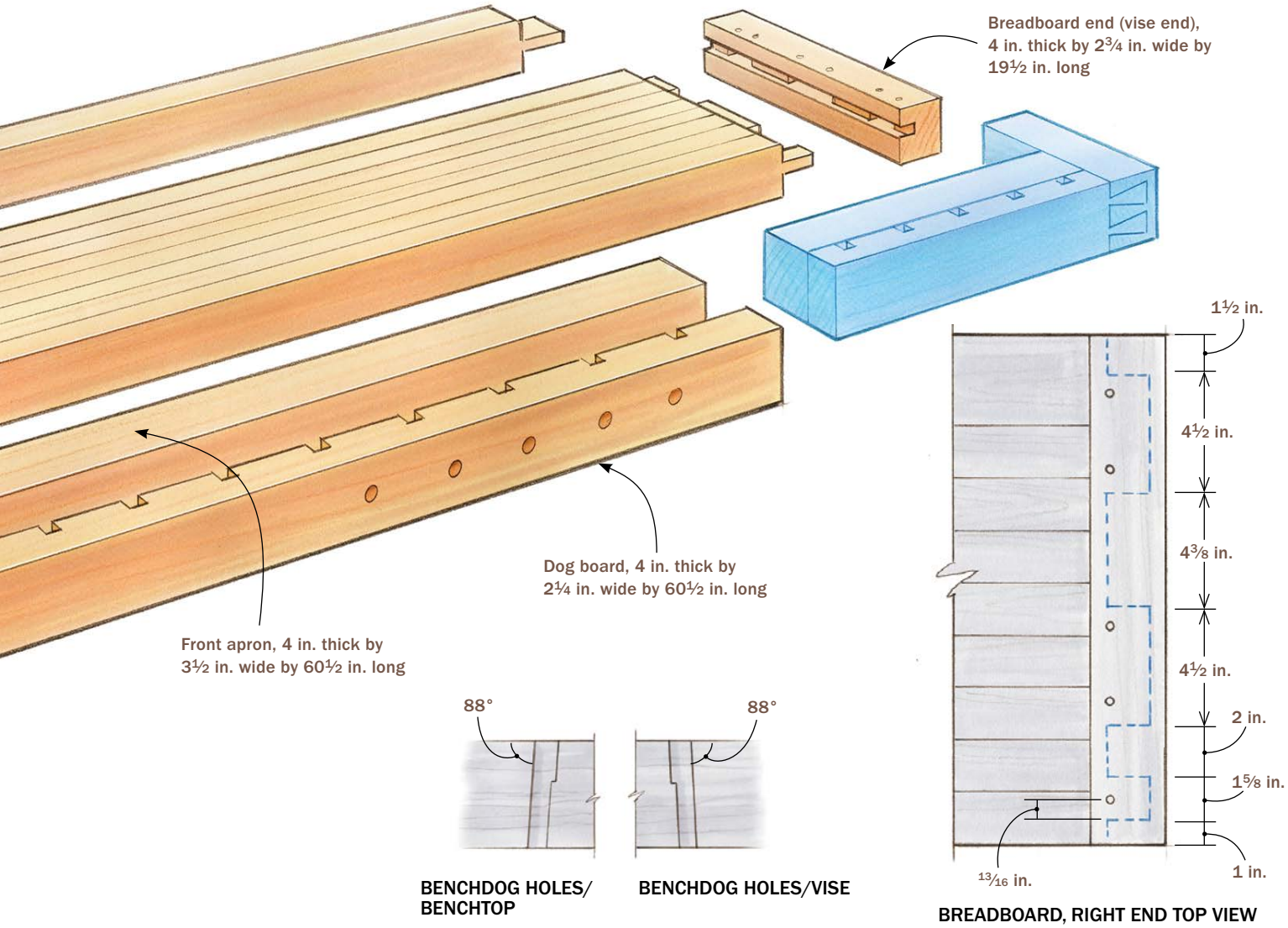


benchtop. That's something that isn't possible with a steel vise. Wagon vises work great when the board is flat on the benchtop, but with a tail vise you can also clamp a workpiece vertically, which lets you cut tenons, for example. The fourth option, the twin-screw vise, handles tenons and edge-planing fine, but it doesn't support work as well as a tail vise for face-planing. These advantages are why I chose a tail vise for my bench.

For many woodworkers, building and installing a tail vise seems intimidating, but it shouldn't be. I've installed quite a few, both on benches of my own and on student benches, and have developed a process that ensures the vise slides smoothly and doesn't snag. I'll show you how I do it.

The top is thick where it needs to be

Making a bench is a big undertaking, but fortunately most of the work involved is fairly routine. The base of this bench is four big legs joined to the rails between them with



BENCHDOG HOLES/ BENCHTOP

BENCHDOG HOLES/VISE

BREADBOARD, RIGHT END TOP VIEW

Cut angled dadoes for the benchdog holes. Use a dado head and a miter gauge to remove most of the waste from the dog holes.

mortise-and-tenon joints. Shiplapped boards set between the lower rails provide a nice place for storing jigs and anything else you like to keep close by. I am going to skip over the base construction here, because the process is relatively straightforward, and focus instead on the top and the tail vise.

The benchtop is thick along the front and back edges but has a wide, thinner section between. The middle doesn't need to be as thick, because all the pounding on a bench should be done over a leg or a top rail. This bench has a thick back apron and a front section made up of a thick front apron and an equally thick dog board. Glue up the thinner middle section, and then mill the back apron, front apron, and dog board to their final dimensions.

Next cut the dog holes in the dog board. The dogs should angle inward. To make that happen, the dog holes in the benchtop slant 2° toward the vise; in the vise, they lean toward the benchtop. I make the dog holes in two steps. First I hog out the waste with a

Rout the final shape. A template ensures that all of the dog holes are identical. Because the dog holes in the vise jaw face the opposite direction from those in the benchtop, Gochnour uses a template that has a pattern for both directions (top). The pattern has a notch so that a flush-trimming bit creates the pocket into which the dog's head fits (above).

dado set at the tablesaw. Then I use a router and template to refine the hole and add a wider section at the top so that a dog, which has a head that's wider than its shaft, can fit completely into the hole. Cut the dog holes in the vise jaw at this time, too.

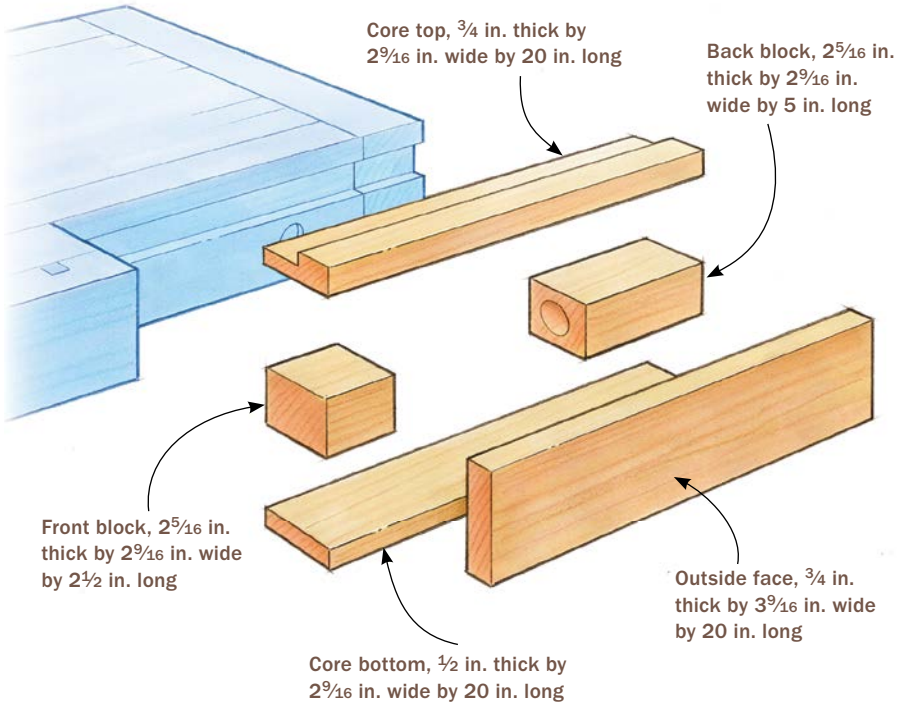
After you've completed the dog holes, glue the dog board to the front apron. Let the glue dry, and then glue the three parts of the top together. Give the glue a night to dry before installing the breadboard ends. You're done with the top for now. It's time to get busy making the tail vise.

Glue the dog board to the front apron. Spread glue only on the dog board, and keep the glue about ½ in. from the dog holes (above left). Gochnour uses Festool Dominoes for alignment and plenty of clamps, alternating them from top to bottom (left).

Bring it all together. A plywood spacer under the center section keeps it aligned with the thicker front and back sections. Be sure to add clamps above the top to prevent the thicker sections from slanting inward on the bottom.

Build the Core of the Tail Vise

The success of a tail vise depends on how well the wooden jaw and metal hardware work together. Start with the vise's hollow core, which is the key to smooth operation.



Make the tail vise in stages

At the heart of this tail vise is some metal hardware. A vertical plate that holds the nut face-mounts to the benchtop. A pair of slides screwed to the wooden jaw grasp the plate. The screw goes through the jaw and threads into the top slide. The jaw has three parts: a hollow core, the vise dog board, and the end cap. Because the vise's success rides on how well you join the hardware to the core, it's best to start there. Get it right, and then add the dog board and end cap.

The core begins by gluing together four parts: a top and bottom, and a front and back block. A large space in the middle accommodates the vise screw and nut. After the glue has dried, add the outside face to the core. What you have now is akin to a box without a lid. Take it to the drill press and drill a clearance hole through the back end for the vise screw. Next, cut a rabbet in the core top. The vise's top slide fits into this rabbet. Clamp the two slides, with the mounting plate between them, to the core, and mark the holes where the bolts go through the bottom slide and thread into the top slide. Unclamp the slides and drill clearance holes for the bolts.

Cap the core. After gluing the four pieces of the vise core together, glue it to the outside face, using a piece of melamine to keep them aligned.

Make way for the vise screw. It takes some serious clamping and an extender for the Forstner bit, but it is possible to drill the hole at the drill press. A fence on the drill-press table helps keep the vise core plumb.

Cut a rabbet in the core top. The easiest way to make this wide rabbet is with two cuts at the tablesaw. The vise's top slide fits into the rabbet.

Slides are attached with bolts. Clamp the slides to the core with the vise plate between them. Transfer the bolt hole locations from both slides and then drill the holes at the drill press, coming halfway in from both sides.

Fit the Core to the Bench

Attach the hardware to the bench, and get the vise core riding smoothly on it before you go any further with the vise construction.

Groove the top. Two passes with a rabbeting bit create a slot into which the top slide fits.

Mortise for the nut. The vise screw's nut has a threaded stud that passes through the vise plate. A nut that secures it from behind the plate fits into a shallow mortise. Clamp a straightedge to the benchtop and register the vise plate against it. Transfer the hole to the bench (left). Drill the mortise with a Forstner bit (right).

Screw on the vise plate. Use a Vix bit to center a pilot hole for each screw, and then drive the screws. Make sure the screw heads sit below the surface of the vise plate.

Assemble in place. Gochnour bolts on the slides while clamps hold the vise core snug against the vise plate. Threaded up from the bottom, the bolts are still accessible after the vise is complete.

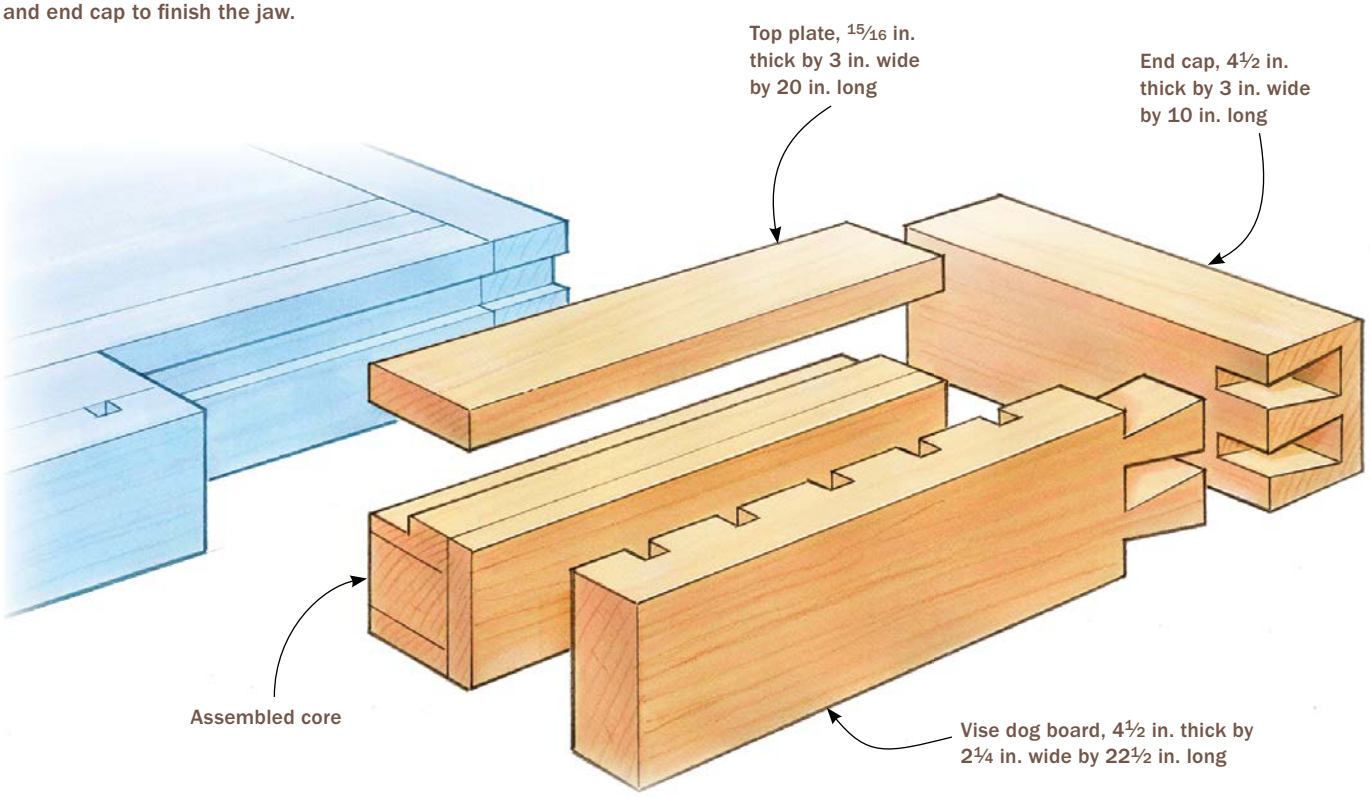
Check the glide. Now's the time to test how well the vise slides. You can trim the rabbet if it's too loose or add a shim under the bottom slide if it's too tight.

Now mount the plate to the benchtop and install the vise core on the plate, as shown in the sidebar on the facing page. Give it a slide. If it's too loose, take a shaving or two from the rabbet and try again. If it's too tight, shim the bottom slide. When the core glides smoothly, move on to the dog board and end cap.

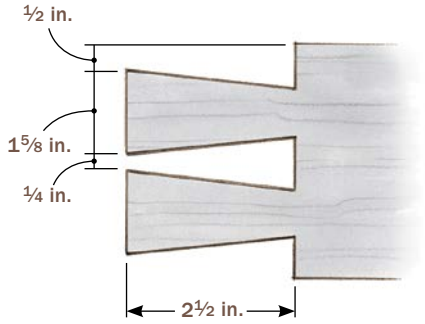
The dog board gets a few dovetails; the end cap gets the pins. After you've cut and fitted the joint, but before you glue the two parts together, drill a hole through the end cap for the vise screw. Then cut slots for the slip tenons that join the end cap to the core and top plate. Glue the jaw and end cap together and then glue that assembly to the vise core.

Finish the Tail Vise

With the hollow core complete, add the dog board, top plate, and end cap to finish the jaw.



DOVETAIL LAYOUT



Dovetail the corner. This is the traditional way to join the end cap and dog board. It's strong and looks great.

Add the core. Keep the glue away from the dog holes (left). When clamping, use a caul to bridge the hole in the vise core (right).

Glue on the top plate. It should sit about 1/16 in. above the benchtop. Gochnour uses a Festool Domino to strengthen its connection to the end cap (above). Apply clamping pressure both side to side and along the plate's length (right). Then add clamps for top to bottom pressure.

The last step in making the vise is to glue on the top plate.

You're ready to mount the completed vise. Check how the jaw closes against the bench. Use a bevel-up plane to shave the jaw's end grain until the vise closes nice and tight. Finally, plane the tail vise flush to the benchtop. Now you can get to work.

Install the vise. Hook the top slide over the vise plate, put the bottom slide in place, and then bolt them together.

Make it flush. After refining the end of the jaw so that it closes tightly against the bench, plane down the tail vise level with the benchtop.

A Small, Sturdy Workbench

MATT KENNEY

When we received this workbench proposal from Eric Tan, it was quickly accepted by the *Fine Woodworking* staff. Tan, who specializes in Ming dynasty furniture, incorporated interlocking joinery—a signature detail of that era—into the bench, creating a strong, rigid construction without the need for glue or hardware. The unique design is brilliant, a no-brainer for a shop project.

All in the joints. Compact design gets its strength and rigidity from clever interlocking joinery.

But there was a problem: For the vast majority of articles, one of our editors travels to the author's shop to take photographs. Tan lives in Taiwan, and I did my best—on several occasions—to convince my editor to send me there to photograph him making the bench. Alas, due to expense and time constraints, my arguments did not prevail. So, instead of flying to Taiwan, I drove a few miles down the road to the shop of Kelly Dunton, who agreed to help us show readers how to make the bench.

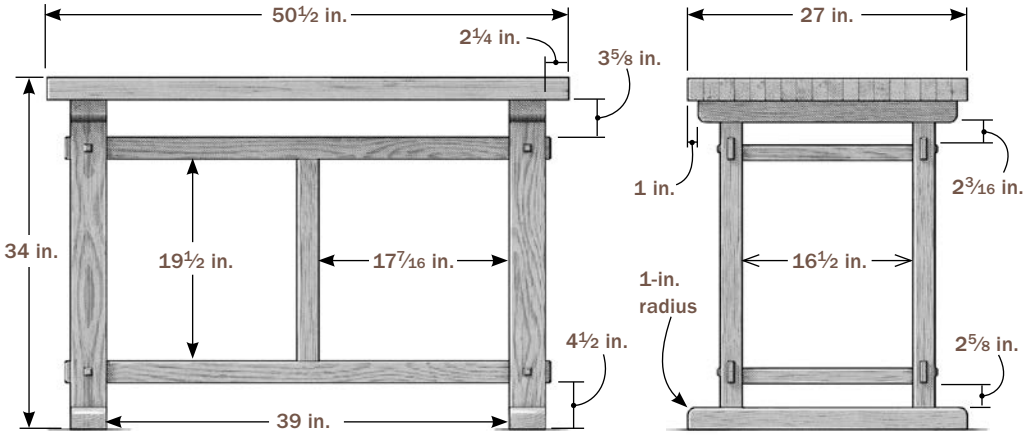
Aside from working in imperial rather than metric units of measurement, Dunton made the bench exactly as Tan designed it. There is more to this bench than its ingenious self-locking joinery. When assembled, it's rigid and heavy, making it well suited for handwork like planing, sawing, and chopping mortises. It's also compact, making it perfect for anyone with limited shop space.

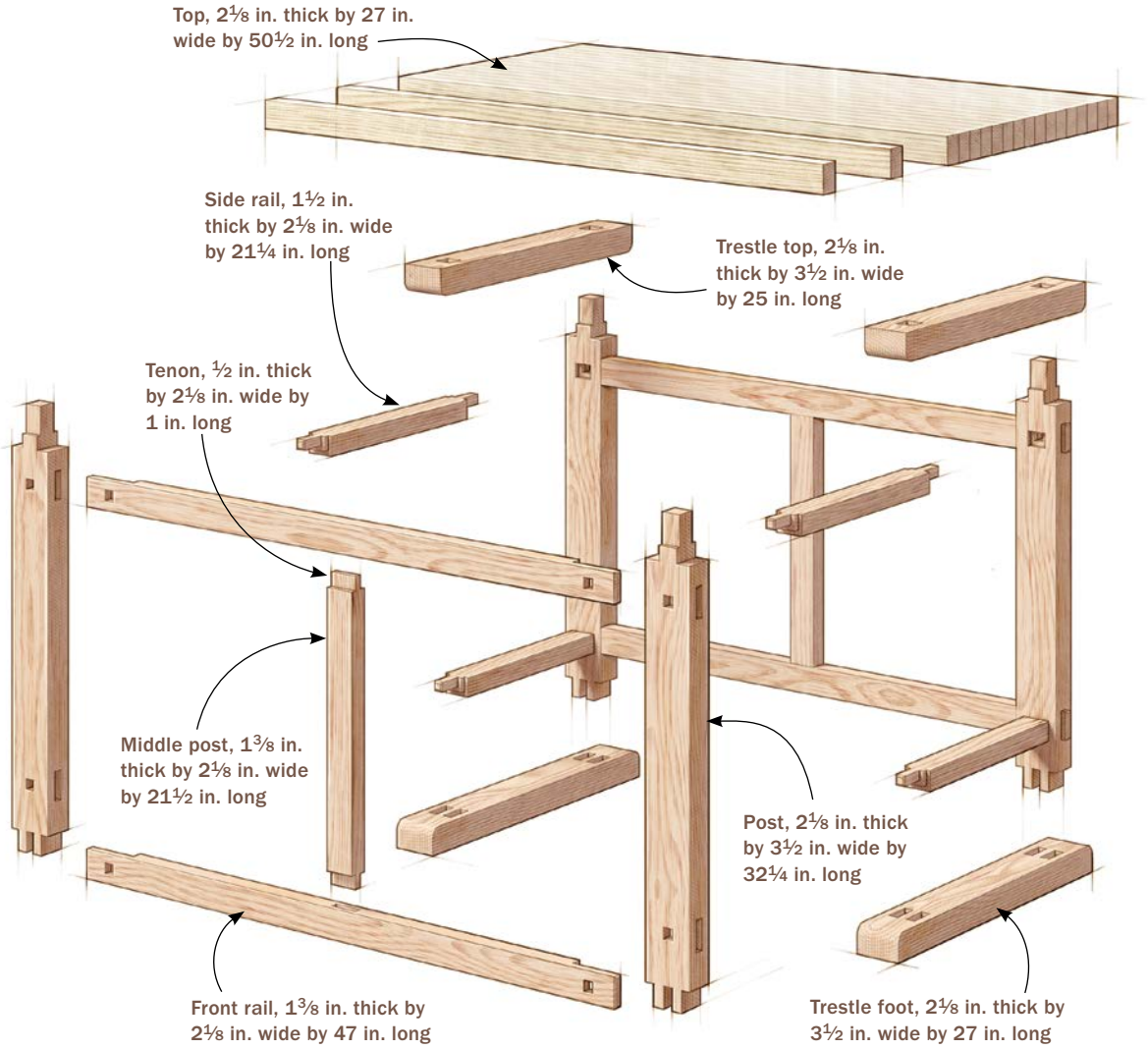
A dizzying bunch of mortises

All the joinery was done with a hollow-chisel mortiser and tablesaw. This bench has 28 mortises, ranging from dead-simple to fairly complex, combining a stopped mortise with a smaller through-mortise. Fortunately, none of them are difficult to cut.

Joinery, Not Glue, Holds This Bench Together

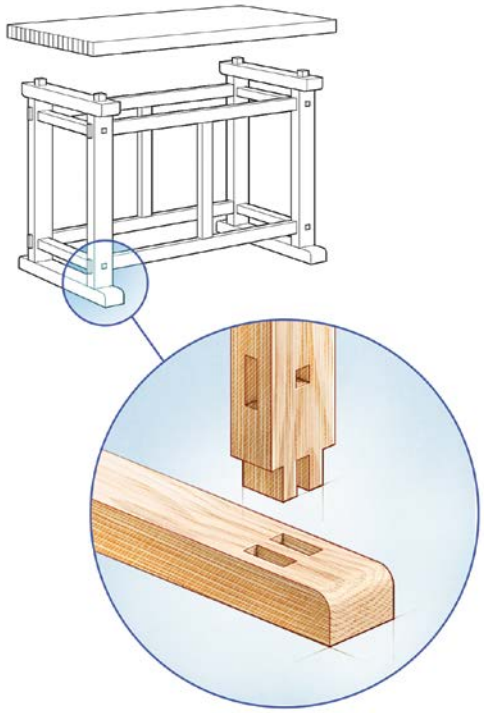
Interlocking joints borrowed from Ming dynasty furniture eliminate the need for glue. We chose ash—heavy and strong—for this bench.

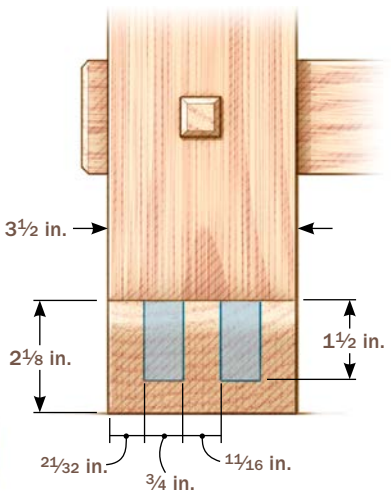




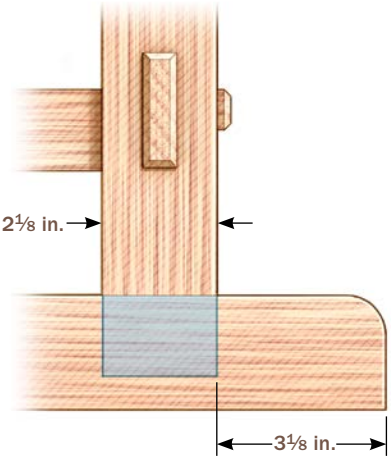
Post and Foot are Double-Jointed

Two tenons are stronger and resist racking better than a single tenon. Fortunately, cutting a double mortise-and-tenon isn't much harder than cutting a single one.





FRONT VIEW



SIDE VIEW

After milling the parts to their final dimensions, go to work on the mortises, starting with the most straightforward: those that connect the middle post to the front and back rails. Dunton cut them in two passes with a ¼-in. bit. Set the mortiser's fence to cut the inside wall first, then flip the stretcher around and cut the second wall without moving the fence.

The posts are attached to the trestle feet with double tenons. Dunton used a ⅜-in. bit for these (and all of the remaining mortises). Set the fence for the outside walls of the mortises. Cut the first pair, then flip the foot around to cut the outside wall for the second pair of mortises. Adjust the fence for the inside wall and repeat the process.

Double setup. For the foot's double mortise, set the fence to cut the outside wall. Spin the foot, and do the same for the second mortise. Repeat the process for the inside wall, as shown.

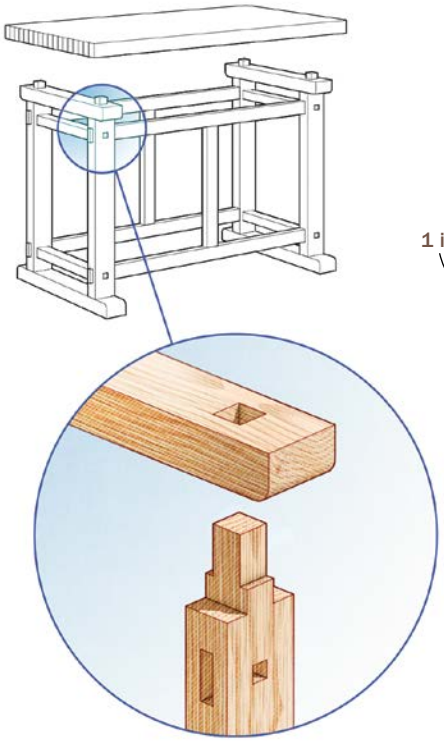
One blade for the cheeks and shoulders. Use a blade that cuts a flat-bottom kerf. For perfectly centered tenons, cut one outside cheek, rotate the post, and cut the other. Adjust the fence and cut both inside cheeks (left). Then shift the fence to nibble away the waste between them. Replace the tenoning jig with a miter gauge and cut the shoulders. A stop block ensures they are aligned (below).

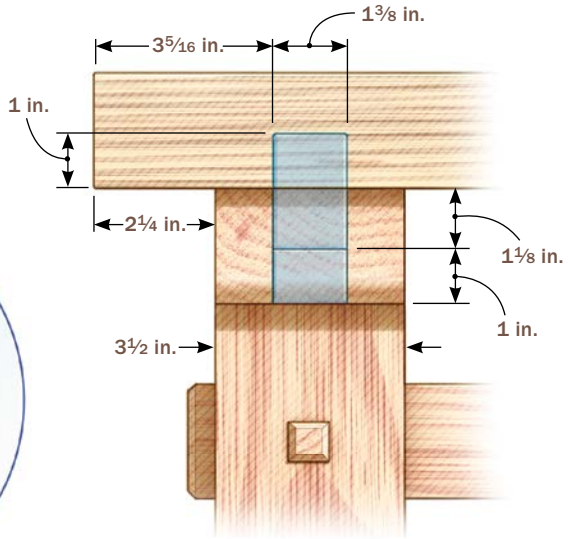
The joint that connects the posts to the trestle tops is a bit more complex. The mortise in the trestle top has a large, rectangular stopped section and a smaller, square through section. Begin with the through-mortise, cutting in from the top to just over 1⅛ in. deep. Flip the trestle top over to cut the rectangular section and connect it to the square portion. Each post has two pairs of intersecting mortises that connect the front and side rails. Cut the stepped mortise for the side rail first. It consists of a larger stopped mortise and a small through-mortise. Again, start with the through-mortise, cutting in from the outside face. Then flip the post and cut the stopped mortise from the inside face. Next cut the through-mortises for the front and back rails. Because of the post's thickness, you'll need to come in from one face and then flip the post and complete the mortise from the other side.

The last four mortises are in the underside of the top, but you can't cut them until you've cut the post tenons and assembled the base. All of the tenons are cut at the tablesaw. Start with the simple tenons in the posts and front

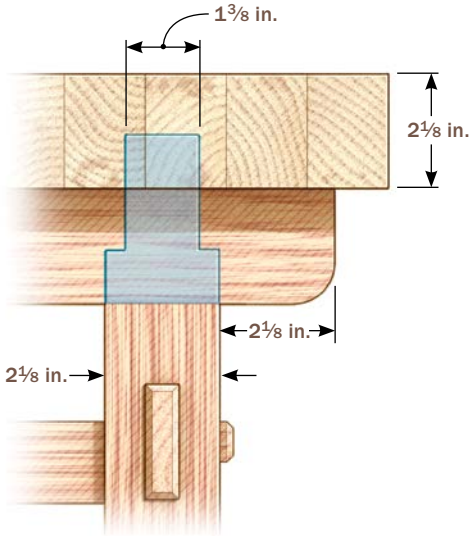
Stepped Tenon Does Twice the Work

The tenon on the top of the post extends through the trestle top and into the benchtop. The lower part acts as a shoulder for the upper tenon, creating a stronger joint.





FRONT VIEW



SIDE VIEW

Two mortises in one. First cut the smaller through-mortise from the other side. Then cut the larger, stepped one on the underside.

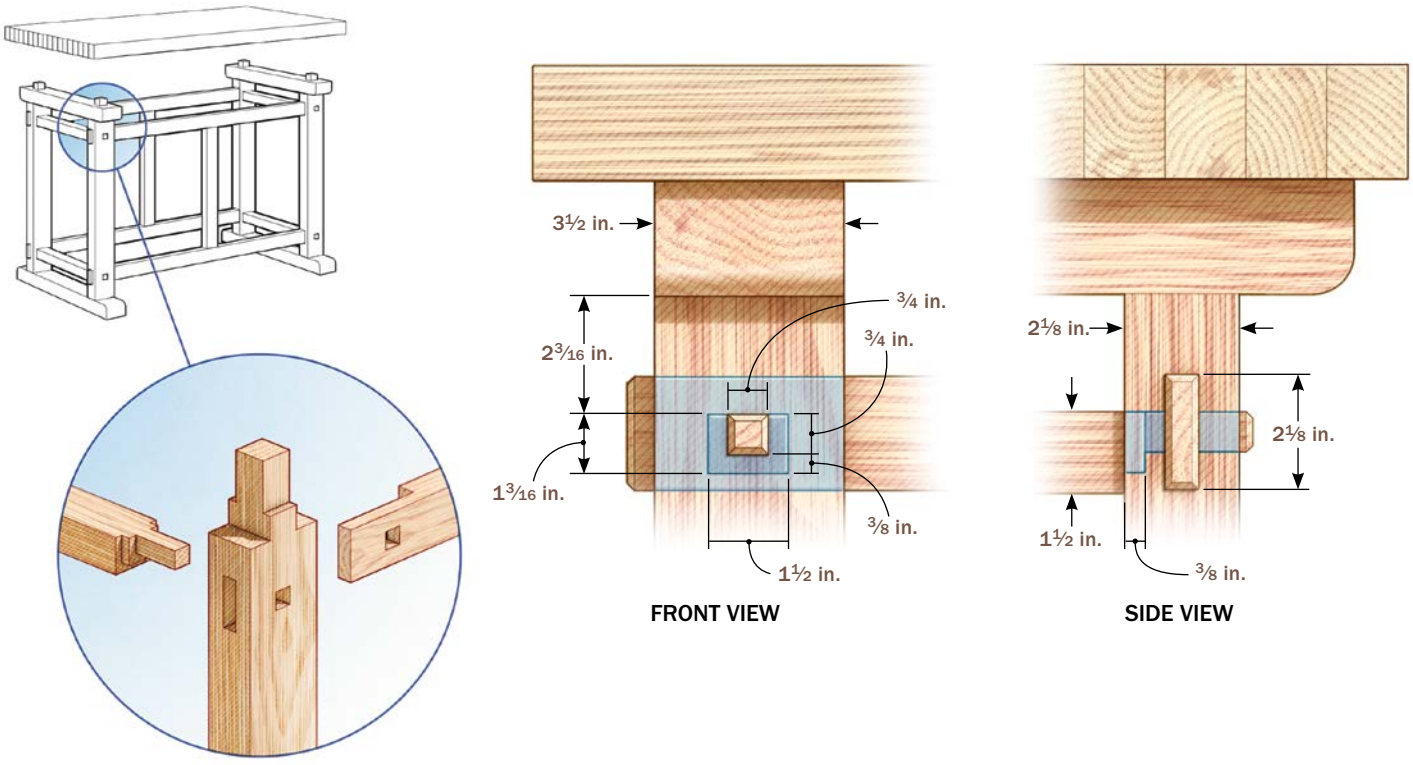
Cut the mating tenon with a dado set. With the blades set to cut the tenon's small shoulders, remove waste from the front and back of the post (above right). Then raise the dado set and cut the long, thin tenon (right).

and back rails, using a dado set and miter gauge. Cut the tenons in the side rails and the top of the posts. Cut the biggest part of the tenon first, then raise the dado blade and cut the smaller part.

To cut the double tenon at the bottom of the post, use a blade that cuts a flat-bottom kerf, like a rip blade. Using a tenoning jig, cut the two outside cheeks: Cut one of them, flip the post in the jig, and then cut the second.

Rails Lock Together

The tenons on the side rails pass through the tenon on the front rails, tying the posts to the rails.



Start with the side rail mortise. Cut the through-mortise from the outside face first, then cut the larger, stopped mortise on the inside.

Then cut one for the front rail. Turn the post on edge and cut halfway through. Flip the post and complete the mortise from the other edge.

Side rail tenon is less complicated than it looks. Start with the large, lower section, cutting the sides and bottom of the rail to create the three shoulders (above). Raise the blade and cut the thin top half (right).

A second setup gets you both inside cheeks, using the same cut, flip, cut process. Nibble out the waste between the inside cheeks by adjusting the jig between cuts so that you work across the waste.

After all of the tenons have been cut, it's time to mortise the tenons in the front and back rails to accommodate the tenon on the side rail. This creates an interlocking joint. Fit one front or back rail tenon at a time. When it's snug in its mortise, lay the post and rail down, so that the mortise for the side rail is facing up. Use a Forstner bit to drill through the tenon where it intersects the mortise. Square up the corners with a chisel. Pull out the rail and move on to the next tenon. After all of the tenons have been mortised, clean up all of the parts, getting them ready for a finish. After this, you can assemble the base.

Dry-fit the side rail. Because the tenon is shaped like a half-lap, make adjustments by planing the side of the tenon with no shoulder.

Drill a mortise through the tenon. Use a Forstner bit to remove the waste (left), and then square up the corners with a chisel (right).

A glue-up with no glue

As you put the base together, each new joint assembly locks the previous joint together, so there is only one way to assemble it. Begin by assembling the middle post and the top and bottom front rails. Next, connect the posts to the front rails. The middle post is now locked in place. Repeat this process to assemble the back of the base.

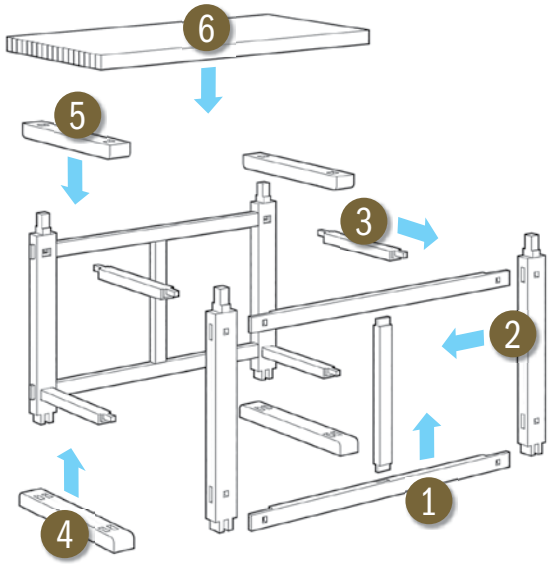
Next, lay down the front assembly and install the four side rails. The tenons on the side rails pass through the tenons on the front rails, locking the posts to the front rails. Lower the back assembly onto the side rails. Now, turn the base upright and lower it onto the feet. Drop the trestle tops into place to complete the base.

Next up is the top. Start with wide boards, ripping them into narrow strips. Flip the strips on edge and glue them together to create the top. This creates a strong top from rift- and quartersawn boards.

Now it's time to mortise the top for the legs. You'll use a template, router, and

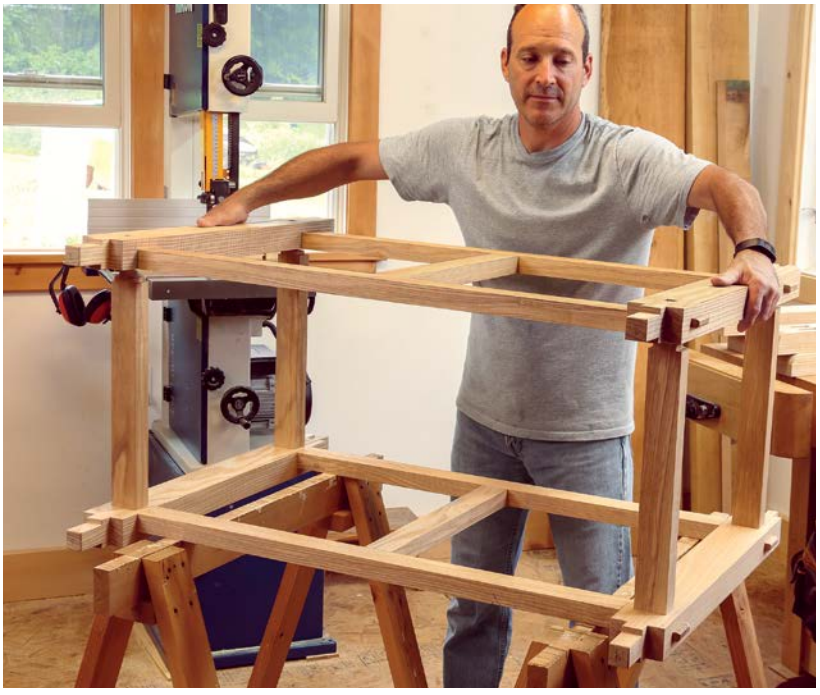
Bench Assembles without Glue and Clamps

The interlocking joinery requires a specific order of assembly. Once you settle the top onto the base, all the joints will lock tight.



Start with the middle post. It fits between the front rails and adds rigidity to the base. Once you put the posts in place, the front rails are locked to the middle post.

Slide in the side rails. The tenon runs through the front rail and the post, which prevents the post from coming loose from the front rail.

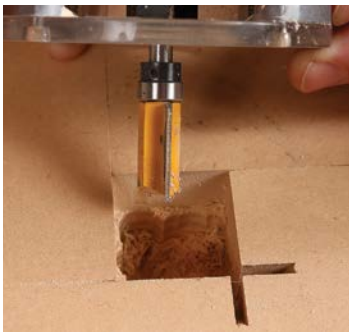


Lower the back onto the side rails. Rest the back assembly on the ends of the tenons and then adjust each tenon until all four are in their mortises. Then the back should slide down (left). The trestle top and foot are next (above)—they lock the posts in place. Now the base is a rigid, single unit.

straight bits for this. Turn the top upside down and put the base on it. The template is made up of three pieces of MDF that are set around the tenon and then clamped in place. Remove the base and you have a perfectly sized template for the mortise. With a spiral bit in your router, remove most of the waste from the mortise, taking care not to rout into the template. Now use a flush-trimming bit to clean up the mortise, following the template. Finally, square up the corners, using the template as a chisel guide. Repeat this process for the other three tenons.

After the mortises are done, turn the base upright and put the top on it. You now have a rigid bench ready for work.

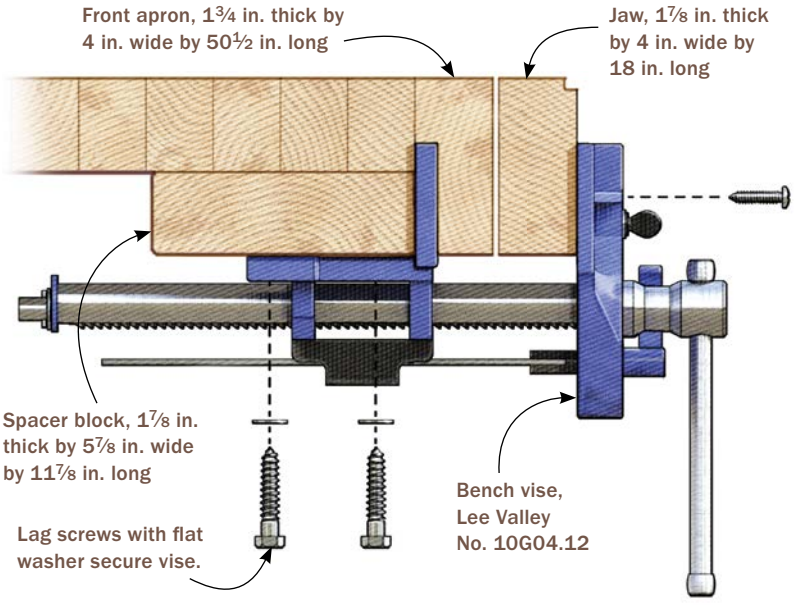
Make a mortising template around the tenons. Working one mortise at a time, Dunton used three pieces of MDF, one of them with a notched corner, to build the router template in place, guaranteeing that the mortise would be located accurately.



Rout the waste. Dunton first used a plunging spiral bit freehand to remove most of the waste, then came back with a pattern bit to flush the sides to the template (top). When squaring the corners (above), the template serves as a guide for the chisel.

A Vise is Optional

A cast-iron vise is a good, proven choice. You'll need to add an apron to the front edge of the top and a spacer block.



Rethinking the Workbench

Although the tablesaw is often cited as the center of the workshop, the workbench is where most of the action happens. For sharpening, handwork, sanding, assembling, and finishing, everyone needs a flat, solid surface to work on. But workbenches vary widely, as do the myriad ways that woodworkers accessorize them.

This special collection of ideas from readers of *Fine Woodworking* centers on the workbench, from the surface itself to everything that happens there.

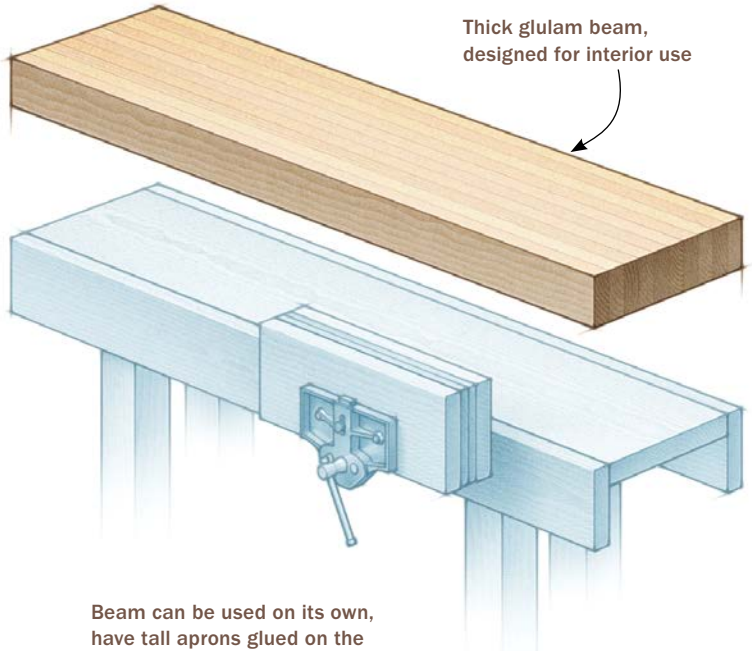
Whether you are dreaming up a new bench or looking to improve the one you have, you are likely to find some great ideas here to make your bench work harder.

Use a glulam beam to make a flat, forgiving benchtop

While builders were constructing a combined garage and workshop at my house, I was building my first workbench. Looking closely at the laminated beams they were using, I saw my first benchtop. I went to the local lumberyard and purchased a 6-ft.-long portion of a laminated beam designed for interior use. It was much less expensive than purchasing similar lumber for laminating the top myself, not to mention the many hours of labor saved. While various dimensions are available, including widths up to 24 in.,my beam/benchtop is 14 in. wide and 3½ in. thick. Adding a tool

tray is an easy way to expand the width. While most glulam beams are softwood, I don't mind the nicks and dents it collects, plus I like the forgiving nature of the surface.

—Peter Miller, Little Rock, Ark.

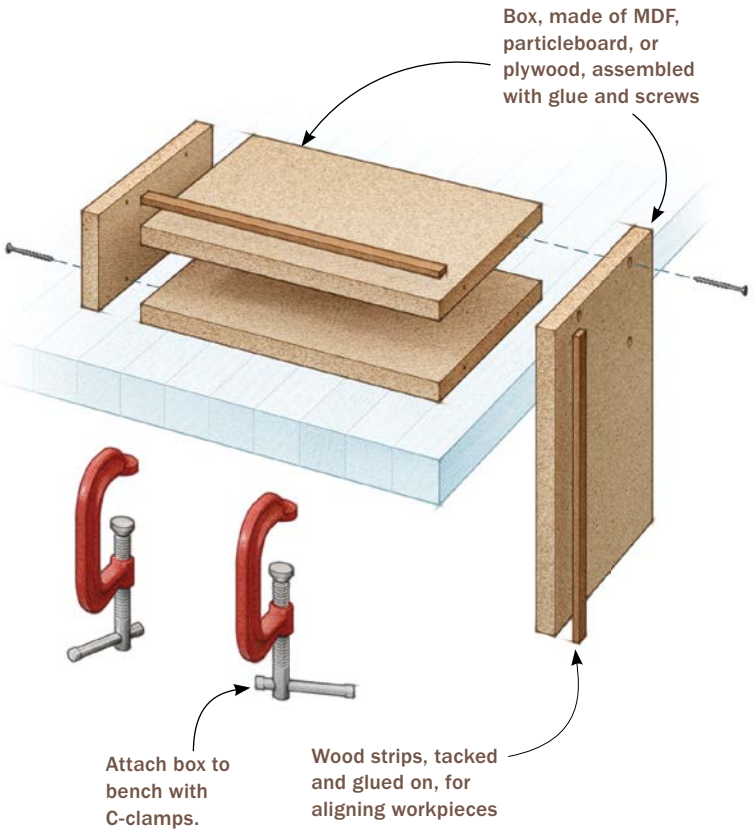


Beam can be used on its own, have tall aprons glued on the edges to add depth and width, or sit on a subtop as shown here.

Simple, solid box helps with handwork

I'm new to dovetailing, and before I made a grand investment in a leg vise or Moxon vise, I decided to try my own home brew. I made this simple but effective jig with scraps of particleboard and some wood strips. The four pieces of particleboard form a basic box, with one side left long to hang down and register the jig against the front of the bench. I glued wood strips along the front edge of the two working faces of the box. A couple of C-clamps attach the box to the bench.

Once I had built the jig, I found it useful for all sorts of hand-tool operations. To clamp a workpiece vertically for dovetailing or tenoning, for example, you just push the workpiece against the molding strip and secure it in seconds with Quick-Grip clamps. The workpiece is perfectly vertical and extremely stable.



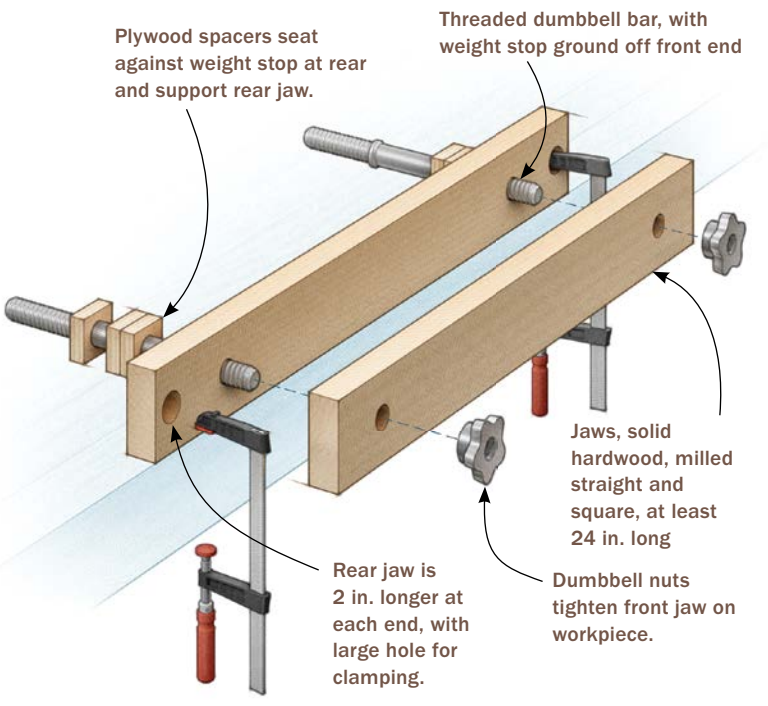
It works just as well for clamping pieces horizontally, for chopping dovetails or routing, bringing the action to a more comfortable height in the process. And it really shines when lining up a tails board with a pins board to transfer the layout from one to the other.

—Steve Farnow, San Diego, Calif.

Dumbbell bars create a cheap Moxon vise

I've been wanting a Moxon vise but have hesitated to spend the money on some of the beautiful Moxon hardware out there. I'm not crazy about the makeshift alternatives I've seen either. Stumbling around in the garage one day, I saw some discarded dumbbell bars with acme threading and large lock collars on the ends and thought how similar they were to twin-screw hardware. After 15 minutes at the bench grinder, removing one of the weight-plate stops on each bar, I had my hardware. I made some simple spacers and then made the vise jaws as you would for any Moxon vise. The jaws will open to about 3 in. and hold tightly and securely, even at 24 in. long. The nuts spin freely and with a little momentum will close on the fly just like the high-priced version. The dumbbell bars sell for about $20 on the web but are a dime a dozen at thrift stores and on Craigslist, etc. With a bit more work and creativity, I think the dumbbell bars will also work for a leg vise and other workbench fixtures.

—Rex Bostrom, Sweet Home, Ore.



Easy way to divide and organize drawers

I build a lot of drawers in my shop to store all my wonderful tools, including under my workbench. But a drawerful of tools and supplies will become a mess in no time without some kind of organizer. I keep the entropy at bay with a simple system of custom dividers, held in place with hot-melt glue. I use ¼-in. plywood, which is cheap and easily cut to lengths and heights convenient for every application. The hot glue goes on fast and lets you start loading the drawer in seconds. Any time an adjustment is needed, a little bit of force will break the divider out. Fast, cheap, strong enough to serve, yet weak enough to remove without damage—it's perfect!

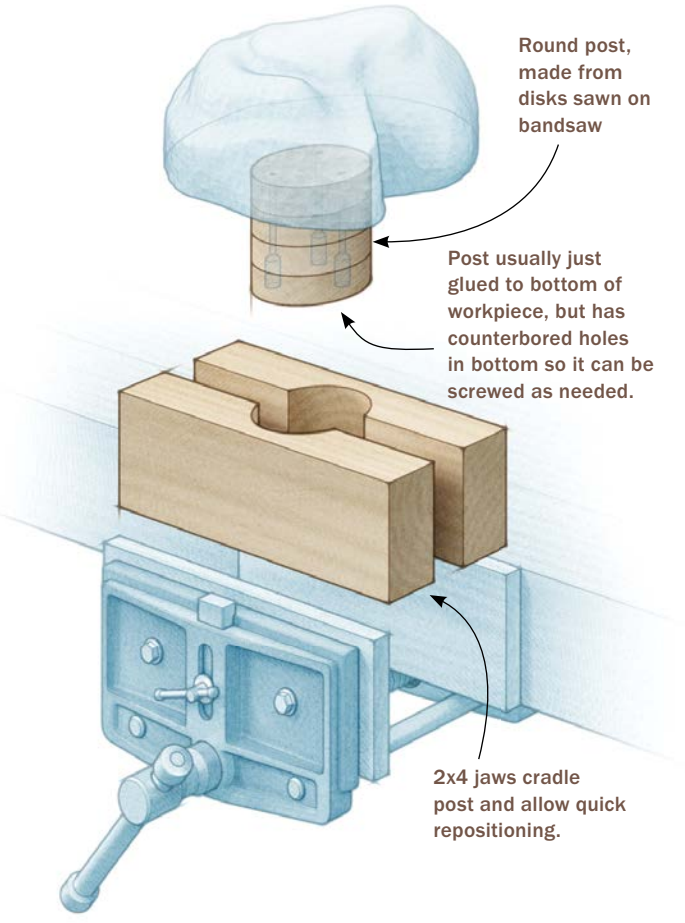
—Chase Hansel, Melbourne, Fla.

Carver's clamp allows access from all sides

I carve all sorts of objects, including some recent tuataras (a New Zealand lizard; see photo bottom left) in tough black beech burl. This simple bench clamp works for most of them, letting me attack the work from almost any angle and reposition the blank within seconds. The post attaches to the carving with yellow glue and is clamped in the two halves of a holding block, with force provided by any workbench vise. (You can add screws to strengthen the joint, but I haven't found that necessary in most cases.) Release the vise and the workpiece can be turned 360°; by tilting the holding block in the vise, you can angle the workpiece up to 30° to allow undercutting. Tighten the vise handle again, and the carving is rock solid.

You'll need a lathe to turn the post, but the rest of the construction is simple. You could turn the post from one block, but for a long-grain glue joint with the carving, I cut disks on the bandsaw to about 3½ in. dia., glued them in a stack, and turned the post from that. In fact, I turned a few posts, sized for various carvings. I counterbore and drill the posts for screws as needed. To make the holding block, I just traced the post on two pieces of 2x4 lumber and bandsawed the matching half-circles. After carving, you can remove the post from the workpiece with a handsaw and clean up the cut faces with a sander.

—John Fry, Richmond, New Zealand

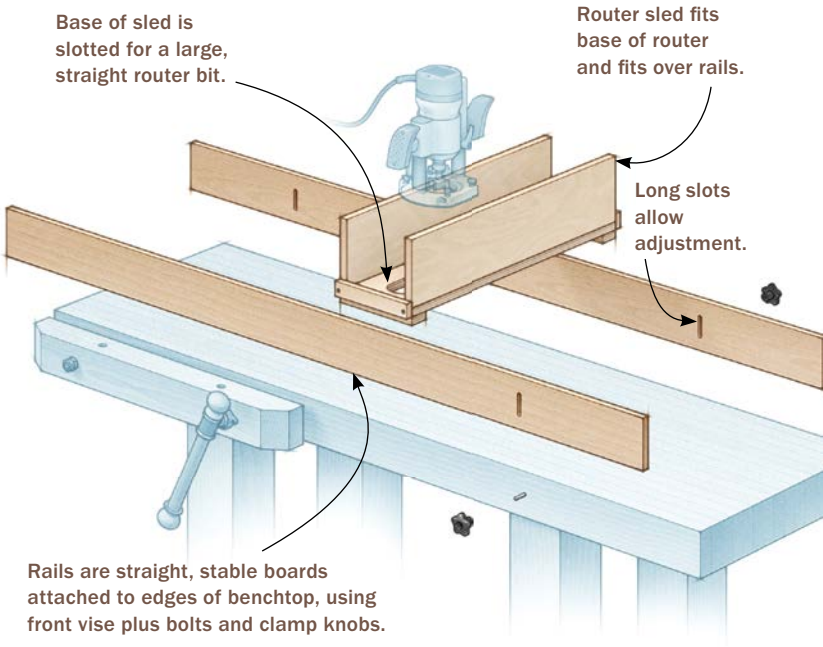


Turn your workbench into a wide jointer

I came across some rough 16-in.-wide walnut boards, far too big for my jointer. Inspired by the jig Nick Offerman uses to surface big slabs (featured in *Fine Woodworking* issue 222), I created a simplified version that sets up in minutes, with simple boards that are jointed straight and attached to the front and back edge of my workbench, and a slightly simplified version of Offerman's sled.

The rear board is attached permanently with bolts and clamp handles, and it takes just a few seconds to raise. I clamp a second board to the front and measure to be sure the ends of both boards are the same height off the bench. My benchdogs make it easy to lock the lumber in place, and I wedge under the board, if necessary, to keep it level and stable. Then, just like Offerman, I load a fat straight bit in the router, zip the router back and forth on the sled, and the wide board comes out dead flat. If it will fit in my planer at that point, I surface the other side that way; if not, I just flip the board and use the jig again. On my bench I can flatten anything up to 25 in. wide and 6 ft. long.

—Joshua Csehak, Boston, Mass.



DIY benchdogs work perfectly

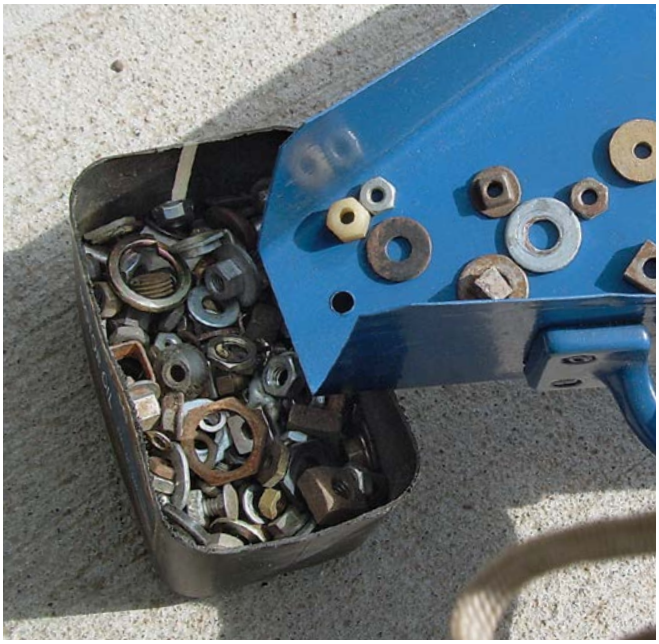
Most shopmade benchdogs employ bullet-catch hardware or spring steel to create some friction in the dog hole so that they can be adjusted up and down without dropping out of reach. I found an easier answer for my benchdogs. I used rubber spline material left over from repairing window screens, setting it in a sawkerf to create the perfect amount of friction. I started with a dowel that was ¾ in. dia. (the same as my dog holes) by 3 ft. long, using the extra length as a way to keep a safe, firm grip on the dowel. A standard-kerf (0.125 in.) blade worked perfectly for the spline material. I cut the slot to a depth between 3/32 in. and ⅛ in., pushing the first 7 in. of the dowel over the blade, trapped between the rip fence and a featherboard, with a zero-clearance insert below. Then I tilted the dowel up out of the cut. Last, I sawed the little notch at the tip of the dog, cut it to length, and tapped the spline into place with a hammer.

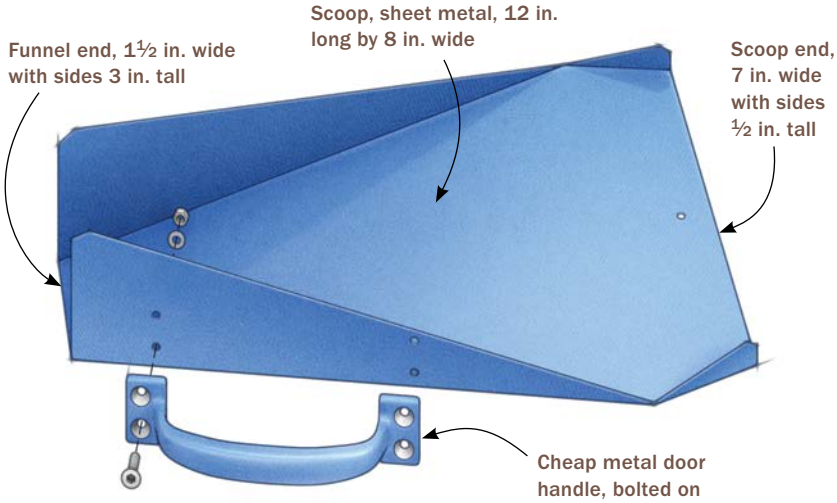
—Adam Wagner, Plymouth, Mich.

Metal scoop helps you sort through small parts

Here is a gadget I put together the other day that I should have made years ago. I am always sorting through nails, screws, nuts, and bolts, and I'm tired of dumping them out on the bench, losing some off the edge or down a dog hole, and then having to round them up afterward. It's a tedious, awkward process. This simple shopmade scoop is both tray and funnel, helping me fan out small parts for a closer look and then dump them smoothly back into the container they belong in. You might already have the materials you need. Any piece of stiff sheet metal will work, with a cheap door handle. The scoop is 12 in. long by 7 in. wide at the big end and 1½ in. wide at the funnel end. The sides taper from 3 in. high at the funnel end to ½ in. at the back. It sure speeds things up in my shop.

—Neil Long, Mound City, Mo.





This Stand Really Delivers

MICHAEL FORTUNE

I made this support stand many years ago, and it has proved to be a very helpful friend. The top can be quickly and precisely adjusted from 44 in. high—tall enough for my bandsaw—down to 31 in., so it stores under my tablesaw's outfeed table.

Compared to store-bought stands, this one is more stable and easier to level. Adjustable feet accommodate uneven floors, teaming up with a broad base and a strong sliding column to keep the stand from budging under heavy work.

With a stable platform like this, it wasn't long before I was adding various rollers and other attachments, making the stand indispensable.

The Four Tops

Including the roller stand at left, Fortune made four handy attachments, allowing the stand to be used with a variety of machine setups.

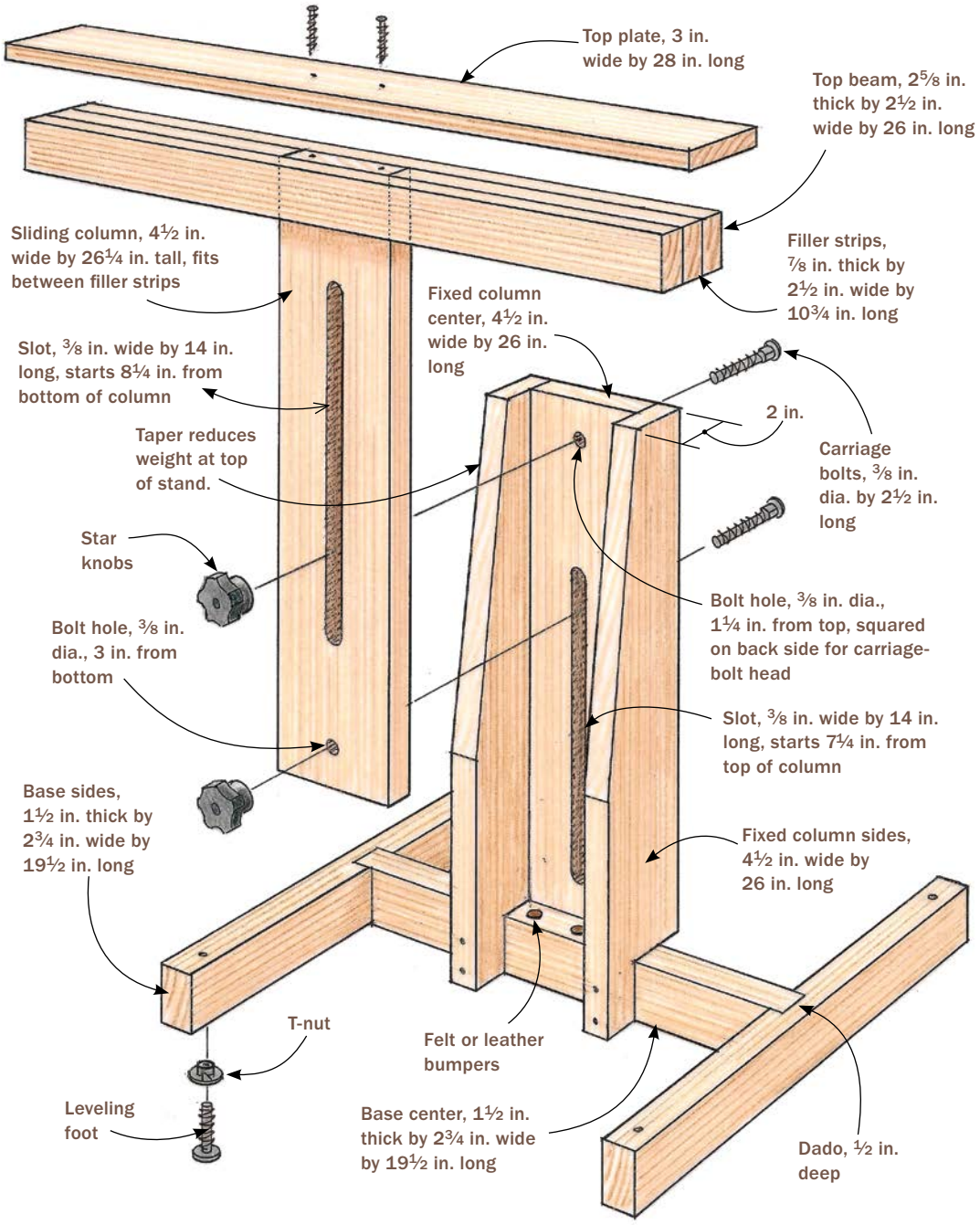
Ball bearings for curves. An auxiliary top with two sets of eyeball rollers supports the work for curved cuts on the bandsaw and router table.

Carpet top for finished parts. This attachment supports long workpieces that have already been surface-prepped or pre-finished, like this tall cabinet side.

Extension for tall tasks. The stand will extend as high as a bandsaw table. To support long pieces at his drill press, which is taller, Fortune clamps on a rectangular frame.

Simple Joinery, Smooth Action

Any scrap hardwood will do for the parts. Assembled with dadoes, screws, and biscuits, this stand has a broad, stable base and an adjustable column that slides easily and locks solidly. Other than the base, all parts are 7/8 in. thick.



Base feet first. To install T-nuts for the leveling feet, Fortune drills stepped holes in the base parts. Then he threads one of the carriage bolts into each T-nut to tap it into place.

Fortune used appliance levelers, bought from a local hardware store, to level the stand. Similar products are available online.

Rout the slots. The fixed and sliding columns have 3/8-in. bolt holes and 3/8-in. slots, which must line up precisely. Drill the holes first, and then use them to set up the router for the long slots.

Sure-footed base keeps it stable

The base is broad and strong, yet the joinery is simple: just shallow dadoes and screws, with some glue for insurance. I found the heavy-duty, adjustable feet sold as appliance levelers at a hardware store, but similar products are available online, often called leveling feet. Avoid the ones with nylon feet, which will slide across the shop floor. Mine have 5/16-in.-dia. threaded posts that screw into T-nuts in the base.

Assemble the base. The base pieces are joined with shallow dadoes, long screws, and glue.

Just above the base is a two-piece column. The fixed column has sides that guide the sliding column, which is screwed to the top. If I relied only on the bolts and slots to keep the sliding section aligned, the slots would wear out and the action would get sloppy. I use two large star knobs to lock the column, with one slot in the fixed part and one slot in the sliding portion. I attached the sides of the fixed column with biscuits.

The top plate on the stand is wide and strong, thanks to a thick support beam made of three layers of hardwood. Filler strips in the middle fit around the sliding column to create a bombproof joint.

Specialized tops are especially handy

The top plate works well as a basic support, but I've made a few auxiliary tops that are essential. All have cleats on the underside that fit around the top plate, with simple toggles that hold them on.

One of my favorite tops has a couple of sets of ball-bearing rollers attached to it. These let stock move in any direction, ideal for cutting curves on big, heavy pieces on the bandsaw or passing a long curve over the router table. For

Fixed column is biscuited. After notching the outside pieces to fit tightly onto the base, attach them to the center piece.

Attach the top beam and plate. The pieces for the top beam are assembled around the sliding column. Put a clamp across the center pieces to make sure they are tight to the column, and make sure the column is square to the beam before the glue sets up.

Glue and screws anchor the column. Screw in from the front and back to attach the fixed column to the base.

Knobs finish the job. One of the bolt holes needs a square recess chiseled into it for the square section under the bolt head. The other bolt head fits neatly into one of the long slots.

straight ripping on the bandsaw, I found an old hard-rubber washing-machine roller and made a wooden holder for it. You can buy similar metal rollers from Rockler. For sanding and finishing large projects, I also made a carpet-covered top that attaches the same way as the others.

One of my drill presses is mounted on a tall stand, and I bring its adjustable table close to eye level for precise work. To support long pieces there, I made an extension frame that attaches to the top of the stand.

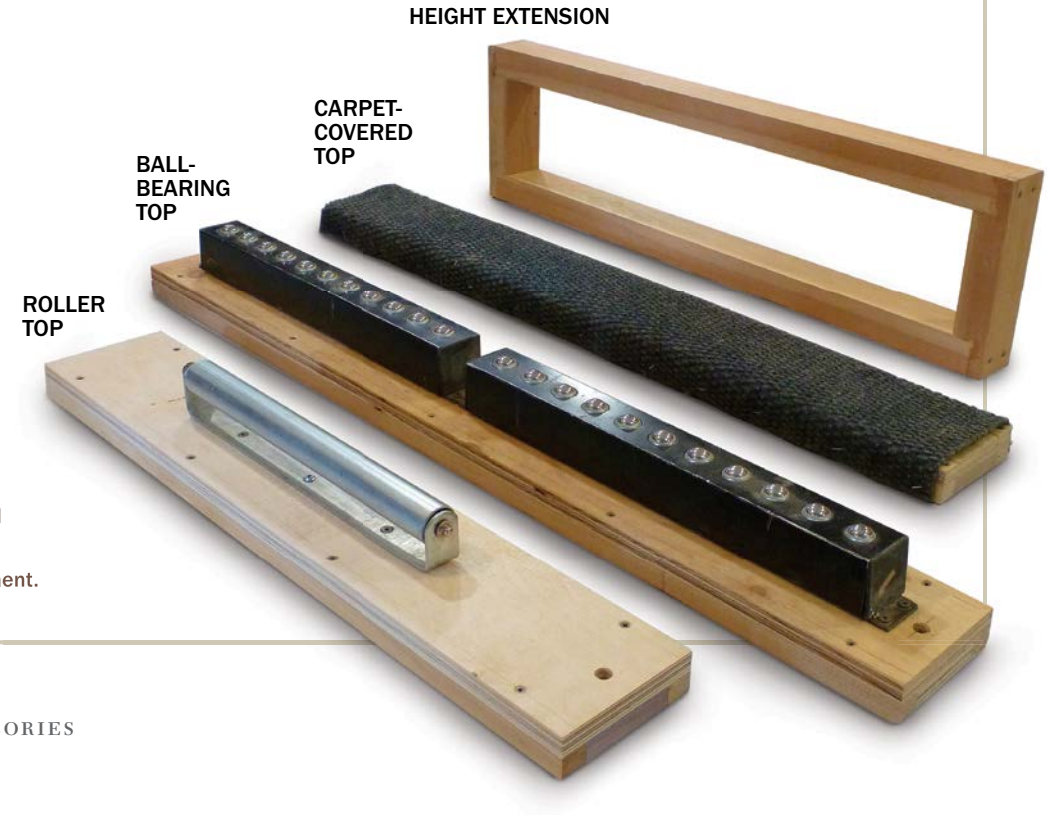
Easy Setup

Adjust the height and level the base. Use a stick to bring the stand level with the work surface (right). Set the roller attachments a little higher, so they bear the weight of the workpiece and will keep it moving. Then adjust the feet (far right) to level the top with the table and correct any rocking.

Auxiliary Tops Add Versatility

The cleats on the bottom of each attachment are the same thickness as the stand's top plate, and fit snugly around it.

Add toggles. Fortune uses small plastic toggles, made for storm windows, to anchor each attachment.



Superb Sawhorses

LEN CULLUM

I can't remember where I first saw a Japanese planing beam on trestle horses, but I do remember my first thought: "I gotta make a pair of those!" Having grown up around wobbly A-frame sawhorses made from 2x4s and festooned with paint spatters, bent nails, and errant sawkerfs, I thought those trestle horses seemed so sturdy, so clean, so intentional. I make them with drawbored mortises and tenons, which add another step to the build but provide extra solidity in joints that will see a lot of stress over the years. Because these heavy-duty horses have myriad uses, referring

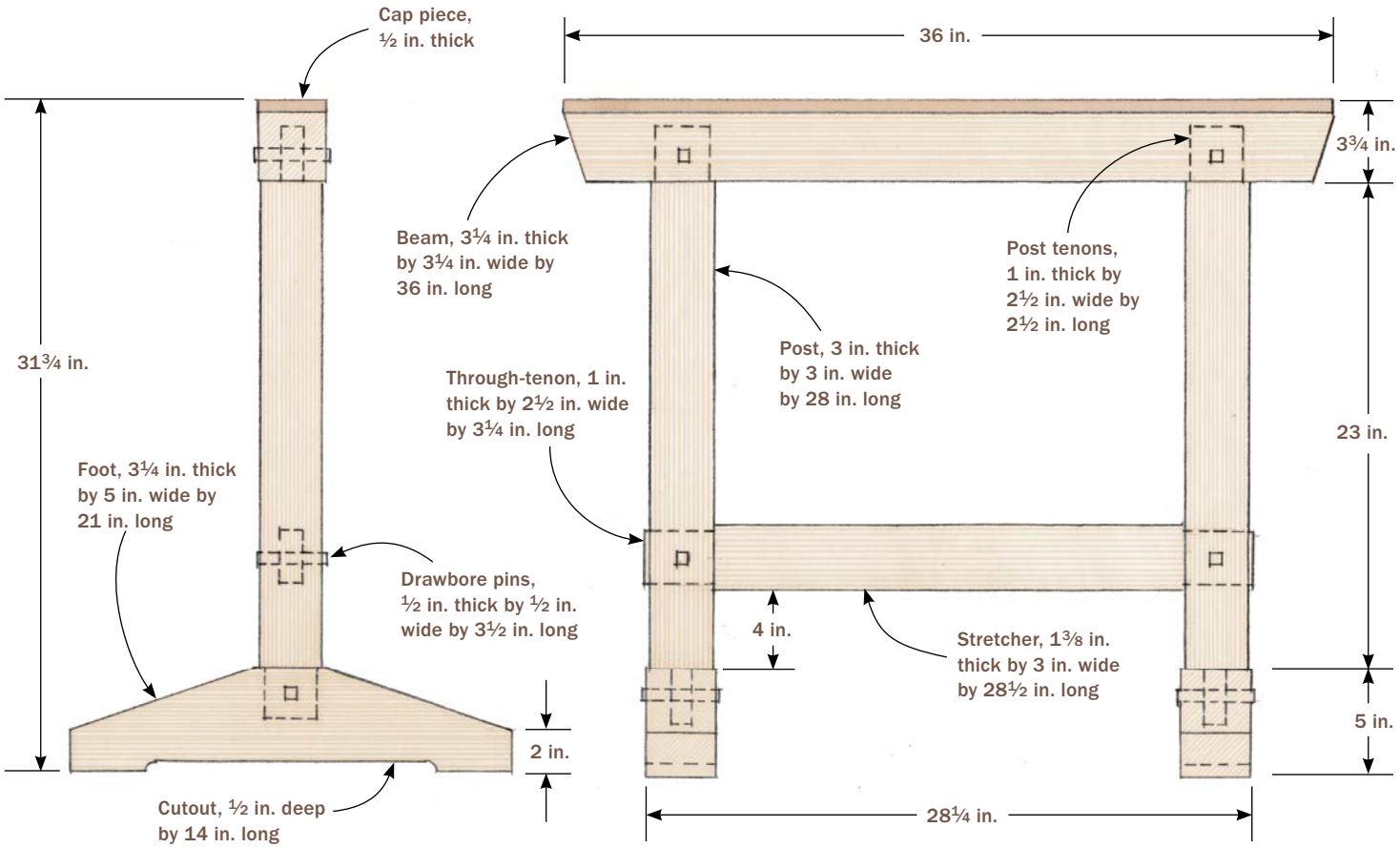
Workhorses. Sturdy designs in two sizes excel on the floor and on the benchtop.

Full size. At a hair under 32 in., the full-size horse is a comfortable height for sawing, planing, and similar workshop tasks.

to them as sawhorses sells them short. I prefer to be more accurate: They are workhorses.

The design of the low horses stems from the fact that most Japanese woodwork is done while sitting. I rarely work on the floor, but I use low horses all the time on the benchtop. They elevate whatever I am working on above the fray of tools and shavings that accumulate on my bench. In the years since I made my first pair, I've been recommending them to all of my woodworker friends. I'll tell them that these are essential, "what-did-I-do-before-I-had-these?" tools; but it isn't until I make them a pair that they really see what I mean—and often go on to make more themselves.

Full-Size Horse



Two-step mortise for the feet. Because the foot blanks are too tall for his hollow-chisel mortiser, Cullum roughs out the mortises with a Forstner bit (above), then refines them with chisels (right).

A true workhorse

When I made my first pair of workhorses, I built them with what I had lying around—Douglas fir construction lumber—figuring they would be the test run for a more serious pair made of oak or walnut. But I never looked back. Douglas fir's strength, weight, and sturdiness (not to mention low cost) made it ideal, and I've used it for every pair of full-size horses I've made since. But whatever wood you choose, they'll deliver a lifetime of use. To determine a comfortable work height for your horses, measure from the floor to the bottom of your closed fist. This gives you a good height for sawing, planing, and the like.

Make and fit the post tenons. The tenons at the ends of the post are not in the same plane, but they are the same size, so Cullum can cut them using the same stops and setup (above left). He cleans the cheeks and chamfers the ends with hand tools, then tests the fit (above).

The feet and posts are first

I begin the horses by cutting the mortises in the foot blanks. Because the feet are too tall for my hollow-chisel mortiser, I rough out the mortises on a drill press and square them up with chisels. Then I move on to the posts, tenoning both ends with a dado head in the tablesaw. Although the two tenons are oriented in different planes, they are the same size, so they can be cut at the same time using the same stops and blade setup. I clean up the cheeks of the tenons with a rabbet plane and a wide chisel and chamfer the ends slightly to ease assembly.

Once I have those tenons fitted, I cut the through-mortises in the posts for the stretcher. Using my hollow-chisel mortiser, I chop from both faces toward the middle, then clean up with chisels.

Both sides now. Cullum cuts the through-mortises for the stretcher tenons at his mortiser, chopping from both faces to the middle.

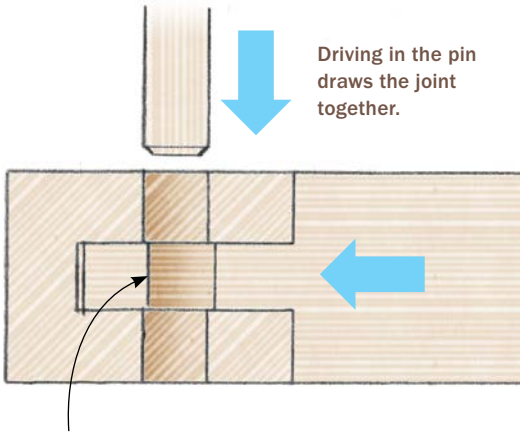
Make way for the pins. With a sacrificial spacer inserted in the through-mortise, Cullum chops a hole for the drawbore pin.

Time for the drawbore pins

You often see round drawbore pins, but I like the look of square ones. I cut the holes for

Mark and move. After assembling the post-to-foot joint and marking the location of the drawbore hole, Cullum chops the mating mortise 1/16 in. closer to the tenon shoulder.

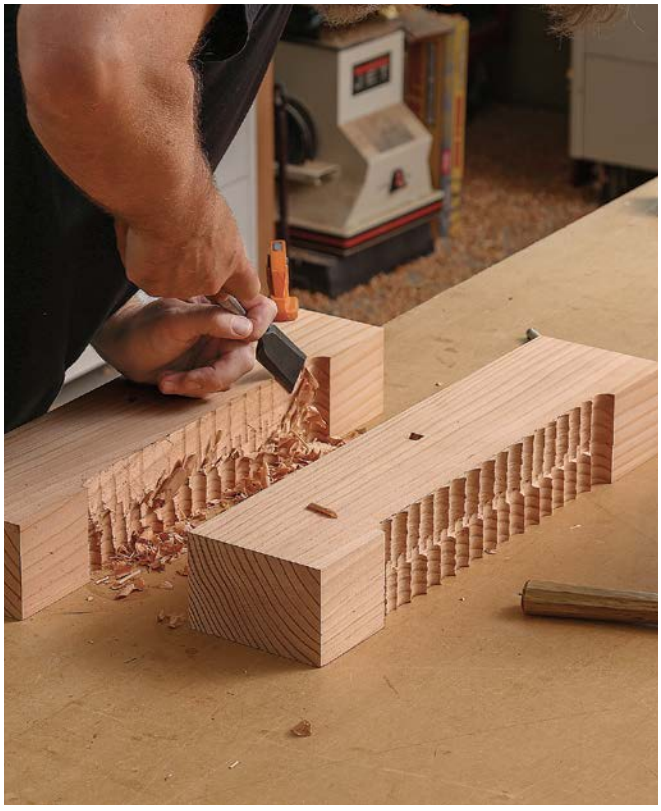
Drawbore Pin



them at the hollow-chisel mortiser. First I cut through all the mortised parts. To keep from producing a splintery mess inside the mortise, you can fill it with a scrapwood spacer. With the pin mortises chopped, dry-assemble all the joints and, using a sharp pencil, trace the pin mortises onto the tenons. Then disassemble the parts and chop pin mortises through the tenons. Cut the mortises 1/16 in. closer to the tenon's shoulder than the pencil marks would indicate; this offset will draw the joint tight when you drive the pins.

Footwork

I shape the feet at this point, just before assembly. The first step is to make the long cutout at the bottom, which makes the feet more stable on uneven surfaces. You can saw this out, but I did it by drilling and chiseling. First, clamp the two feet together bottom to bottom and drill a line of overlapping, half-depth holes with a Forstner bit. Then flip the clamped feet and repeat the drilling from the other side. When the drilling is done, unclamp the feet and clean them up with a wide chisel, leaving the ends of the cutout



Great relief. With the foot blanks clamped together bottom to bottom, Cullum drills a row of holes with a Forstner bit, then quickly chisels the washboard flat. Alternately, the relief could be bandsawn.

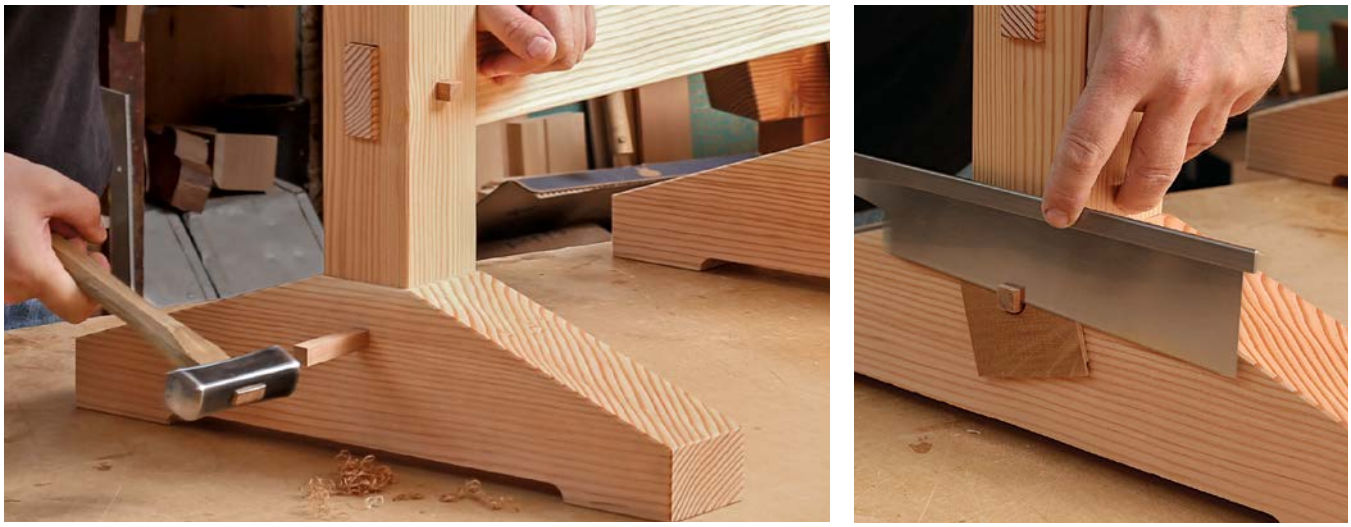
rounded. To create the sloping top surfaces of the foot, bandsaw just shy of your layout lines and clean up with a few passes over the jointer. Now you can also cut the angled ends of the beam.

Quick slant. Cutting close to his layout lines, Cullum bandsaws the foot's diagonals (top), then smooths out the sawcut with a few passes on the jointer (above).

How to assemble a horse

Start with the stretchers, slipping their through-tenons into the post mortises. Then carefully drive the pins all the way through the joint. You should see the joint tighten as the pin goes in. Drive the pins until they stick out equally on both sides. With the

Assemble in stages. Cullum first drives the pins connecting the stretcher to the posts (top), then fits the posts into the beam (above).



On with its feet. Last, the upper frame is fitted to the feet and cinched with pins (left). Cullum makes the pins overlong and trims them off about ⅛ in. proud (right). A thin scrap drilled out at the center protects the horse and determines the length of the pin.

stretcher pegged, add the beam. Attach the feet last. You can cut the pins flush, but I like to leave them a little proud. The easiest way to do this is to drill a hole in a scrap of wood (about ⅛ in. thick), slip it over the pin, and saw against it.

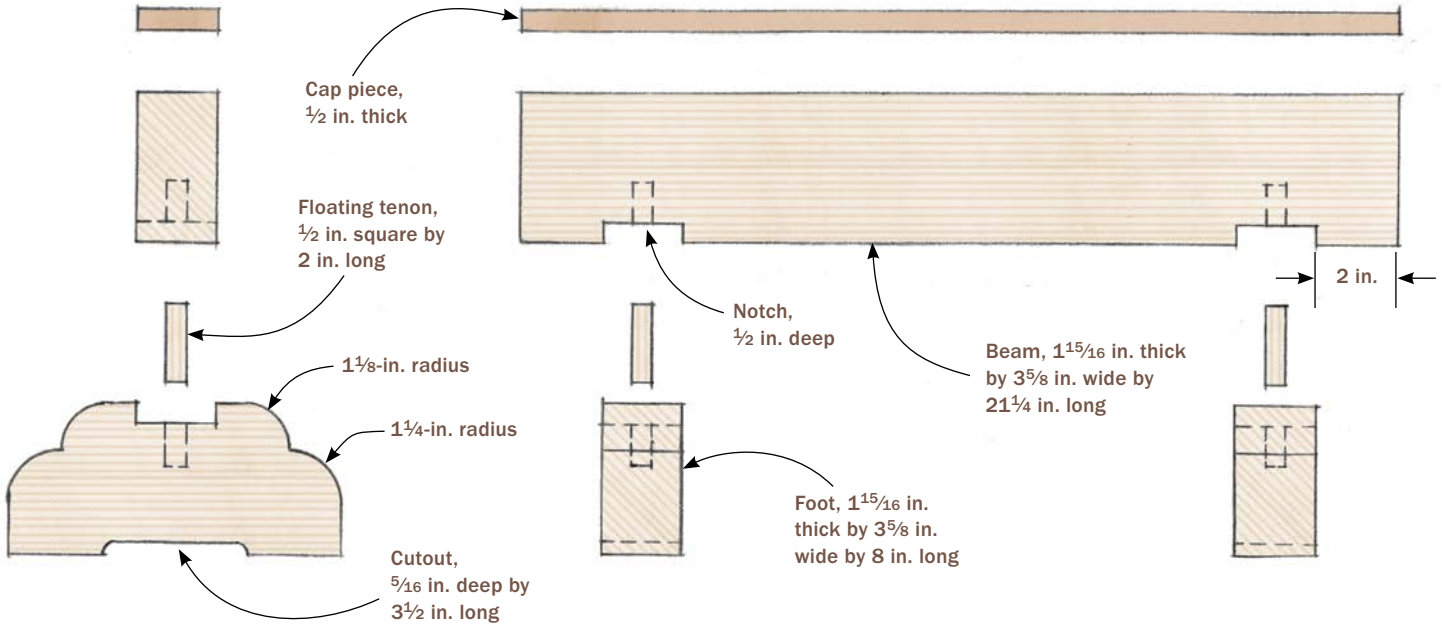
Finishing up

The horses are now ready for the finish of your choice. I typically use Danish oil, but anything will do, or nothing at all. Once the finish is dry, the last step is to attach the sacrificial cap piece to the top. Because I work with a lot of softer woods, I use clear cedar for this. That way not only is the horse protected from errant sawcuts and the like, but the work I place on the horses also is protected from the harder fir. To make these caps easy to replace—and free of metal fasteners—I attach them with double-sided tape.

Protect the top. A couple of strips of double-sided tape hold a sacrificial cap piece in place on the beam (above). The softwood cap protects both the beam and the workpiece from damage (right).

Pony up. Japanese woodworkers use small sawhorses while working on the floor, but for Cullum they serve to elevate the workpiece off the bench.

Low Horse



Strength in a small package

The low horses are a design I continually fiddle with. I have five pairs now, and they're constantly in use. I've made them from different woods, in several sizes, and am always making tweaks to the design in a quest to find the mythical sweet spot. I built this pair with a full-sawn Port Orford cedar 2x4, which gave me a stouter, taller set than the others.

Half-lap joinery

The feet are joined to the beam with half-lap joints. They are simple to cut, but the layout and fit has to be right on, so take your time and be precise. After cutting all of the parts to the same length, I mark layout lines on one foot. Then I set a stop on the miter gauge, and using a dado head in the tablesaw, cut and test the joint. When I'm happy with the fit, I cut the other three, and then move on to the beams. To lay out the joints on the beam, I fit a foot to its location and mark lines. Using those lines I set stop blocks on the miter gauge, starting with a fit that's a bit too tight and adjusting one stop until the fit is right on. Then I cut the other notches with that setup. The fit should be snug but shouldn't require more than a couple of light taps with a hammer to seat.

Create the half-laps. To notch the feet, Cullum uses a dado head, flipping the workpiece and using the same stop block for both end cuts. Afterward, he fits the notched foot blank on a beam and marks for the mating notch.

Twin stop blocks for the beam. Cullum cuts the two shoulders of a notch in successive passes using a stop block at either end of the miter-gauge fence. Then he checks the fit.

Make way for the internal tenon. To reinforce the half-lap joint, Cullum adds a floating tenon between the foot and the beam. Here he cuts the mortise for it.

I generally build low horses with simple, glued half-laps, but I decided to reinforce these joints with floating tenons. If you do the same, now is the time to lay them out precisely and cut them with a hollow-chisel mortiser or drill press and chisels.

Make 'em pretty

As far as function goes, these little guys are pretty much done. I could just glue them up and call it a day. But since the cedar is so nice and they'll be around my shop for years, I want to take them further. I have seen examples with feet ranging from simple 45° slopes to curly carved temple brackets. The ones I make fall somewhere in between. I begin by making a pattern from a piece of card stock and tracing it onto each foot. Then

Forming the foot. A piece of card stock makes a good template for laying out the curves of the foot (top). With the foot blanks clamped together (middle), the relief cuts begin with holes drilled at each end. Then it's on to the bandsaw (above), where the cloud-lift curves and the rest of the relief are cut.

I bandsaw it to shape. Just before assembly, I chamfer all the edges with a chisel or a knife, avoiding the areas near the joints.

The glue-up

It's time to apply some glue and knock the little horses together. I don't bother with clamps, but after hammering them together it's a good idea to place them on a flat surface and put some weight on them while they dry. As with the larger horses, I add a sacrificial softwood cap piece to the beam using double-sided tape. Then all that's left is to put them to use.

Pare the pegs. Using a knife, Cullum chamfers the ends of the floating tenons (above) to be sure they enter their mortises cleanly. He begins the assembly by gluing the pegs into the feet (right).

No clamps. After he drives the joints home with a hammer (left), Cullum will place weights on the beam while the glue sets. To protect the beam—and his workpieces—Cullum adds a sacrificial cap piece to the beam, adhering it with double-sided tape. He uses a Japanese chamfer plane to produce just the right finishing touch on the edges (above).

Essential Clamp Kit

JEFF MILLER

The old chestnut is true—you can never have too many clamps. But which clamps you need depends on the type of work you're doing. As a general rule, you should buy the clamps best suited for the primary work you do, but you'll also need a more general selection of clamps for the wide range of projects and shop tasks you'll encounter. Assuming a finite budget, you'll need to make some choices to build an appropriate clamp kit for your shop.

After years of building custom furniture, I've come to learn what makes one clamp really shine and what causes others to collect dust in the corner. Here's a roundup of the clamps I use every day that allow me to tackle

any project or task quickly and efficiently, as well as some pointers on where to start if you're just beginning to outfit your shop.

Bar clamps

Bar clamps are the shop workhorse. They excel at gluing up panels, assembling carcases, building chairs, clamping up large laminations, and even serving as a vise when working on shaped legs. They come in a variety of lengths and are capable of exerting a great deal of pressure or of clamping gently if needed. Bar clamps also come in a variety of forms and prices, each with corresponding benefits and drawbacks. No matter which type of bar clamp fits your budget and needs, they will form the core of your clamp kit.

I-beam clamps are heavy-duty

These are the most expensive bar clamps but also the most heavy-duty, with cast-iron heads and a bar styled after steel girders. All

Where to Start

A stable of 36-in. and 48-in. clamps will be enough to tackle most jobs, but you'll need a few shorter ones for gluing up small tables and panels where the larger clamps can be cumbersome. For long glue-ups, such as tabletops, benches, and beds, a few 72-in. clamps will be vital.

- 6 at 24 in. long
- 6–8 at 36 in.–48 in. long
- 2–4 at 72 in. long

this metal gives them incredible rigidity and lots of clamping power. Rigidity is one of the main reasons these clamps are so potent. A super-rigid bar not only allows more pressure to be applied but also keeps the clamping pressure directly in line with the clamp heads—exactly where you want it. I-beam clamps are typically equipped with plate clutches and heavy-duty screw mechanisms, both of which make setting up a clamp on the work as painless as possible.

Aluminum clamps are lightweight

Aluminum bar clamps (photo above) are a far less expensive option than I-beam clamps. The tradeoff with these lightweight clamps is that they exert less pressure, flex more, and are generally more cumbersome to adjust. However, the lighter weight can be a tremendous benefit when you're working alone on a tabletop or case glue-up. Unlike cast-iron clamps, the aluminum won't react with the water in glues and the tannins in wood to stain your work. Clamps with wing-type handles are the best, but those with a sliding pin work fine as well.

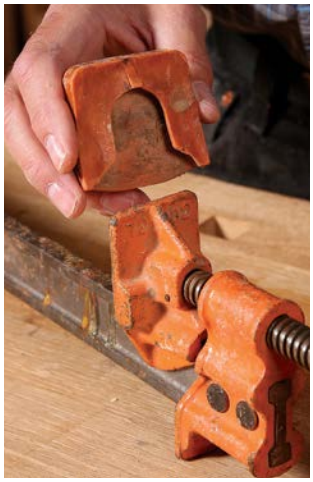
Pipe clamps are inexpensive

Pipe clamps are less expensive than aluminum bar clamps and can be found at most hardware stores. Pipes can't match I-beam bars for rigidity, and some brands of pipe clamps don't have the jaw depth found on the other bar clamps. But even in a shop well equipped with bar clamps, pipe clamps are good to have around for unusual clamping situations. With a handful of lengths and a few couplers, you can easily create clamps of any size to tackle projects the others can't reach. I recommend getting ¾-in. pipe clamps if you can. They are more rigid and have better handles compared with the fittings for ½-in. pipe.

Cheap and versatile. The head of the pipe clamp threads onto the end of the pipe, while the tail (above) slides on and retains its position with a plate clutch. The pipe comes threaded at both ends, so all you need to create a longer clamp is an inexpensive coupler and another length of pipe (left).

Protect Your Work

Many bar clamps come with plastic or rubber pads from the factory (right). If yours don't, attaching some ¼-in. plywood and leather pads will keep your work from getting dinged. Miller uses silicone adhesive to attach the pads (middle); it's flexible and easy to remove when the pads need changing.



F-style clamps

F-style clamps, sometimes referred to as steel bar clamps, are great for most smaller tasks, such as gluing up drawers and boxes, and clamping narrower stock together. Larger versions are useful for holding work or jigs on a bench, for smaller lamination work, and for persuading joints to close on smaller pieces. It's important to align them well, because if the bar isn't parallel to the intended direction of pressure (usually perpendicular to the surfaces being glued), they can cause parts to slip as pressure is applied. Two of the most important features to look for are smooth adjustment and adequately sized handles.

Parallel-jaw clamps are a popular variation on the F-style clamp. But I don't use them because I find them cumbersome to adjust, which makes glue-ups more difficult.

Pinpoint clamping. F-style clamps are great for smaller jobs that don't need high pressure or large clamps, such as gluing up a drawer (above). Versions with an extra-deep throat make it easy to clamp jigs to benchtops and work surfaces (right).

Where to Start

- 2–4 at 12 in. long
- 2–4 at 18 in. long
- 2–4 at 12 in. long, deep throat

Quick-Grip clamps

A few of these are terrific to have because they are easy to use with one hand and provide a quick and easy hold. They can exert a lot of pressure, but there is little fine control of that pressure. They're great for getting something in clamps easily, whether it is a part in a jig, a glue-up where you have only one hand free, or a quick patch-and-repair job.

Where to Start

- 2–4 at 12 in. long

C-clamps

C-clamps are always useful to have around, mostly because of their good functionality and low level of fussiness. They're small but strong and are unlikely to distort under pressure. They are used for a variety of tasks, but are especially useful for clamping down stops on tablesaw sleds and other jigs with a fence or for any small jobs where an F-style clamp would be unwieldy.

Where to Start

- 2 at 2 in. long
- 2 at 4 in. long
- 1 at 6 in. long

A helping hand for big glue-ups. Use a hand screw to align the ends of boards while gluing tabletops, benchtops, or panels.

Hand-screw clamps

They may seem like a throwback, but hand screws are great for a number of jobs. Use them for holding odd-shaped pieces safely when cutting on the bandsaw or when drilling on the drill press. They are also good as a vise for holding small parts on the bench or in a bench vise. Hand screws are easy to find and even easier to modify. If you find yourself trying to get a firm grasp on oddly shaped parts, modify the jaws to fit your need. For example, adding V-notches across or along the jaws makes clamping round parts much easier.

Where to Start

- 2 at 6 in. long
- 2 at 10 in. long

Perfect for small or odd-shaped parts. Getting a steady hold on turned or round work can be tricky. Adding notches to hand screws is an easy and secure way to hold round stock at the bandsaw (top) or upright in a bench vise (above).

Spring clamps

These are generally cheap and useful for holding parts in jigs, for holding templates in place when marking out parts, and even for light-duty gluing. One big drawback is that there is little to no control over the amount of clamping pressure they provide. In general, the bigger ones apply more pressure. They can be found cheaply in sets and are worth having in the shop.

Where to Start

- 2 at 4 in. long
- 2 at 8 in. long

Sturdy Stool for Home or Shop

CHRISTIAN BECKSVOORT

Bar stool with upholstered seat. With its square tapered legs, turned rungs, and arched rails, this stool is simple to build. Even the curved, upholstered seat is not that difficult to make.

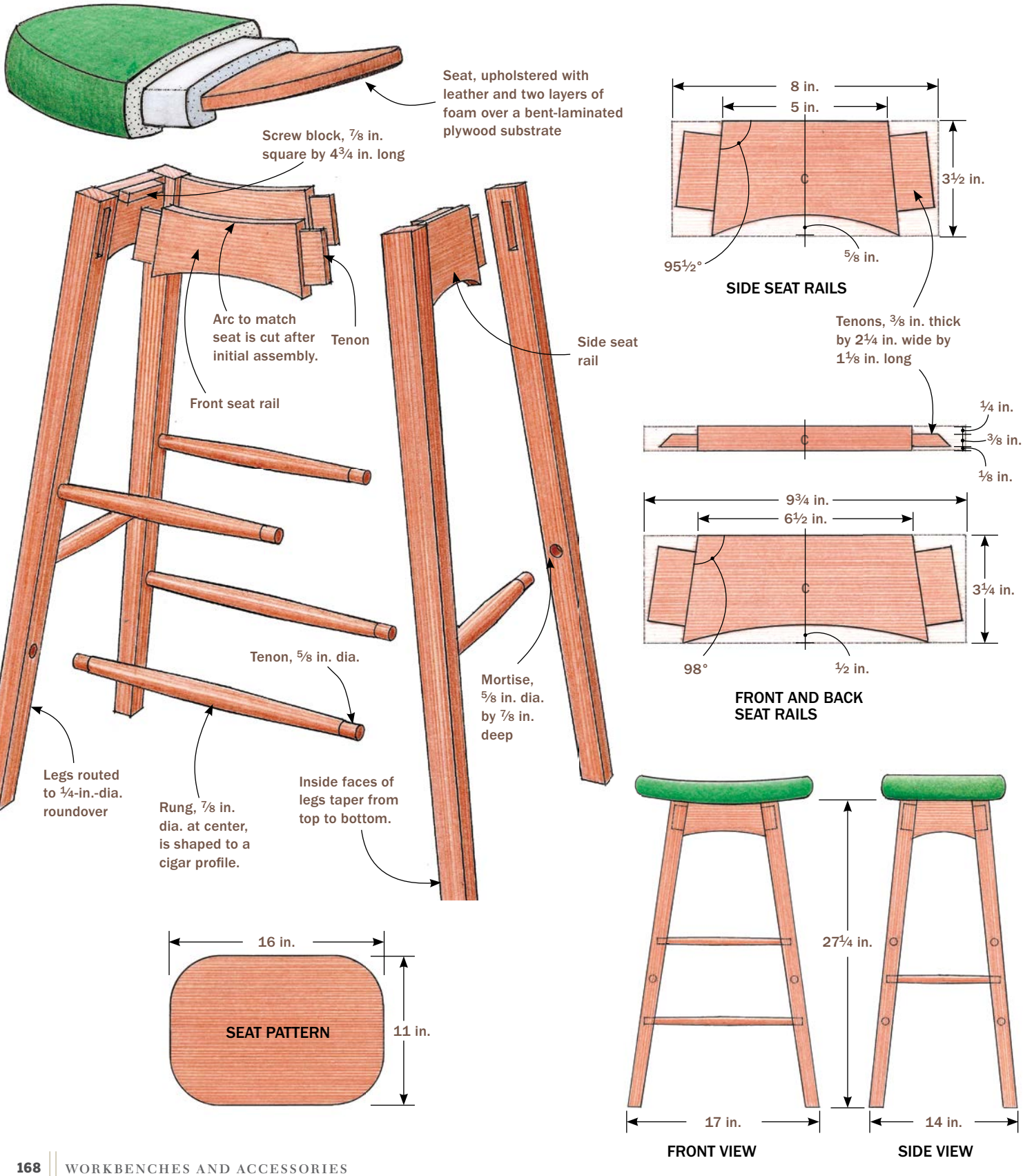
I built this cherry stool with a leather seat to use in the kitchen, but to my wife's dismay, I kept carrying it out to the shop—it turns out to be perfect as a bench stool when I'm chopping dovetails. I've also taken it with me when I do shows, where I need a seat that's comfortable all day long. It fits the bill for all three uses, and it doesn't take long to build.

I started by making a full-scale drawing, something I rarely do. I can visualize most rectilinear furniture in my head, but for chairs, which have few flat surfaces or right angles, a full-scale drawing is a necessity. Forty minutes with a piece of cardboard, and I had all the primary elements down: square tapered legs, round rungs, arched rails, and, for comfort, a curved, upholstered seat. I gave the stool an overall height of 29½ in., which works well with our high kitchen counter and my tall workbench. As a rule of thumb, a seat should be 11 in. to 12 in. lower than its mating table or counter. So a stool for a 36-in. counter should be about 24 in. tall. To make the stool as comfortable as possible, I decided on an upholstered seat, but I sent it out to be upholstered. If you like, give it a try—it's not a complicated job.

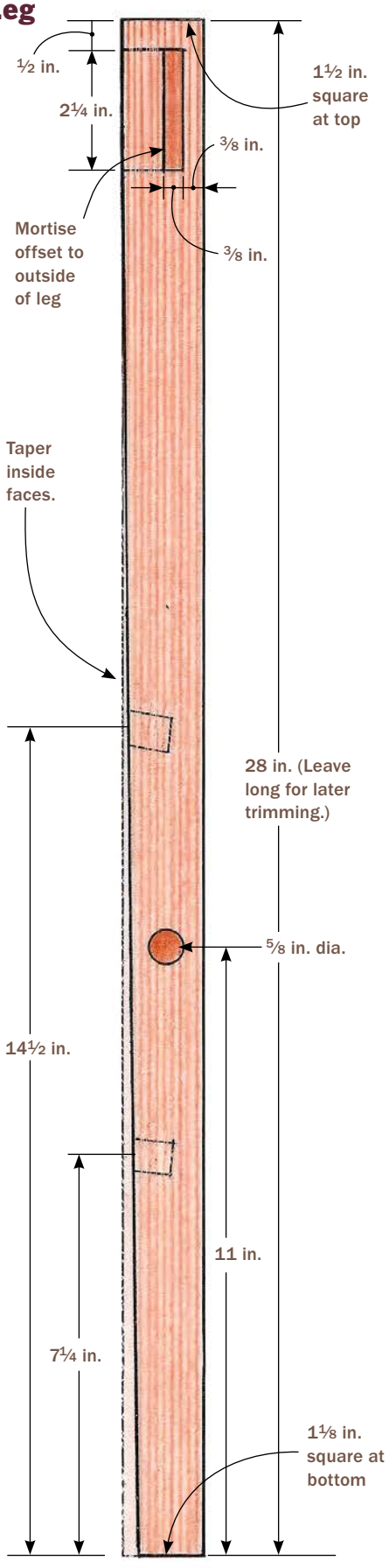
Make the legs first

I made the legs with straight-grained stock and tapered their inside faces. I used a shopmade tapering jig on the tablesaw, but cutting to a line on the bandsaw would also

Comfortable and Quick to Build



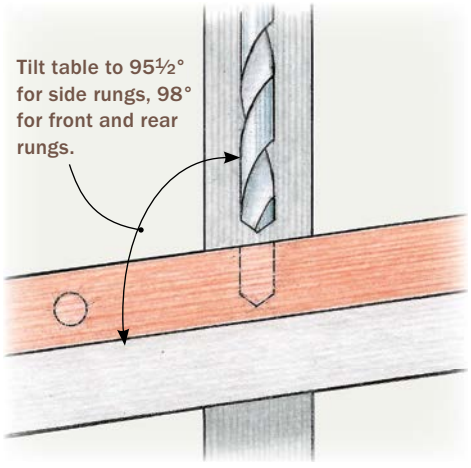
Mortised Leg

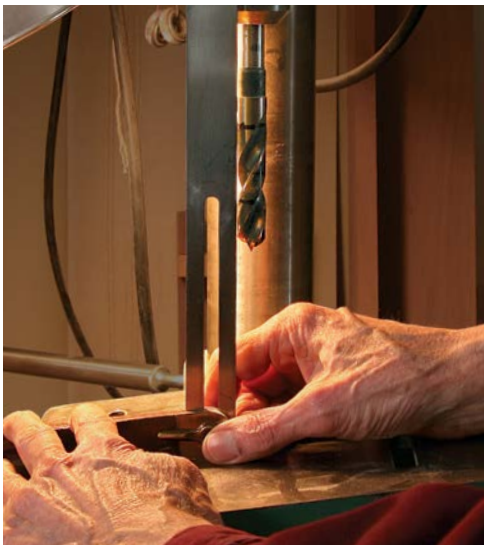


Make and mortise the legs. Using a shopmade tapering jig, Becksvoort tapers the two inside faces of each leg. Then he cuts the mortises and rounds over the long edges of the leg on the router table.

work. Once the legs are tapered, mark them on top so it's easy to keep track of which is which and how they are oriented. To give the stool a softer, less angular look, ease all four corners of the legs at this stage with a ¼-in. roundover bit on the router table. Then it's on to mortising for the seat-rail tenons. I did this with my horizontal mortiser, but any other mortising method would be fine. Whichever technique you use, be sure to register off the outside—untapered—face of the leg, so that the face of the seat rail will be parallel to it.

DRILLING ANGLED MORTISES





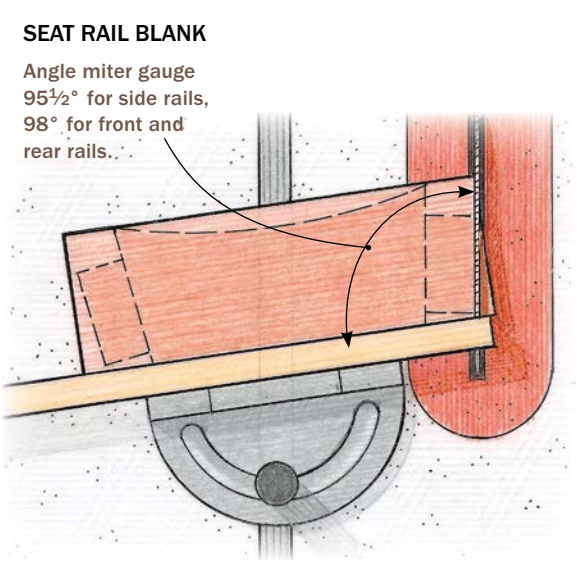
From drawing to drilling. After tapering the legs, cut the mortises for the seat rails and rout the roundovers. Then, to cut the angled mortises for the rungs, set a bevel gauge (top) to the angle on your drawing, and tilt the drill-press table to that same angle (above).

I cut the round mortises for the rungs at the drill press, using a ⅝-in. brad-point bit. I tilted the table to match the leg-to-rung angle and drilled about ⅞ in. deep.

Shape the seat rails

After milling the seat-rail blanks, make the angled crosscuts on each end. These angles produce the splay of the legs. Note that the side rails are cut at a different angle from the front and back rails for a less-pronounced splay. Once the angles are cut, you can cut the tenons on the tablesaw, as I did, or by hand. The tenons intersect inside the leg, but I offset them toward the outside to make

Prep the Seat Rails



End angles first. Crosscut the seat rails with a miter gauge on the tablesaw. Then, with the blade lowered and the miter gauge at the same setting, cut the shoulders of the tenons.

Buzz the ends at the bandsaw. Make the end shoulder cuts at the bandsaw and clean them up with a chisel if necessary. The tenons are offset toward the outside face of the rail.

A meeting of the miters. With a block plane, miter the rail tenons so they don't contact inside the leg.

Trace a curve. You can use a flexible ruler in a bar clamp to reproduce the curve on the full-scale drawing and trace it onto the seat rails. The curves are then bandsawn and smoothed.

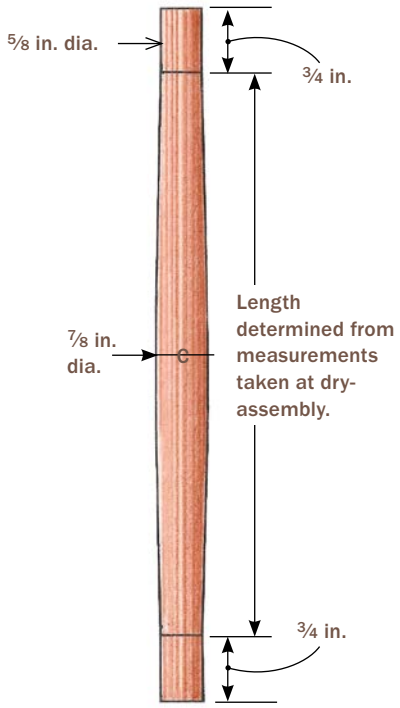
them as long as possible, and I mitered their ends with a block plane.

Next, bandsaw the arc on the bottom edge of each rail, and fair the curve with files or a sander. The side seat rails have a tighter-radius arc than the front and back seat rails. To speed things up, stack and tape together the pairs of rails for sawing and sanding.

Tenon and taper the rungs

Dry-assemble the stool with a band clamp at this point, and take measurements for the rungs directly from the stool. The lengths

Stool Rung



Measure for the rungs. Dry-assemble the legs and aprons and measure the length for each rung separately. Add ¾ in. to each end for the tenons.

Tenoning rig. With the rung blanks milled square and cut to length, Becksvoort uses a tenon cutter in the drill press to cut the tenons on each end. Alternately, you can turn the tenons.

Clever doughnut. A scrap with a ⅝-in.-dia. recess drilled into it helps mount the rung on the lathe. The small, through centerhole seats on the lathe's dead center.

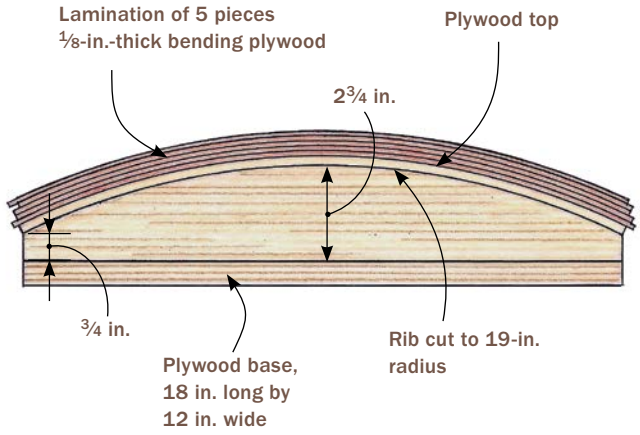
Make that rung a cigar. After turning the square blank to a cylinder with a roughing gouge, use a smaller gouge to taper the rung to a gentle cigar shape.

should be close to what the drawing shows, but may be off slightly depending on how accurately the rail angles were cut. After milling the rung blanks to a bit more than ⅞ in. square, cut the three pairs of rungs to length, being sure to include ¾ in. extra at each end for the tenons.

Next up is shaping those tenons. You'll be turning the rungs to their cigar shape, and you could also turn the tenons. But I often mill them with a tenon cutter chucked into the drill press. Then I put the rung on the lathe and turn it to shape. I fit one of the tenons into a three-jaw chuck. The other is held in a little adapter I made by drilling a ⅝-in.-dia. hole partway through a scrap of wood. A small hole centered on the ⅝-in. hole seats against the dead center, automatically centering the workpiece. I turn the rung to about ⅞ in. dia. at the middle, and taper it down from there to ⅝ in. at each end. If you don't want to turn the rungs, you can shape them by hand with a drawknife, spokeshave, and block plane.

Five-ply sandwich for the seat. Five sheets of ⅛-in. plywood are clamped over a bending form to make the upholstered seat's substrate. Band clamps pull the plywood tight to the bending form. As an alternative, a vacuum bag could be used with the same bending form.

Bending Form for Curved Seat



Prepare for the upholsterer

Although I didn't do the upholstery myself, I did make the substrate of the seat, a dished lamination of five pieces of ⅛-in. bending plywood. I bent them to shape over a shopmade form, which has five ribs of ¾-in. plywood covered with three pieces of ¼-in. plywood. A vacuum bag would be excellent for this task.

To shape the seat, make a pattern with rounded corners from pasteboard. When the seat lamination is cured, place the pattern on it and trace around it. Then bandsaw to the line, round over the edges with a router, and sand the edges. Now it's ready for upholstering. My upholsterer used a bottom layer of 1-in.-thick dense foam and a top layer of ¾-in.-thick softer Dacron foam. He covered the layers with leather, stretched and stapled in place.

This stool could also accept a wooden seat. Glue up a blank, bandsaw it out, and shape it with spokeshaves, rasps, files, scrapers, and sandpaper.

Shaping the seat's perimeter. Becksvoort bandsaws the bent-laminated seat to shape (left), following lines traced from a pasteboard pattern. Then he smooths the sawcuts with a disk sander. To ensure comfort and a smooth wrap of the leather, he uses a ⅜-in.-dia. roundover bit (above) to ease the edges around the top of the seat. Use a ¼-in.-dia. roundover bit to radius the bottom edge.

Assemble the front and back first. Glue up the front and back as separate units and set them aside to cure.

The top edge must mirror the seat. Trace the curve of the seat onto the legs and seat rail of the front and back units (above). With the subassembly riding inside face down and the bandsaw table tilted 5½°, cut along the curved line for the scooped seat (right).

Assembly in two steps

I sand all the parts to at least 220-grit at this point and assemble the front and back units. When they've dried, trace the curvature of the seat profile across the top of the rails and legs. Then, with the bandsaw table tilted to 5½°, cut along the pencil lines.

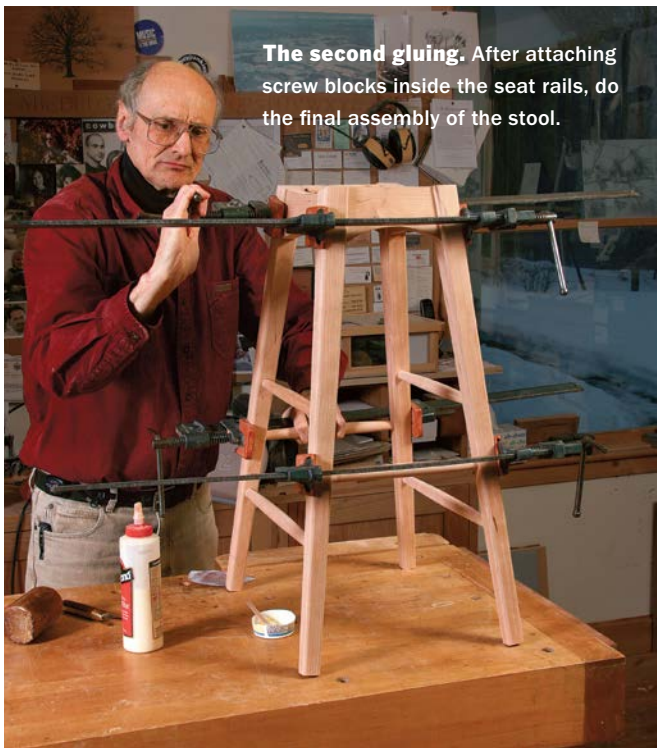
Dry-assemble the side rails and rungs to the front and back units. You'll see that the side rails now protrude above the front and back legs. Mark the amount by tracing the curve at the top end of the legs onto the side rails, and then trim off the excess at the tablesaw or bandsaw. Glue screw blocks to the inside faces of the side rails, and you're ready for the final glue-up.

The seat meets the base

When the seat lamination is cured, attach it to the base with screws driven through the screw blocks. Then stand the stool on a flat surface and mark around each leg with a pencil laid flat. Bandsaw to those lines, and rasp and sand out any irregularities.

Remove the seat to upholster it and to oil the base. Then add felt or rubber pads to the feet, if you like. When the upholstering is done, reassemble, sit, and enjoy.

Dry-fit and draw a line. With the side rails and rungs dry-assembled, mark the side rails where they protrude above the leg. Then disassemble and trim to the line at the bandsaw or tablesaw.



The second gluing. After attaching screw blocks inside the seat rails, do the final assembly of the stool.

Wobble check. To eliminate rocking, trim all four legs in the same plane. Holding the stool steady on a flat surface, trace around each foot with a pencil held on its side and elevated on a scrap. Cut to the lines on the bandsaw, and follow up with rasps and files.

Done. When the seat is upholstered, drive screws through the screw blocks to attach it to the stool's base.

PART SIX

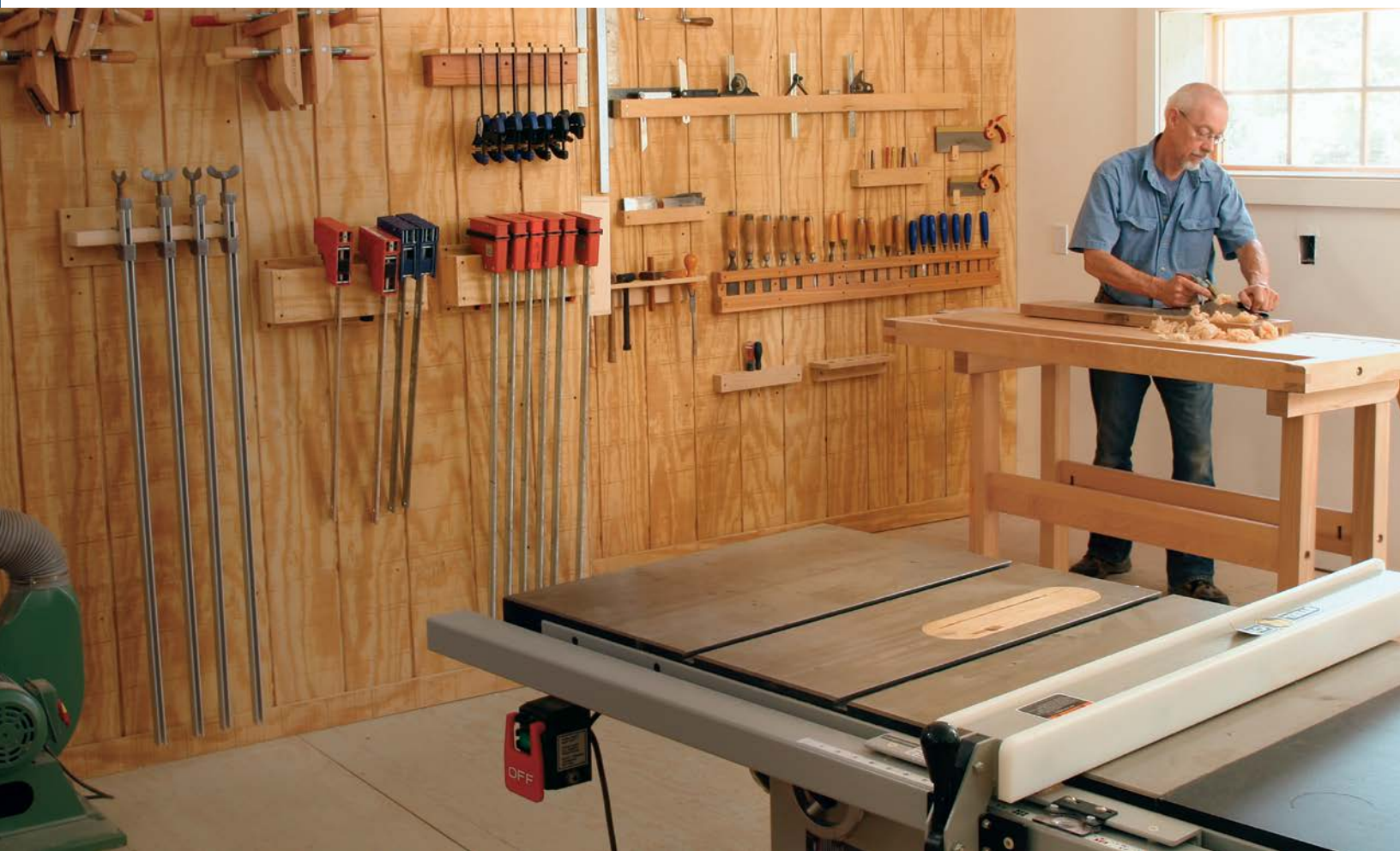
Shop Storage

Smart Shop Storage

JOHN WHITE

By the time you're into woodworking seriously enough to set up your own shop, several things may have already happened, or will happen soon. You will search catalogs, yard sales, and the Internet for tools large and small that you need, think you need, or just plain want—and you will buy them. You will bring home great-looking lumber because it is beautiful, even though you have no immediate plans for it. And someone, possibly a friend, will tell you that "you can never have too many clamps," and you will believe that person.

Each of these things will happen repeatedly, and your space, no matter how voluminous, will soon be a cluttered mess. This collection of my favorite storage ideas from shops I've set up, and from *Fine Woodworking's* readers, will help you keep clutter at bay. To show you how the cabinets, racks, and holders all work together, we built them all into the garage of *Fine Homebuilding's* Project House, where they will get good use.



Build your own cabinets. You'll get a custom assortment of drawers, plus open storage. White's clever arrangement includes a pair of fixed units with space in between for one of two rolling tool carts. An open bay in the nearest cabinet holds a shop vacuum, which can connect to any tool (router table, miter saw) that rolls alongside.

Put the walls to work. For frequently used hand tools, clamps, and hardware, the most efficient storage is in the open, close at hand.

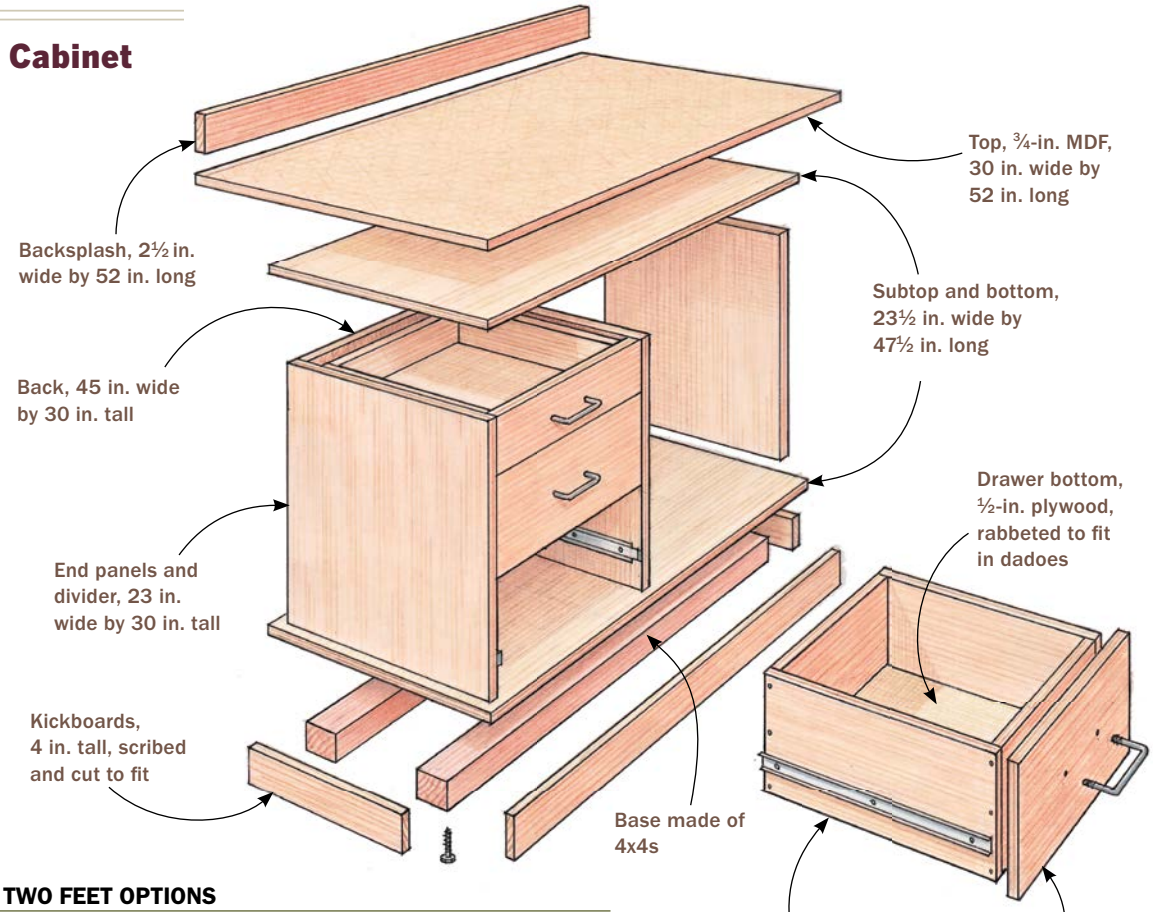
Keep materials organized. Your lumber stash can take over the shop if you're not careful. Sturdy, accessible racks let you keep plenty of solid stock on hand without having it in the way.

Cabinets: Build to fit

I especially like base cabinets in the shop because they provide horizontal work surfaces along with plenty of storage. For the Project House shop, I made a set of fixed and rolling cabinets (two each) that occupy most of a long wall. The fixed units create 20 sq. ft. of countertop in addition to nearly 50 cu. ft. of storage in the spaces underneath. The top rank of shallow drawers works well for smaller items, while the deeper drawers underneath can hold routers, belt sanders, biscuit joiners, and other large tools. One open cabinet provides space for a shop vacuum, and an opening in the MDF top makes it easy to connect to any tool you roll into place. A backsplash prevents anything from falling behind the cabinet.

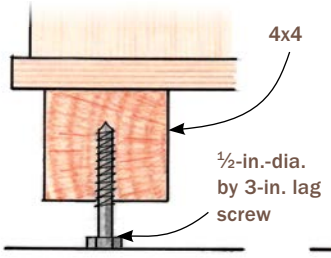
I build shop furniture like this from ¾-in. Baltic- or Russian-birch multi-ply. You probably won't find this at your local home center, but it's worth seeking out at a plywood or lumber dealer because it is rigid, stable, and without voids. The cabinets are sized to be cut efficiently from standard 4x8 sheets. The boxes can be assembled easily

Fixed Cabinet

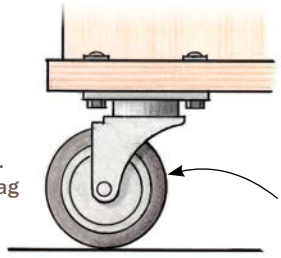


TWO FEET OPTIONS

FIXED CABINET BASE

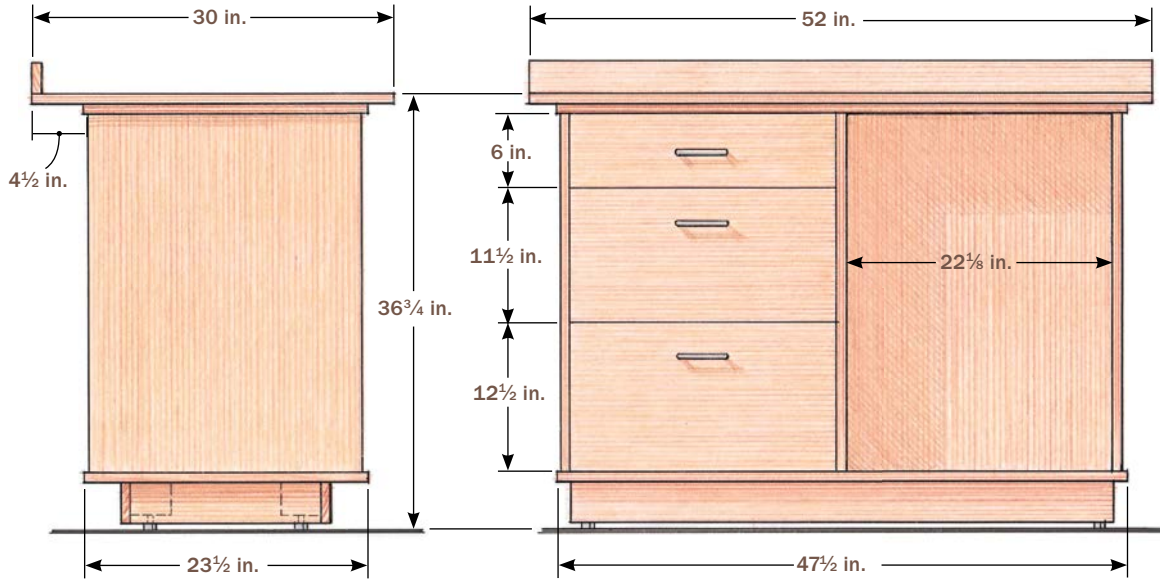


ROLLING CABINET BASE

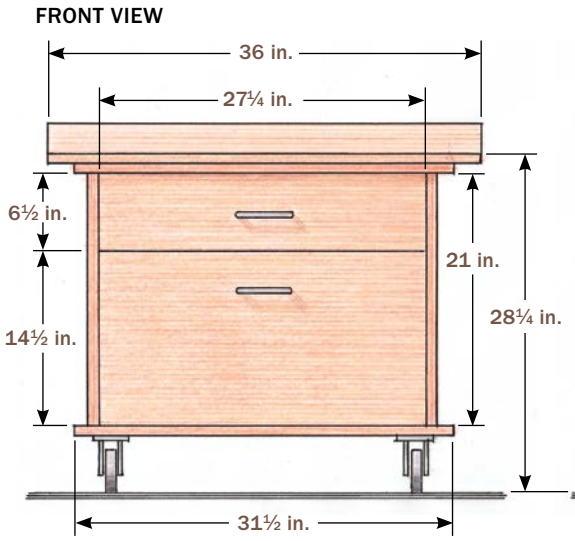


SIDE VIEW

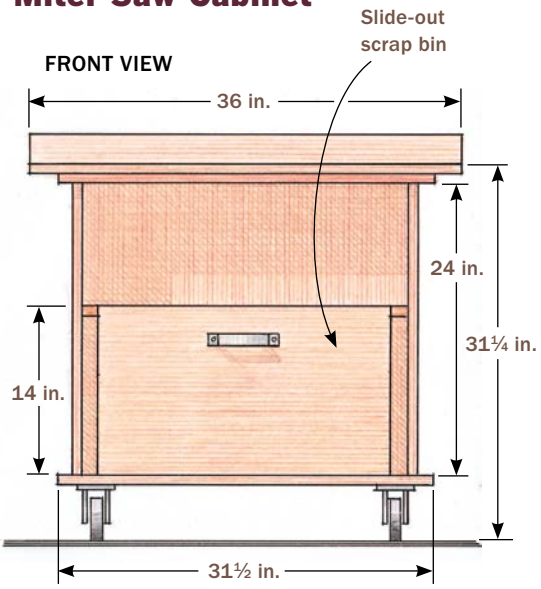
FRONT VIEW



Router Table Cabinet



Miter Saw Cabinet



Simple materials, simple joinery. With the exception of the MDF top, White built the cabinets entirely from Baltic-birch plywood. Basic butt joints, held with plenty of countersunk, coarse-thread drywall screws, make a sturdy box.

Two ways to meet the floor. For the fixed cabinets, White mounted the boxes on skids milled from kiln-dried 4x4s, with a ½-in. lag screw at each corner for leveling. The scrap is there to set the initial height. The rolling cabinets ride on heavy-duty casters (fixed in back, swivel in front).

Topping it off. To the plywood subtop, White screwed a layer of ¾-in. MDF for a replaceable, low-friction surface. He had to create a large overhang in back to accommodate a protruding foundation wall, but you might not have to.

with coarse-thread drywall screws. Be sure to drill pilot and clearance holes for each screw or you'll split the plywood and lose strength.

Cabinets: Installation

Whenever possible, I like to position base cabinets on a long stretch of unbroken wall. This makes an ideal location for a miter saw station, offering plenty of room to orient long stock for cutting, with the countertops working as long support wings.

I leave space between the fixed cabinets to accommodate a rolling tool stand. I built two of those: a low one to hold the compound-miter saw and a second to carry a benchtop router table. A benchtop planer would be another great candidate for a rolling cart. The rolling cabinets swap in and out of a central "parking space" when I'm ready to use them and hook up in seconds to the shop vacuum that lives just next door.

TIP White used a measured length of plywood to locate each pair of drawer slides at the correct height. This ensured that the drawer hung level, and in the right place.

There's no need to anchor the fixed cabinets to the wall; they aren't going anywhere. Once they're in position, adjust the lag-screw feet to make sure they are level and in the same plane. Then roll the miter saw into place and adjust the saw's height so that its bed is level with the countertops. To do this, I measured the distance between the bed and countertops and then bolted the saw to a pair of riser blocks milled to that thickness.

Level the tops. After moving the fixed cabinets into place, White used a long level to span the gap between them and adjusted the lag-screw feet to make sure the tops were level and coplanar.

Add smart riser blocks to align the saw. White deliberately built the miter saw stand low, so the tool's height could be dialed in precisely to match the cabinet height. To do this, he measured from the saw's bed to the countertop height (left), then mounted the saw on blocks milled to the corresponding thickness (above).

Change Out Tools in Minutes

Built-in dust collection. An open cabinet bay holds a shop vacuum. The hose threads through a hole in the cabinet's top for connection to the miter saw and router table, as well as any power tools used on the countertop. A sliding bin underneath the saw collects cutoffs.

Ready to rout. The router-table cabinet is sized to put the tool's work surface at a comfortable working height. After rolling either cart into place, White secures it with two simple screen-door hooks (above).

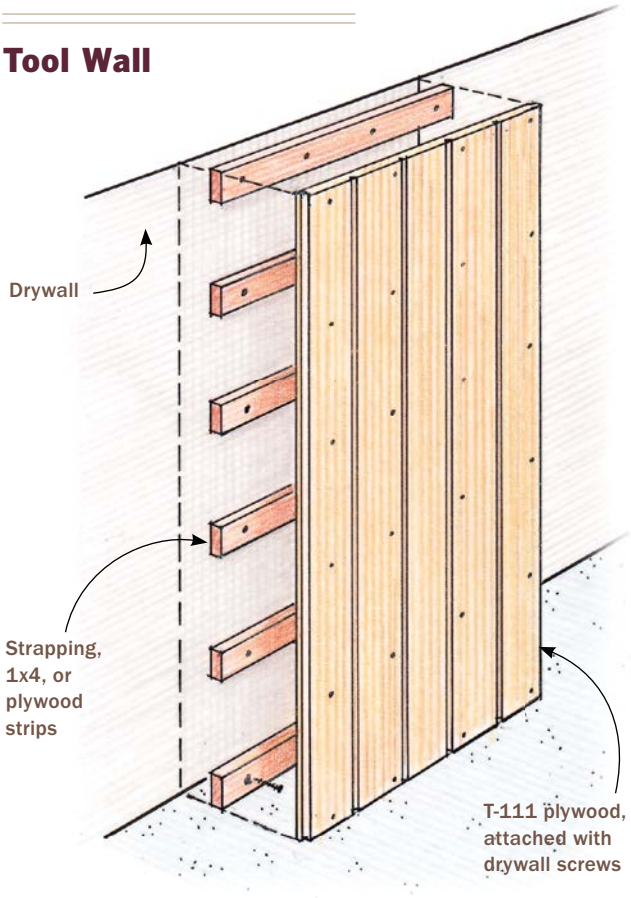
Wall storage

Cabinets are great for stowing tools and supplies that don't see action every day. Tools used all the time should be closer at hand. This is especially true near the bench, where I keep chisels, saws, and layout tools in open racks on the wall. This makes them easy to find, retrieve, and stow. The same system works terrifically for clamps. A lot of woodworkers stow their clamps on a cart that rolls out of the way when not in use. For a smaller shop, it makes more sense to use open wall space.

A fast and flexible way to create this storage is by covering the studs or wallboard with sheets of T-111 plywood (grooved siding with a roughsawn face). I like T-111 because, like any plywood, its strength means you can install tool racks anywhere, without searching for a wall stud. But I like the roughsawn look of T-111, and its surface disguises abandoned screw holes.

The plywood surface makes it easy to attach an assortment of shelves and custom holders for a wide variety of tools and clamps. And the arrangement is easy to reconfigure as your tools and needs change.

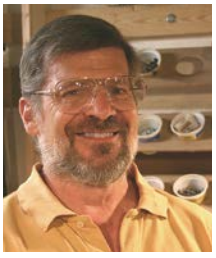
Tool Wall



A sturdy backboard for clamps. White used T-111 plywood, an inexpensive exterior sheathing product, as a base for mounting tools and clamps. Battens screwed to the wall provide more attachment points for the siding and eliminate the worry of aligning seams with stud locations.

Secure, accessible storage. The plywood's strength lets you attach clamp-holders wherever you need them without worrying about anchoring them to wall studs.

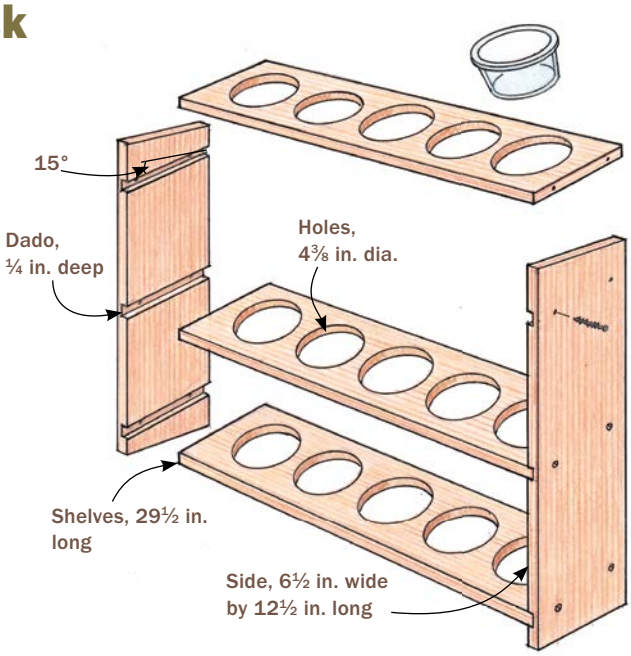
Custom tool holders. Near the bench, White mounted an array of holders for hand tools of all kinds. For chisels, he routed dadoes of differing widths in a long board and then added strips on the front side to keep the chisels in place. The tool walls make it easy to find, retrieve, and stow the items you need most often.



John Hartranft's design inspired this rack.

Handy Hardware Rack

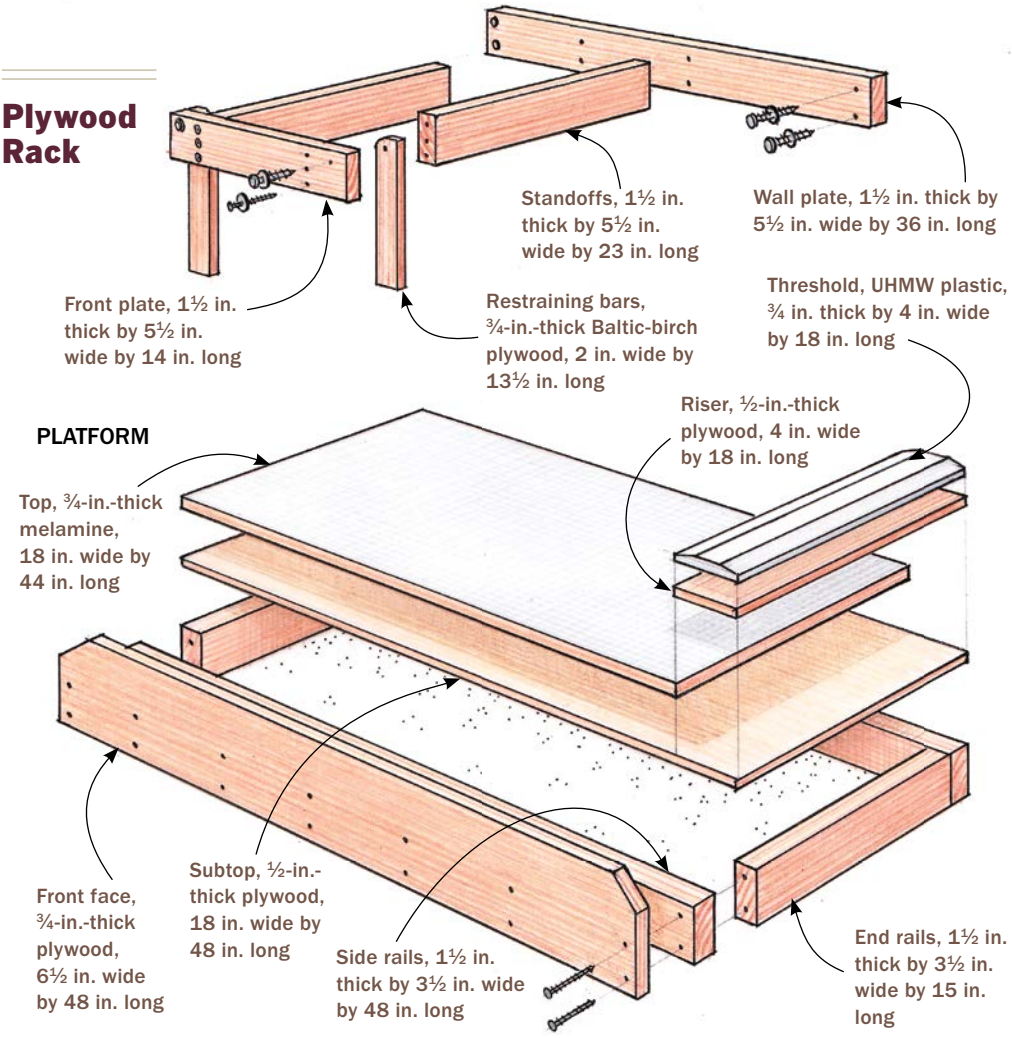
Woodworkers use all kinds of fasteners and hardware, from carriage bolts to brass wood screws. It makes sense to keep a variety on hand, so you don't have to interrupt your work for a trip to the hardware store. To keep them organized yet handy, *Fine Woodworking* reader John Hartranft suggested a simple rack like this. His was drilled to hold open-top yogurt containers. I used larger deli containers, which you can buy in bulk at amazon.com. The design puts the contents on display, and the shelves provide space for labeling. Another great thing about this design is that the containers can be lifted out and carried to the work.



Grab and go. This wall-mounted hardware shelf uses deli containers to hold a variety of wood screws, nails, and dowels. The containers can be lifted out easily.

A bit for big holes. With a fly-cutter attachment for the drill press, cutting large-diameter holes is a straightforward process. Make sure the workpiece is firmly anchored to the table.

Easy-access plywood rack. Karen McBride's plywood rack inspired the design of White's vertical storage rack.



Sheet-goods storage

Because they are heavy and hard to handle, the most efficient place to store sheet goods is near the entrance where you bring them into the shop. In this shop, I placed the plywood rack right next to the twin carriage doors. And, because the tablesaw is only a couple of steps away, there won't be any trouble maneuvering through the shop with a cumbersome 4x8 sheet.

The smart vertical design was suggested by reader Karen McBride. The rack holds the sheets between the wall and a support arm that can mount to a wall (as shown on the facing page) or a ceiling joist. The support arm stops the travel of the sheet tops; this lets the user flip the sheets forward to view and retrieve a sheet from anywhere in the pile. The bottom ends of the sheets rest on a slightly raised platform covered with melamine particleboard with a UHMW plastic strip on the open end for easy sliding in and out of the rack.

Lastly, some folks say that a shop is only as good as its lumber stash. But how good is that, really, if the stash is disorganized? The solution is to get your lumber up on a good sturdy rack. It's not much more expensive to buy one than build one, so we bought one. I put the rack along the shop's back wall, with long stock below the window and shorter boards higher up, between the back door and the back window.

Safe storage for sheet goods. The restraining bars lift out of the way for loading. A lipped platform secures the sheets at the bottom.

Take your pick. The restraining bars let you leaf through the stack to find a sheet and remove it easily without removing others.

Rock-solid lumber rack. A heavy-gauge steel rack, mounted to the wall studs with lag screws, can hold several hundred pounds of lumber. These brackets and standards are sold individually at leevalley.com.

Organized. To work around the window, longer boards are stored low, shorter lengths up higher.

Keep Your Tools Out in the Open

JIM PUTERBAUGH

The notion of workflow always seems to come up when woodworkers discuss shop design, but it's mostly limited to machinery and workbenches. This is a mistake because workflow also involves smaller things like routers, handplanes, chisels, layout tools, sandpaper, scrapers, and even safety glasses. Where those are located and how accessible they are can have a significant impact on how smoothly your work progresses.

This is why I organized my shop so that as much as possible is visible. With everything out in the open, there's no time wasted trying to remember which drawer holds my countersinks, or where exactly I put those 1¼-in.-long screws. As a result, I can work faster and more smoothly because I can quickly grab a tool and use it.

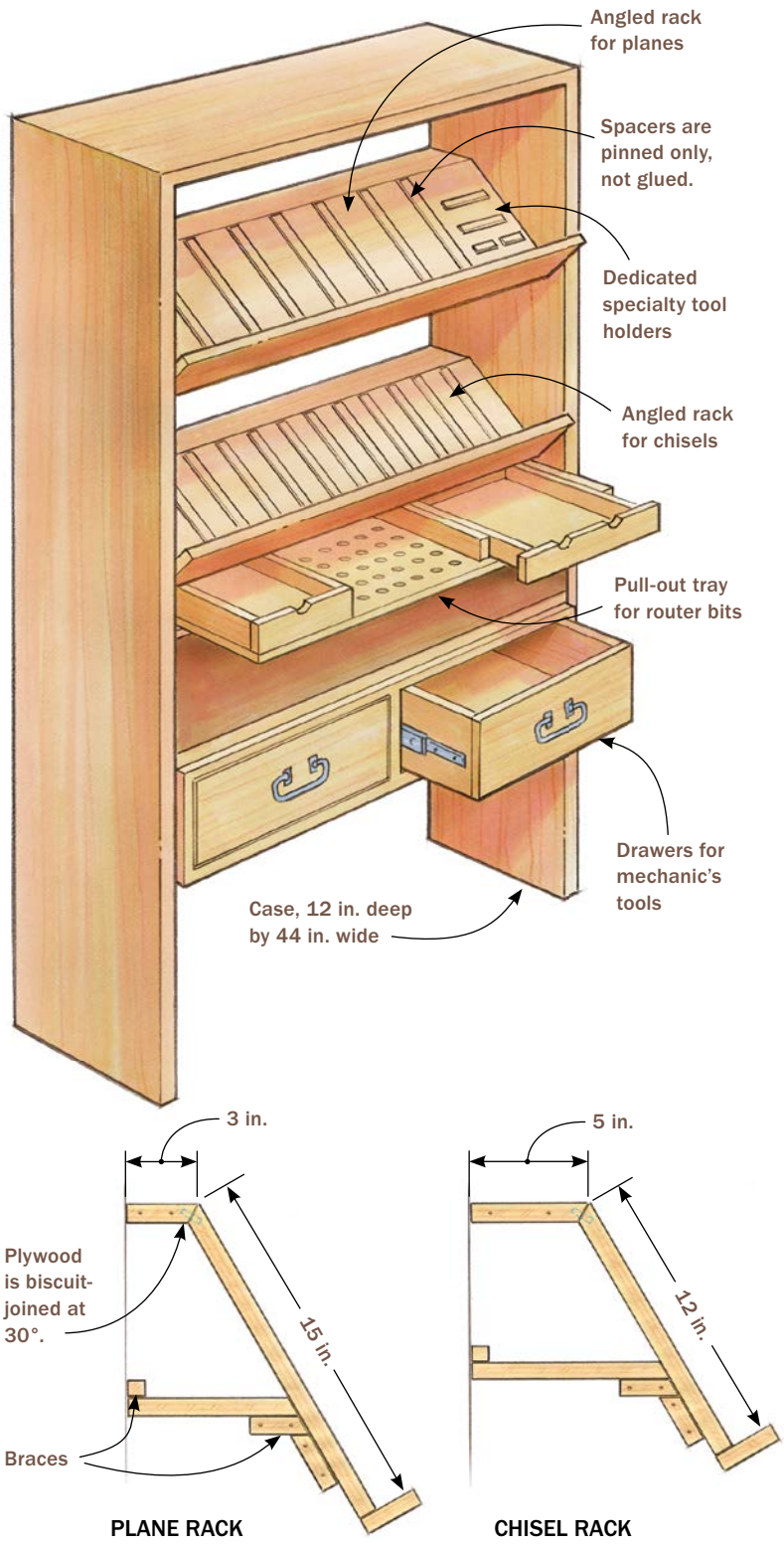
Don't confuse an open shop with a messy one. To be successful, an open shop must be reasonably organized: a place for everything and everything in its place. A bit of clutter is fine, but too much and the shop no longer functions as it should. I divided my tools into common-sense groups and arranged them around the shop so that they are close to where I use them. Lathe tools are at the lathe, in a wall-hung bracket that has a spot for each tool. Planes are within reach of the bench.

In addition to these practical reasons in favor of the open shop, there is another reason I prefer it over a shop full of cabinets and drawers. Tools and the other trappings of woodworking are beautiful, especially when laid out in a lovely array. An open shop puts that beauty on display where it can inspire you.

Rack for hand-tool storage

Organization is critical in an open shop. The best way to organize hand tools in the open is with a shelving unit. I have an angled rack for my planes and another for my chisels. The tools run across the rack in a line with dividers between them. There also are dedicated holders for scrapers, spokeshaves, a drawknife, and a variety of other tools. A pull-out tray holds router bits and a pair of drawers houses mechanic's tools. I added shelves on the outside of the case for cordless drills, and I store air tools below the drawers.

Hand-Tool Rack

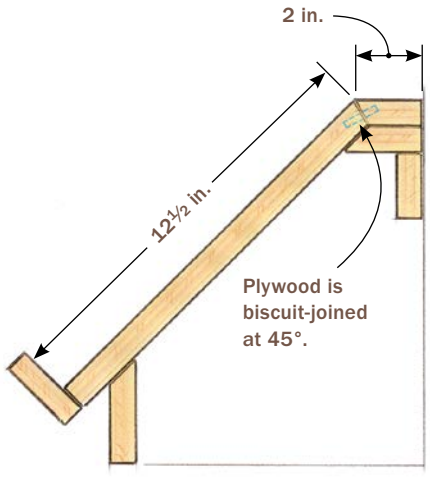


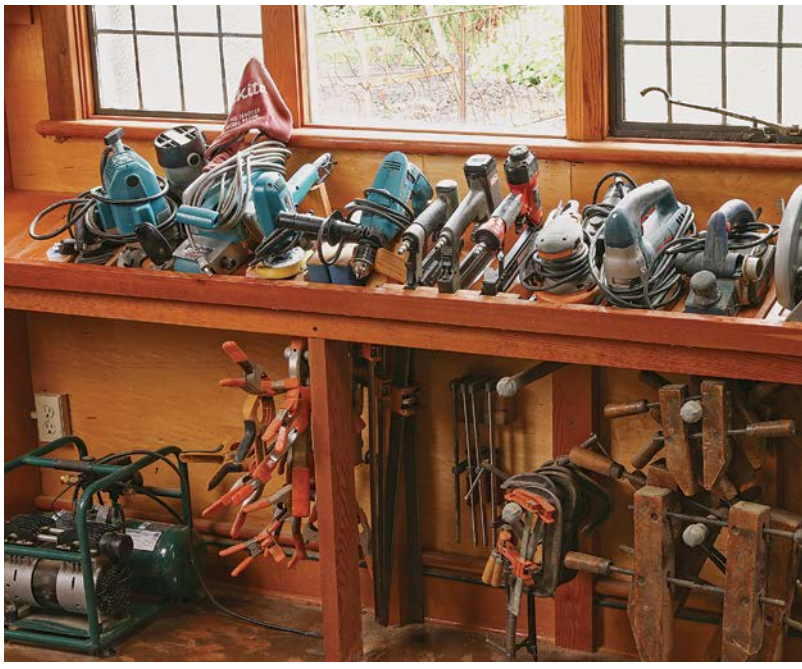
Hand tools at hand. A few steps from his bench, Puterbaugh's planes and chisels are ready for action. Pleasantly displayed, they add to the shop's romance, too.

Make a place for every tool. The best way to stay organized is to create a dedicated space for each tool. Open shelves hold power tools (top), while drawers with slotted racks keep wrenches orderly (above).

Power-tool shelf

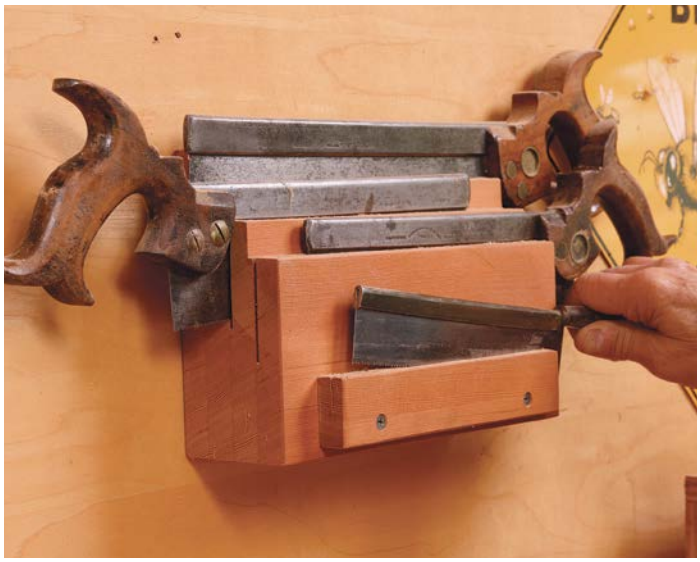
Power tools can quickly become a jumbled mess, so I made an angled rack to store them. Dividers create a dedicated spot for each one. The rack's angle presents the handles in an easy-to-grab way. I wrap the cord around each tool to tidy up the space even more.

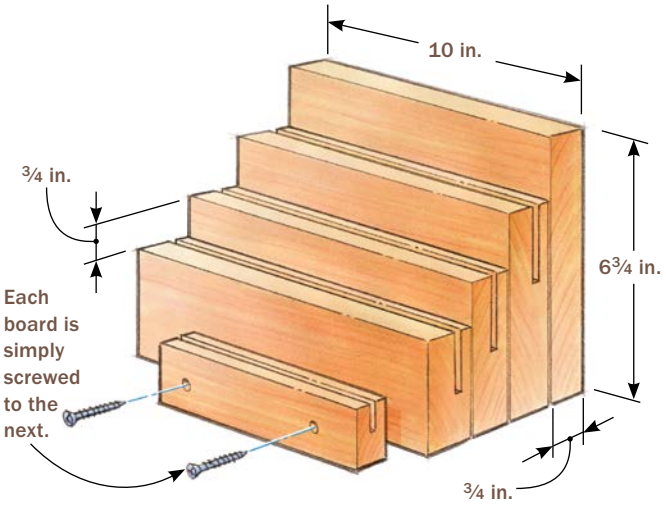




Hanging saw block

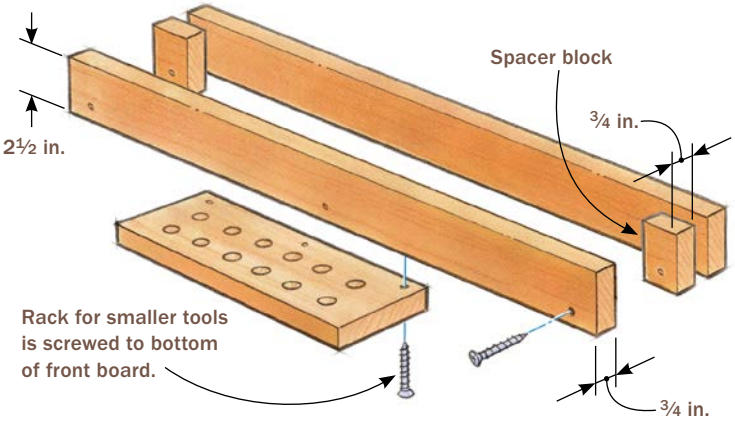
Handsaw blades need protection, so I buried them in a block. Screwed to the wall, the block is a convenient way to store multiple saws within easy reach of my bench. The simplest way to cut a snug slot is to use the saw itself. Cut a kerf deep enough to hide the blade completely. Alternating the handles from side to side makes them easier to grasp.





Lathe-tool rack

The most convenient place to have your lathe tools is near the lathe, which is why I built a dedicated rack and hung it on the wall behind mine. The rack is long enough so all the long-handled tools can be spread out in a single row. The rack has no dividers, so tools are quickly removed and replaced.



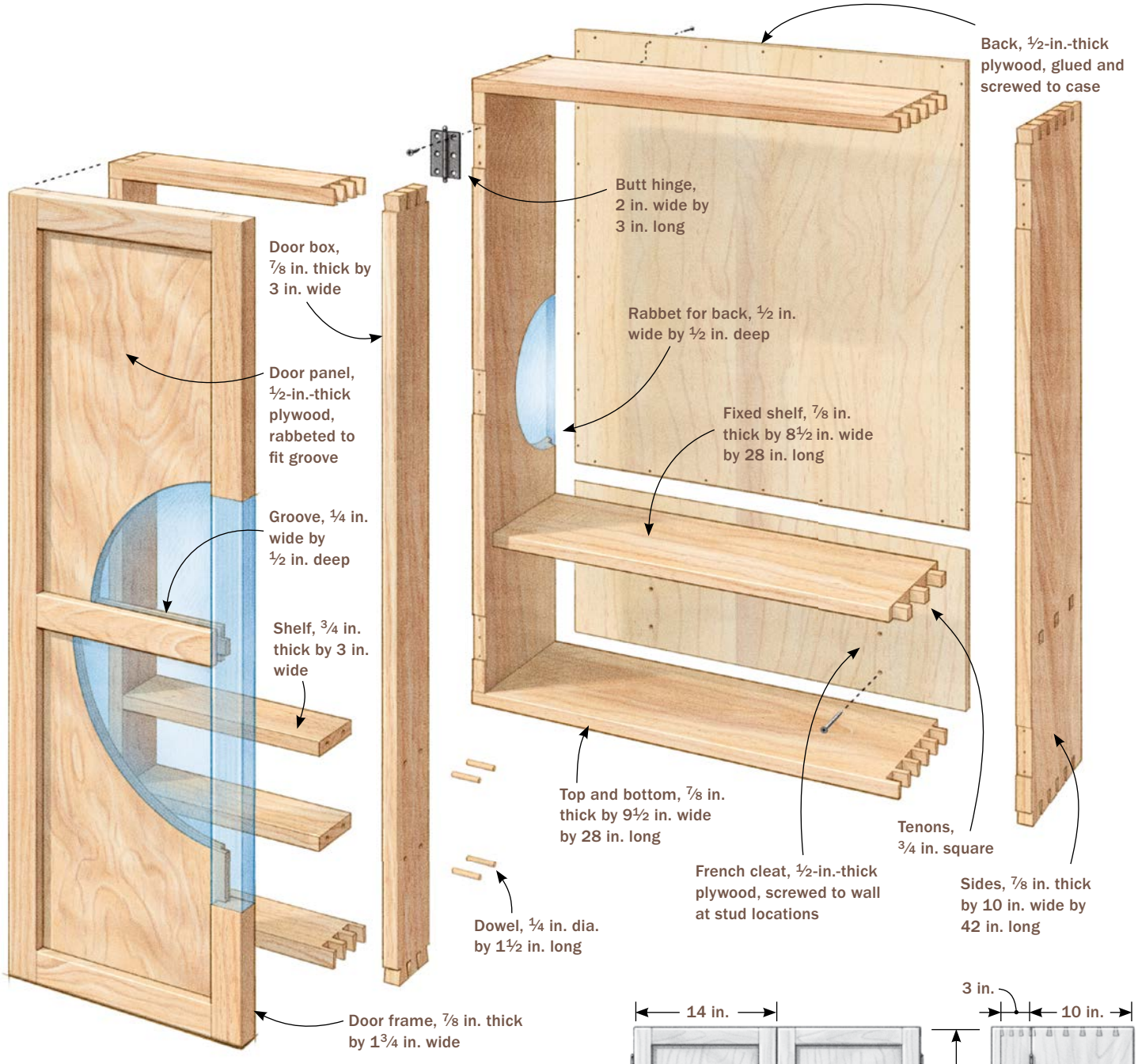
A Cabinet for Hand Tools

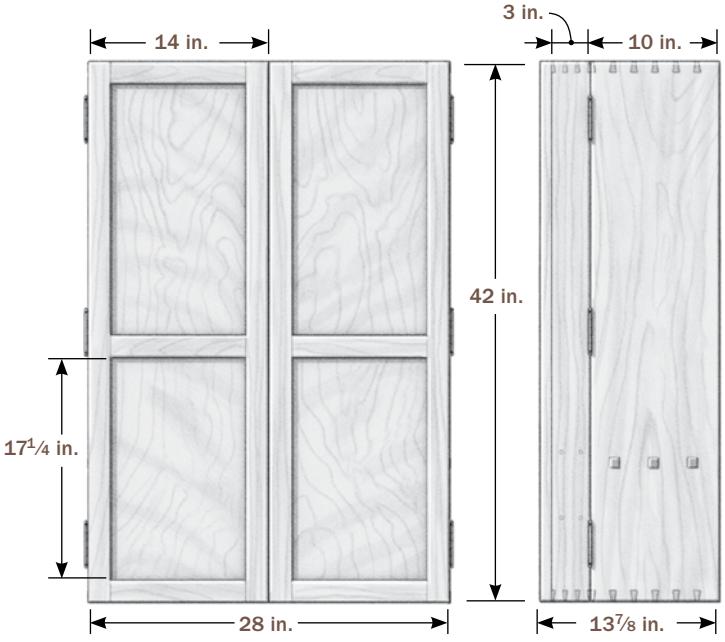
MICHAEL PEKOVICH

When I stop to think about it, I probably spend as much time in my shop with power tools as I do with hand tools. But when the dust and noise from milling parts finally settles and I head to my bench, that's when the fun begins—when I feel like I'm really woodworking. And that's why my cobbled together hand-tool cabinet was always the heart of my shop. Over the years, though, as my tool collection grew, I finally had to admit that I had outgrown my old friend and it was time to build a new one.

Space is limited in my shop, so I needed a way to pack more storage into the new cabinet without taking up more wall space than the old one. I solved the problem in two ways. First, I made the case deeper, giving me more room for handplane storage in the lower portion and enough depth for

Big storage in a small space. Swing-out panels in the doors and upper case let you pack in more tools without taking up any more wall space.

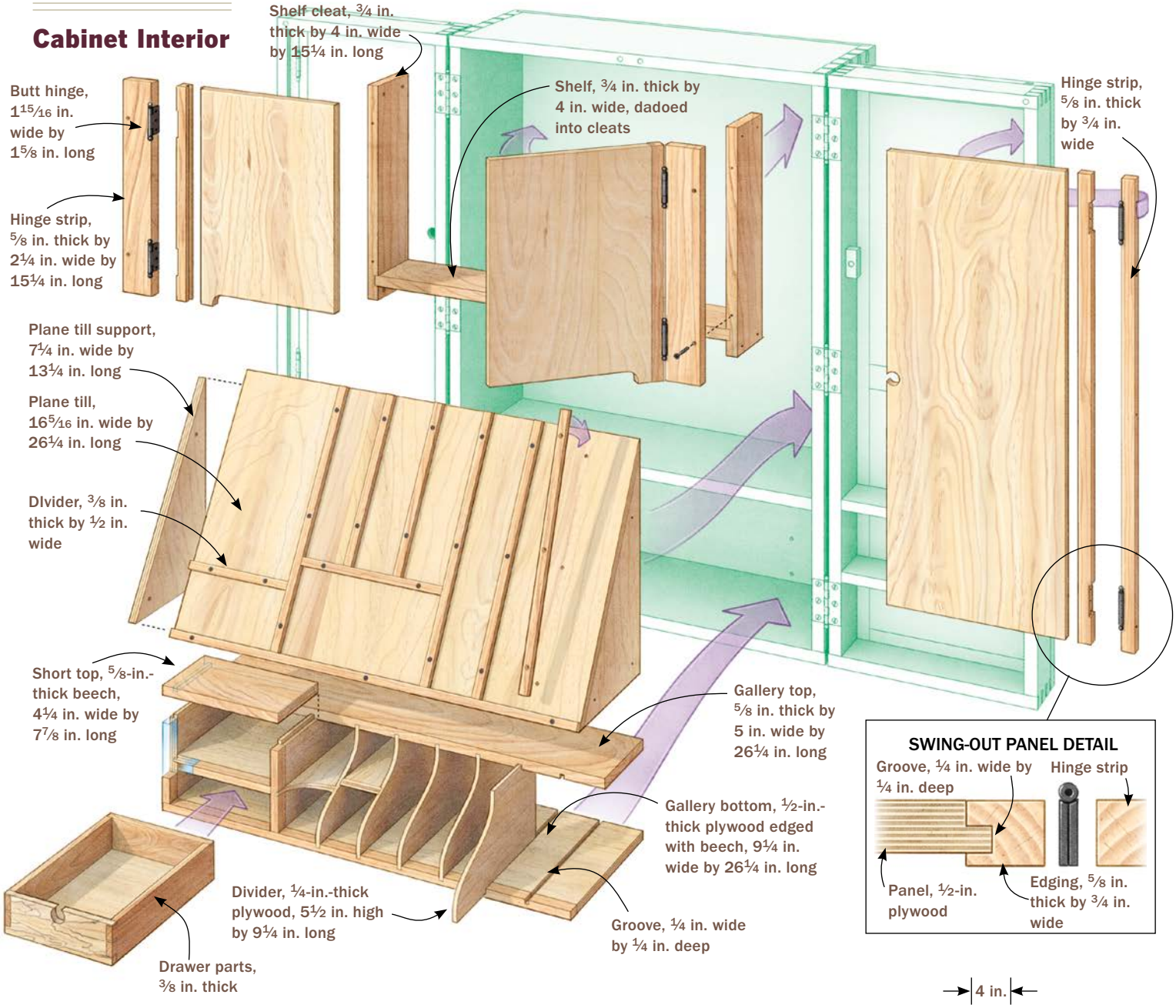


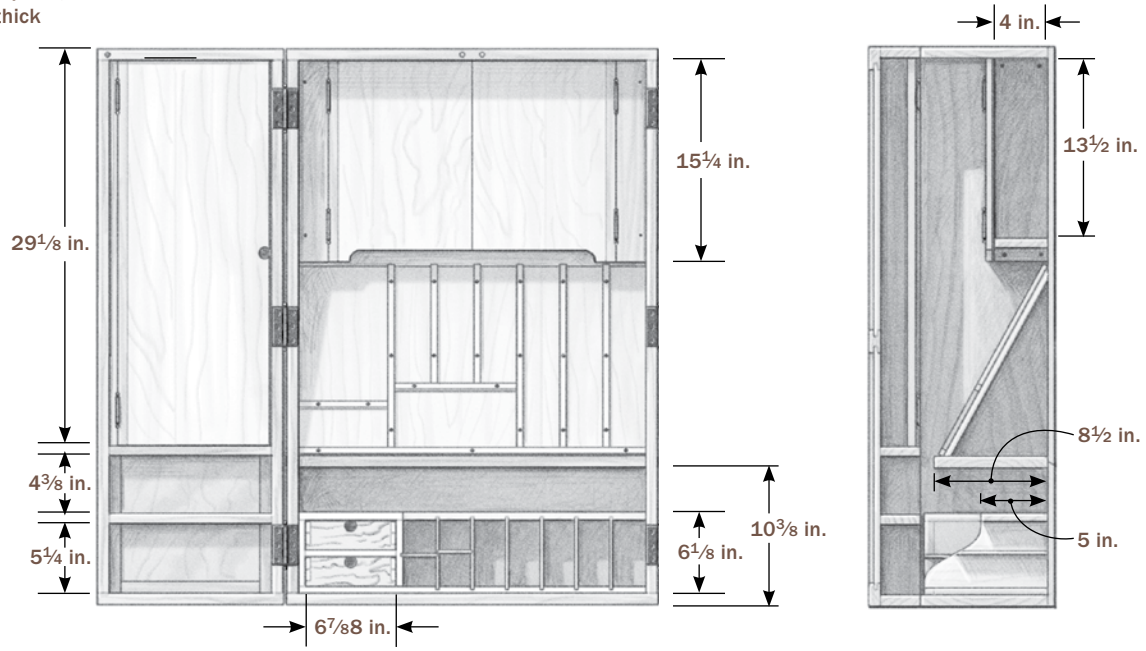


Serious Tool Storage

The spacious cabinet doesn't devour a lot of wall space, yet holds a wealth of hand tools. The case and door boxes are made from solid beech. Baltic-birch plywood is used for the door panels, swing-out panels, and plane till.

Cabinet Interior





Sources of Supply

BUTT HINGES

House of Antique Hardware;
houseofantiquehardware.com

Part numbers:
R-08BM-1822-0B;
R-08IH-83020-10B

swing-out panels above. Also, I built the doors as shallow boxes instead of flat panels, an idea I borrowed from contributing editor Chris Becksvoort (see his tool cabinet on p. 51). These deeper doors combine shelf space for smaller planes and swing-out panels for extra space to hang tools. After some careful design and layout, I now have all my hand tools in one easy-to-reach place—and the cabinet looks great, too.

Tools drive the design

Designing a tool cabinet can be a challenge. It's not just the number of tools. You have to figure out ways to store tools of varied sizes and shapes. Even a bigger cabinet would not have room for every tool I own, so I took a hard look at my collection to determine which tools I use regularly, which ones I use only occasionally, and which ones simply gather dust. I wanted to make sure that the tools I use most are always within easy reach; that the tools I use once in a while, like carving gouges, are stored in less accessible parts of the cabinet; and that the dust gatherers find a home somewhere else. By the way, I also built in a little extra space for new tools I have my eye on. To help with the design, I made a full-size mock-up out of plywood scraps. This gave me a better idea of the space I had and how to use it to its fullest. To customize the cabinet for your tools, I'd recommend you do the same.

Exposed joinery is beautiful and strong

I'm not big on dressing up most shop cabinets, but I think a tool cabinet deserves some extra attention. For me, that means a solid-wood case with dovetails at the corners, and frame-and-panel doors mounted with mortised butt hinges. Still, I made good use of Baltic-birch plywood in the back and door panels as well as in the interior of the case. It provides a solid surface for mounting tool holders and its thin, void-free plies mean that the exposed edges look nice. You could certainly build the whole cabinet from plywood or go to the other extreme by adding veneer or marquetry. It's a great place to show some flair and dress up your shop, or you can keep it simple.

A dovetailed case. Pekovich attaches a sled with a tall fence to a pair of miter gauges to cut the tails. With the tablesaw blade tilted, he makes a pass at each pin location and then rotates the board to complete the pin socket.

A custom blade leaves clean corners. The top of each tooth is ground to 7½°. When the blade is tilted to the same angle, it creates a flat-top cut, leaving just a sliver of waste in the middle.

The pins are next. Start by scribing the pins from the tails board (above). After sawing to the scribe lines with a backsaw (right), remove the waste in between the pins with a router equipped with a spiral straight bit. Pekovich uses a simple box (far right) to bring the workpiece to a comfortable height for routing.

I cut the dovetails on the tablesaw. Then I cut the pins with a handsaw, hogging out the waste between pins with a router and paring to the line with chisels.

To give the case more rigidity, I joined the fixed shelf to the sides with through-tenons. Normally I start by cutting the mortises, but in this case it was easier to transfer the tenon layout to the mortises rather than vice-versa.

First I cut the tenon shoulders using the tablesaw. I formed the cheeks by cutting a shallow rabbet, with the blade buried in a sacrificial fence. The rabbet has three benefits. First, it provides a consistent shoulder line to pare to when removing waste between the tenons. Second, it obscures any gap at the mortise. And finally, I can give a shelf a final handplaning without affecting the thickness of the tenons.

For the mortises, I started by marking the shelf location on the back edges of the sides and then carried those lines across the faces. Next, I stood the shelf on each case side to mark the mortises on the inside and outside faces. I roughed out the mortises on the drill press and squared them up with a chisel.

Once the joinery was completed, I dry-fitted the case, making sure the assembly was square. I also lightly chamfered the ends of the dovetails and through-tenons with a block plane because I planned to leave them proud instead of trimming them flush after glue-up. After gluing up the case, I made and installed the plywood back panel. I cut it and the lower French cleat from the same piece, beveling their mating edges at 45°. The bevel cut is hidden by the fixed shelf and centered in its thickness. Then I assembled the doors and the door boxes (photos, p. 198).

Inside, planes get priority

With the case complete, it was time to work on the storage components. I started at the heart of the cabinet with the plane till and

Add the fixed shelf. Use a marking gauge to scribe shoulder lines on the shelf and then mark the tenon locations with a pencil. Set the blade height to the scribe line to form the tenons.

Cut the cheeks. Bury a portion of the sawblade in a sacrificial fence to cut the shallow rabbet that forms the cheeks.

Clean up the waste. Bandsaw most of the waste and then chisel to the baseline. To ensure a tight fit, chop halfway down, undercutting the joint slightly, and then flip and work from the other side in the same way.

the gallery, designed to hold my collection of handplanes. The till not only displays the larger planes nicely but it also makes them easily accessible because it tilts back at 30°. Triangular cleats screwed to the case sides support the till.

The planes are separated by a series of dividers screwed to the till. I used the actual planes and a ¼-in.-wide spacer strip to locate the dividers.

At the bottom of the cabinet I created a gallery that also includes a couple of drawers, useful for everything from drill bits to tape measures. The whole section slides in and out as a unit (photo, p. 199, bottom) and is screwed to the base of the cabinet at the back.

The gallery is narrower at the top than at the bottom, and the dividers are curved. This allows easier access to the handplanes. The ¼-in.-thick plywood dividers slide into dadoes in the ½-in.-thick top and bottom. I added horizontal dividers to two of the partitions to double up

Scribe the mortise locations. Stand the shelf in place, using a square to align it flush with the back edge. Knife around each tenon and repeat on the opposite face of the case side.

Drill and chop. Remove most of the waste on the drill press. Then use a chisel to chop out the rest, working back to the scribe lines gradually. Chop halfway down, undercutting slightly, then flip to complete the cut.

block plane storage, gluing in stops to keep the smaller planes from sliding in too far.

Doors within doors double the storage area

At the top of the cabinet, just above the plane till, I added cleats to the cabinet sides. These not only support a small shelf but also act as a place to attach a pair of swing-out plywood panels made from ½-in.-thick Baltic-birch plywood. I relieved the bottoms of each panel so they wouldn't block access to the planes below. I also added swing-out panels to the inside of each cabinet door. The panels give me another strong surface to attach tool holders and help the cabinet pack in even more storage in a shallow space (photo, p. 200, top right).

Neat tricks for customized tool storage

The final step of the construction was to create a safe, secure home for each tool in the cabinet. Some solutions, like chisel racks, fit a variety of tools. Others, such as holders for marking gauges and saws, are customized for each tool. Finding the right solution for each tool is half the fun.

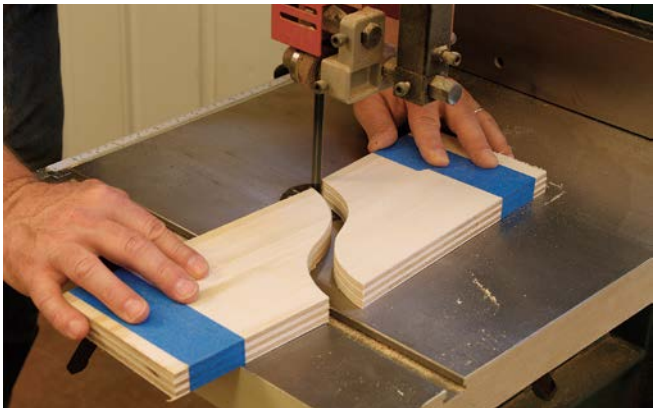
My chisels hang on a holder with concentric-size holes that accommodate a variety of handle diameters. I have several spokeshaves of various shapes and sizes, but a pair of racks with upward-angled arms handles all of them. Squares can be secured with a simple slotted block of wood. Handsaws require a custom-fit holder. I started by making a block to fit the opening in the handle, then screwed on a pivoting tab to hold the saw in place. Rare-earth magnets set into blocks help keep long tools from swinging. For the finish, I kept it simple. I just wiped on a few coats of shellac to give the case a little protection and make it easier to clean.

To hang the cabinet, start by attaching the French cleat to the wall with 3-in. screws at the stud locations. Rest the cabinet on the cleat and screw through the back of the case into the studs.

Big glue-up made easier. To provide clearance for the proud dovetails and the through-tenons, Pekovich elevates one side using wood strips (left). Then he assembles the main carcase, checking it for square. Once the case is dry, he attaches the back with glue and nails (above). Screws add a little extra security.

Add a frame-and-panel front to the doors. The plywood panels are glued into a stub-tenon frame (right). This creates a handsome yet rigid assembly that helps keep the door from sagging while providing a solid, flat surface for attaching tool holders. The frame-and-panels attach to the door boxes (far right) with a simple glue joint.

Build the plane till. The plane till is simply a plywood panel screwed to triangular cleats mounted to the case sides. It's easier to add the plane dividers before installation. Set each plane in place and slide a ¼-in.-thick shim against it to create some wiggle room. Screw down the dividers without glue to make future alterations easier.

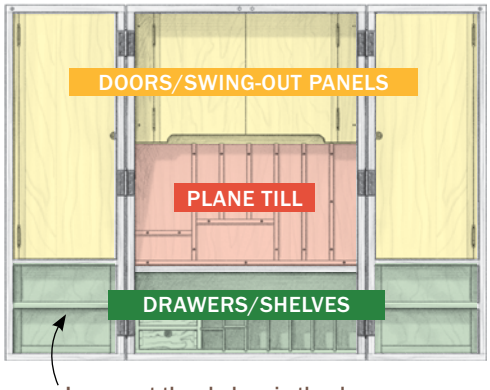


Six dividers, one cut. Tape the dividers into a single stack and cut all the profiles at once. A symmetrical curve creates offcuts with the same profile.

Clean dadoes for the gallery dividers. Cut the dadoes for the dividers with a dado blade and a crosscut sled. A fresh plywood base taped to the sled eliminates tearout.

Make It Your Own

The interior is divided into three basic zones that can be customized to fit anyone's tool collection. The vertical surfaces are great for saws, spokeshaves, chisels, screwdrivers, and layout tools. The angled till keeps handplanes within easy reach. The shelves at the bottom can be outfitted with dividers for even more plane storage or filled with drawers for screws, hardware, router bits, and small tools.

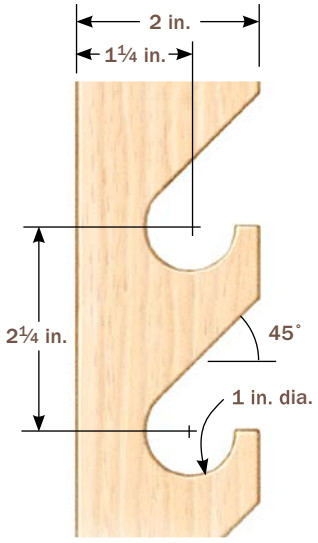


Leave out the shelves in the doors and extend the swing-out panels for even more vertical storage space.

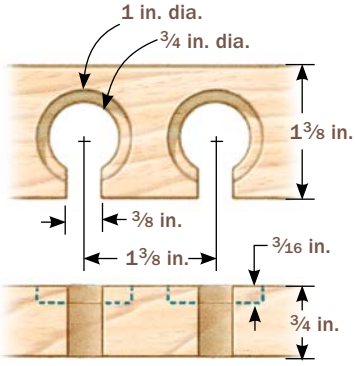
Glue up the gallery and slide it in as a unit. The left side of the gallery is outfitted with a pair of drawers for odds and ends. The shelves are for block planes.

Add the door shelves. Use spacer blocks to locate each shelf while you drill and pin them in place. You can change the location of the shelves later by drilling out the pins.

A swing-out panel increases storage. The ½-in. plywood panel is edged with a thicker hardwood strip on one side to allow for hinge mortises. The panel is attached to a cleat that is mounted to the drawer box.



Simple spokeshave rack. A pair of uprights hold the shaves securely. Start by drilling holes, then finish the profile at the bandsaw.



Versatile holder for chisels and gouges. The stepped holes fit handles large and small. After drilling, cut the access slots on the tablesaw.

Tool Chest with Surprise Storage

C. DANIEL SMITH

Four layers of tools. Smith stores large and heavy tools in the deep outer doors. The shallow inner doors hold frequently used smaller tools. The carcase is solid ash with mahogany plywood panels. Interior fittings are solid mahogany with oak plywood panels.

Fifteen years ago I built a wall-hung tool chest much like the one shown here. But in the meantime my collection of hand tools had outgrown that chest, and I decided to build a larger one.

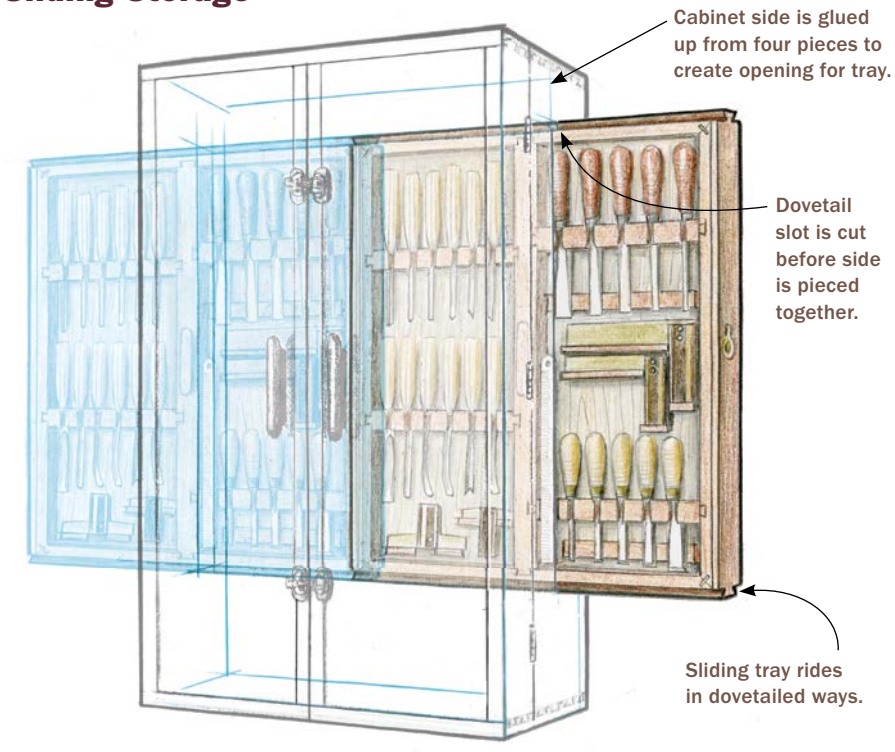
My original chest had storage in three layers: in the deep main doors, on a pair of shallow inner doors, and on the back board of the cabinet. But for this version, I increased its capacity with a fourth layer of storage, a shallow tray that sits behind the inner doors and in front of the back board. To keep access quick and straightforward, I made the tray so that it slides side-to-side in dovetailed tracks. When you open the chest's inner doors, you can access any of the tools on the sliding tray. Or, using the wooden handle at the middle of the tray, you can slide the tray aside to reach the tools on the back board.

When you do slide the tray aside, it travels right out the side of the chest. This means you can also access the tools in the tray without ever opening the doors: Just pull the brass ring on either side of the chest, and the tray slides out. The wooden handle on the front of the tray acts as a stop, so the tray slides just halfway out either side of the chest.

To determine the placement of tools, I cut scraps of plywood to the size of the various components and laid out the tools until I had arrangements I liked. I placed the heaviest and deepest tools in the front doors. I put some of my most frequently needed tools on the shallow inner doors. The sliding tray, with no extra depth to spare, became home to carving and bench chisels and some layout tools. I reserved the back board for tools that I use less frequently.

Sliding storage. The third layer of storage in Smith's tool chest is a tray that slides sideways. It can be accessed from outside the chest even when the doors are closed, or from the front when both sets of doors are open. Behind the sliding tray is a fourth layer of storage, reserved for larger tools that are used less frequently.

Sliding Storage



Knowing how my tool kit continues to grow and change, I built the chest so its main components can be disassembled, and I made all the tool mounts removable—screwing them in from behind—so I can alter their arrangement when I need to. I made the handle on the front of the sliding tray removable too (above left), so the tray can be slid right out of the chest if need be. I used French cleats top and bottom in the back of the carcase to secure the chest to the wall.

Under-Bench Tool Cabinet

CHRISTIAN BECKSVOORT

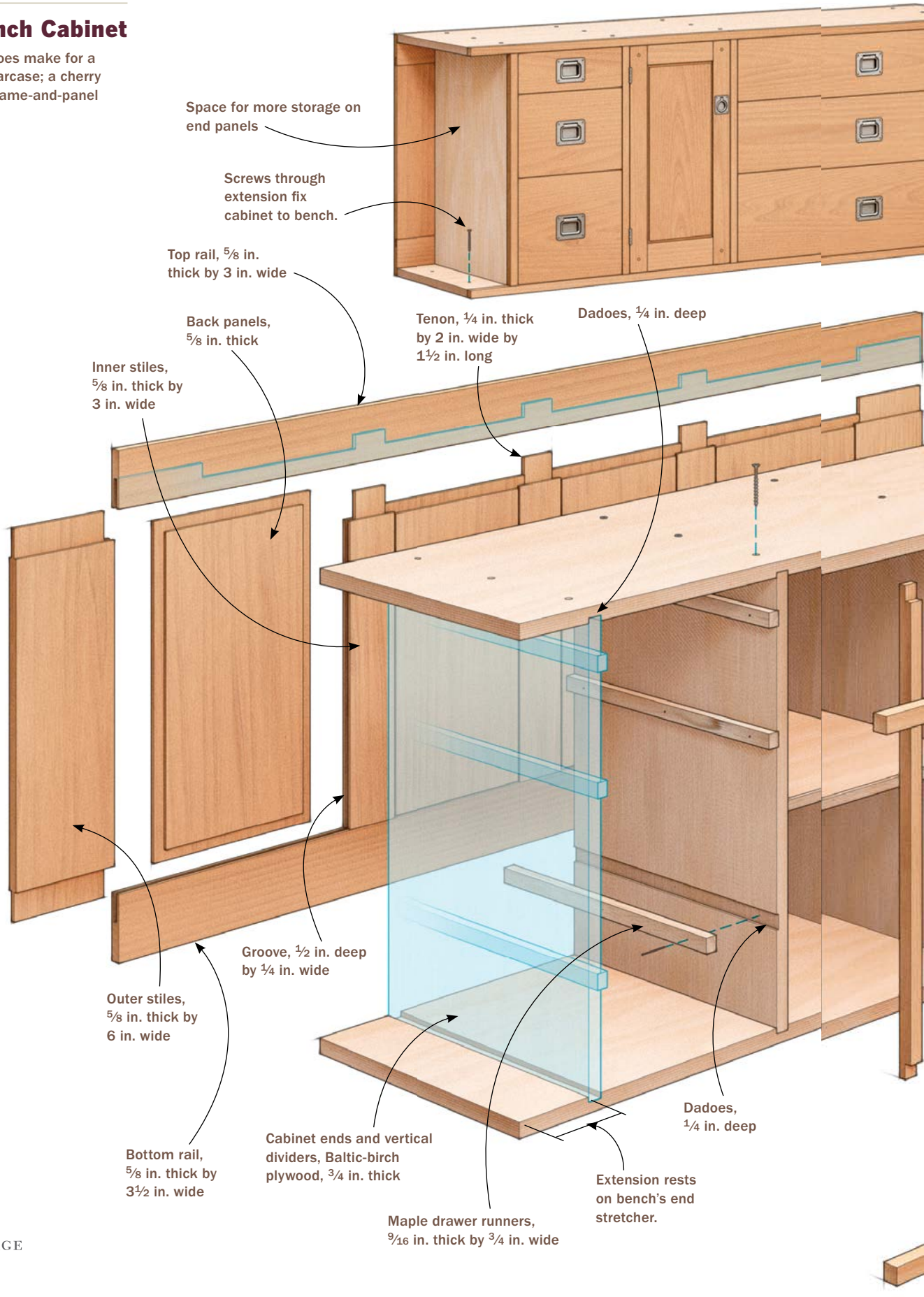
The shelf below my workbench was always heaped with stray stuff—clamps, power cords, glue, scraps, jigs—things I often needed at the bench but never quite found a home for. It was constantly a mess, and the space above the mound of stuff was wasted, too. Sound familiar? Wouldn't a storage cabinet under there be just the ticket?

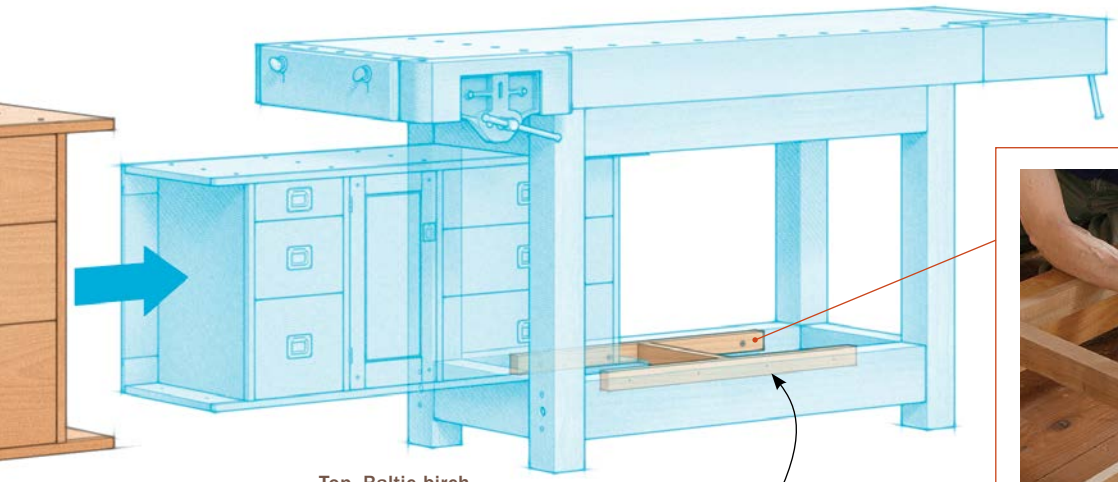
All it takes is proper planning and a little effort to create a custom cabinet to fit your bench, your tools, and your work style. Just as I did when building my wall-hung tool cabinet (featured in *Fine Woodworking* issue 153), I measured and grouped similar items to fit specific drawers beforehand to achieve an efficient and well-planned layout. Your cabinet will differ in size and layout, of course, depending on your bench and your tools.

Below the bench. Practical storage cabinet utilizes the wasted space beneath your benchtop.

Under-Bench Cabinet

Plywood and dadoes make for a quick, practical carcase; a cherry face frame and frame-and-panel back dress it up.





Screw in more support. Because his cabinet was built to fit between the front and back legs of his bench and slide in from one end, Becksvoort needed to add ledger strips inside the stretchers to support it.

Top, Baltic-birch plywood, ¾ in. thick

Ledger strips screwed to stretchers

Plywood shelves, ½ in. thick, edged in front with solid wood

Solid-wood lap-joined face frame, ¾ in. thick by ¾ in. wide

Drawer sides and back, ⅝ in. thick

Drawer front, ⅝ in. thick

Top rail, ⅝ in. thick by 1⅞ in. wide

Solid wood face, ⅛ in. thick, creates a half-blind look.

Drawer bottom, ¼-in.-thick Baltic-birch plywood

Tenon, ¼ in. thick

Bottom, Baltic-birch plywood, ¾ in. thick

Panel, ⅝ in. thick

Holes for adjustable shelves are 1 in. apart and inset 1½ in. from front edge.

Stiles, ⅝ in. thick by 1⅞ in. wide

Bottom rail, ⅝ in. thick by 2⅝ in. wide

Layout Tips for Tools

Not every bench is the same, so you'll have to custom-fit this design to suit your situation. To determine the exterior dimensions of your cabinet, measure the distance between the legs of your workbench. My cabinet slides in from the end of the bench, just fitting between the front and rear legs, and leaving a 3-in.-wide clamping ledge along both the front and back of the bench. This also keeps the cabinet from interfering with the benchdogs. If your bench doesn't have stretchers positioned to support the cabinet, you may have to add ledger strips as I did.

Some time spent planning the arrangement of items in the drawers and cabinet will result in the most efficient layout. I started by grouping similar items that might go into the same drawer. I put all the stuff that accumulates in the tool well—sanding blocks, glue bottles, pencils, tape, spacers, and partially used sandpaper—together in the top shallow drawer. Larger items like clamps, hold-downs, and bench hooks fit in the larger drawers.

When I designed my wall-hung tool cabinet I made scaled graph-paper cutouts of my tools to find the best fit. But here I simply laid things out on the bench to see how they fit together. I cut a scrap to the length of the cabinet, arranged the tools, and marked the door and drawer sizes on the stick.

Plywood case and simple joinery

Since this is a shop project, I used plywood for the carcase, cut simple dado joints, and screwed it together. But I dressed it up with a solid face frame in front and a frame-and-panel back. When you cut the plywood to size, subtract ¾ in. from the width for the face frame and ⅝ in. for the paneled back. Cut out the shelves at the same time, subtracting ¼ in. for solid lipping on the front edge.

At the tablesaw, use the dado set to cut dadoes in the top and bottom for the dividers and in the ends and vertical dividers to accept the runners for the side-hung drawers. Then glue and screw the case together. The screws are driven from the top and bottom, so they won't show. With the case assembled, drill holes for adjustable shelves. I make a hardwood template on the drill press, making a series of holes 1 in. apart. I use that template with a hand drill to cut the holes in the carcase.

Solid-wood details

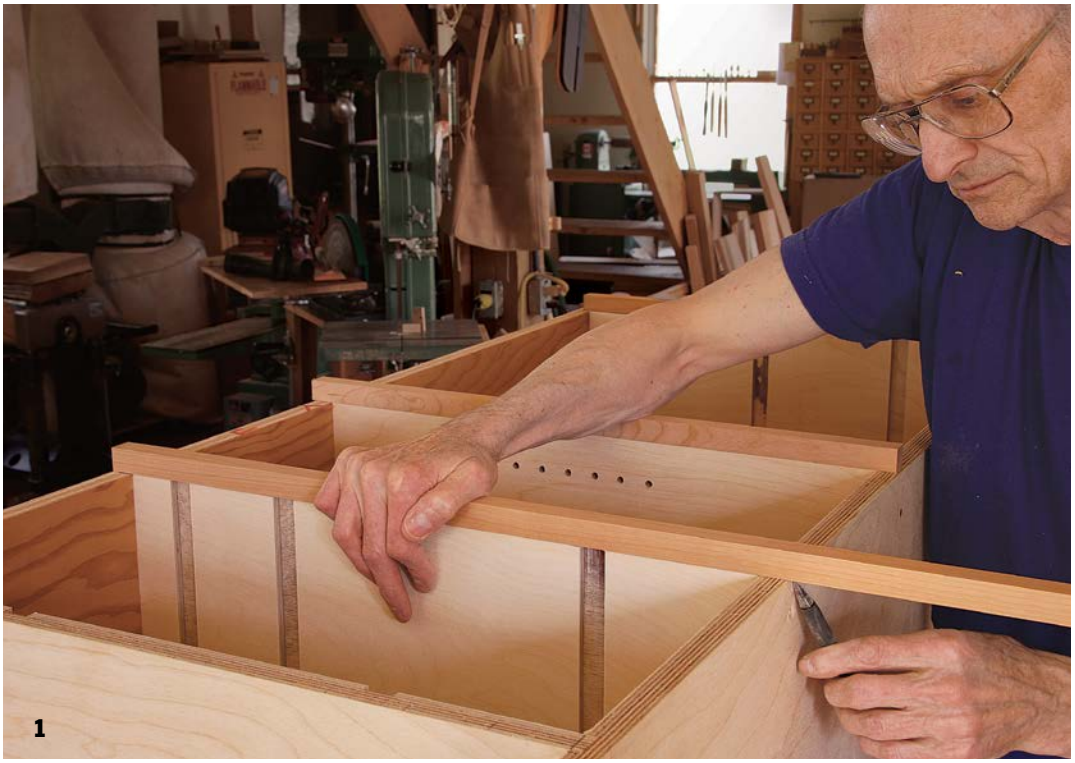
To make the face frame, mill your stock to ¾ in. square and mark the pieces to length directly from the carcase. Cut the lap joints at the tablesaw, then glue and nail the face frame to the carcase. I use a nail gun for this, and later I fill the small nail holes with wood putty.

Next it's time to build the frame-and-panel back. After cutting the rails and stiles to size, cut their mortise-and-tenon joints (or dowel or biscuit joints if you're so inclined), and groove all the parts to accept the panels. Then dry-assemble the frame. Measure the

Source of Supply

FLUSH-MOUNT DRAWER AND DOOR PULLS
HamiltonMarine.com,
Handle flush hatch lift, No. WC 6040;
Chrome-plated brass ring pull, No. SD 222400

No-frills carcase. Becksvoort's native language may be solid wood, but he built the carcase of this utilitarian cabinet with plywood—dadoed, glued, and screwed.



Dressing up the basic box. A ¾-in.-thick, lap-joined face frame of solid cherry dignifies the front of the cabinet. Becksvoort marks the vertical members to length directly from the cabinet (1). The verticals then get rabbeted with the dado blade on the tablesaw (2), and the horizontals are dadoed (3). With the horizontals dry-fitted to ensure proper location, he glues and nails the verticals one at a time (4).

Prepare to hang the drawers. With the drawer in place, transfer the location of the runner dado from the case to the drawer side. Becksvoort uses old credit cards as spacers beneath the drawer.

panel sizes directly from the frame, and cut the panels to fit. Assemble the back, and set it aside to cure. After the drawers are fitted, you'll glue and nail the assembly to the back of the carcase.

Smart storage areas

I made the side-hung drawers from solid wood, joining them with dovetails and then cutting grooves in the sides for the drawer runners. You could make the drawers from plywood if you wish, though the action of the runners will not be as smooth. At this point, install the runners inside the case and check the fit of the drawers. I like a drawer to be about 1/16 in. narrower than the drawer pocket. Once the drawers are fitted, I mount the pulls. Flush pulls are preferable, since any protruding hardware may get in the way of clamping from above. I bought my pulls from Hamilton Marine; similar pulls are available from White Chapel.

Finally, make the mortise-and-tenoned frame-and-panel door. Fit it, install its pull, and hang it. Then apply your finish of choice to the cabinet and start putting all that stray stuff in its place.

Rout for the runners. Cut stopped grooves in the drawer sides to accept the solid-maple drawer runners. Becksvoort puts tape on the router table's fence to establish the location of the bit (top). Clean up the stopped end of the runner groove with a chisel (above).

Fix the runners. Becksvoort glues in the maple runners, using brads instead of clamps to hold them in place.

Beautify the back. With the drawer fitting finished, Becksvoort glues the solid cherry frame-and-panel back to the cabinet.

Fitting Flush-Mount Pulls

After roughing out a recess with a trim router to accept the main part of the pull, Becksvoort uses a countersink bit (below left) to create clearance for the screw dimples at the corners. Carbon paper and a gentle tap with a mallet (bottom left) mark the areas that need further excavation with a chisel (below right).

Metric Equivalents

INCHES	CENTIMETERS	MILLIMETERS	INCHES	CENTIMETERS	MILLIMETERS
⅛	0.3	3	13	33.0	330
¼	0.6	6	14	35.6	356
⅜	1.0	10	15	38.1	381
½	1.3	13	16	40.6	406
⅝	1.6	16	17	43.2	432
¾	1.9	19	18	45.7	457
⅞	2.2	22	19	48.3	483
1	2.5	25	20	50.8	508
1¼	3.2	32	21	53.3	533
1½	3.8	38	22	55.9	559
1¾	4.4	44	23	58.4	584
2	5.1	51	24	61	610
2½	6.4	64	25	63.5	635
3	7.6	76	26	66.0	660
3½	8.9	89	27	68.6	686
4	10.2	102	28	71.7	717
4½	11.4	114	29	73.7	737
5	12.7	127	30	76.2	762
6	15.2	152	31	78.7	787
7	17.8	178	32	81.3	813
8	20.3	203	33	83.8	838
9	22.9	229	34	86.4	864
10	25.4	254	35	88.9	889
11	27.9	279	36	91.4	914
12	30.5	305			

Contributors

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Credits

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The articles in this book appeared in the following issues of *Fine Woodworking*:

pp. 5–9: Fine Shop in a Former Garage by Mike Korsak, issue 265. Photos by Jonathan Binzen. Drawings by Dan Thornton.

pp. 10–16: The Snug, Unplugged Workshop by David Fisher, issue 265. Photos by Jonathan Binzen, except p. 14 (bottom right), p. 15 (bottom), and p. 16 (bottom right) by David Fisher.

pp. 17–20: Bring Your Shop into the House by Marshall Fletcher, issue 251. Photos by Asa Christiana. Drawing by Kelly J. Dunton.

pp. 21–24: Freestanding Dream Shop by Elia Bizzarri, issue 251. Photos by Jonathan Binzen.

pp. 25–29: Put a Shop in a Shed by Ken St. Onge, issue 244. Photos by Ken St. Onge, except p. 25 by John Tetreault and p. 28 (top right, bottom right) and p. 29 by Matt Kenney.

pp. 31–32: Visionary Workshop by Jonathan Binzen, issue 244. Photos courtesy of Carl Johnson and Kate Swann, except p. 31 (bottom) and p. 32 (bottom right) by Steven Widoff and p. 31 (inset) courtesy of City of Tampa.

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WHERE WE WORK WOOD

WHETHER IT'S A FULLY EQUIPPED MODERN WOODSHOP or a bench in the basement, every woodworker needs a place to work. This comprehensive collection from the editors of *Fine Woodworking* magazine is the consummate guide to getting the most out of your workshop and covers every aspect of setting up shop, from choosing a location to using the shop safely and comfortably. With advice on workbenches, accessories, and shop storage, *Workshops* is the perfect companion whether you're starting from scratch or upgrading the shop you have.

- **Organize your shop with smart carts**
- **Heat and cool your shop**
- **Build a small, sturdy workbench**
- **Explore amazing woodshops in unexpected places**
- **Bring your shop into the house**

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