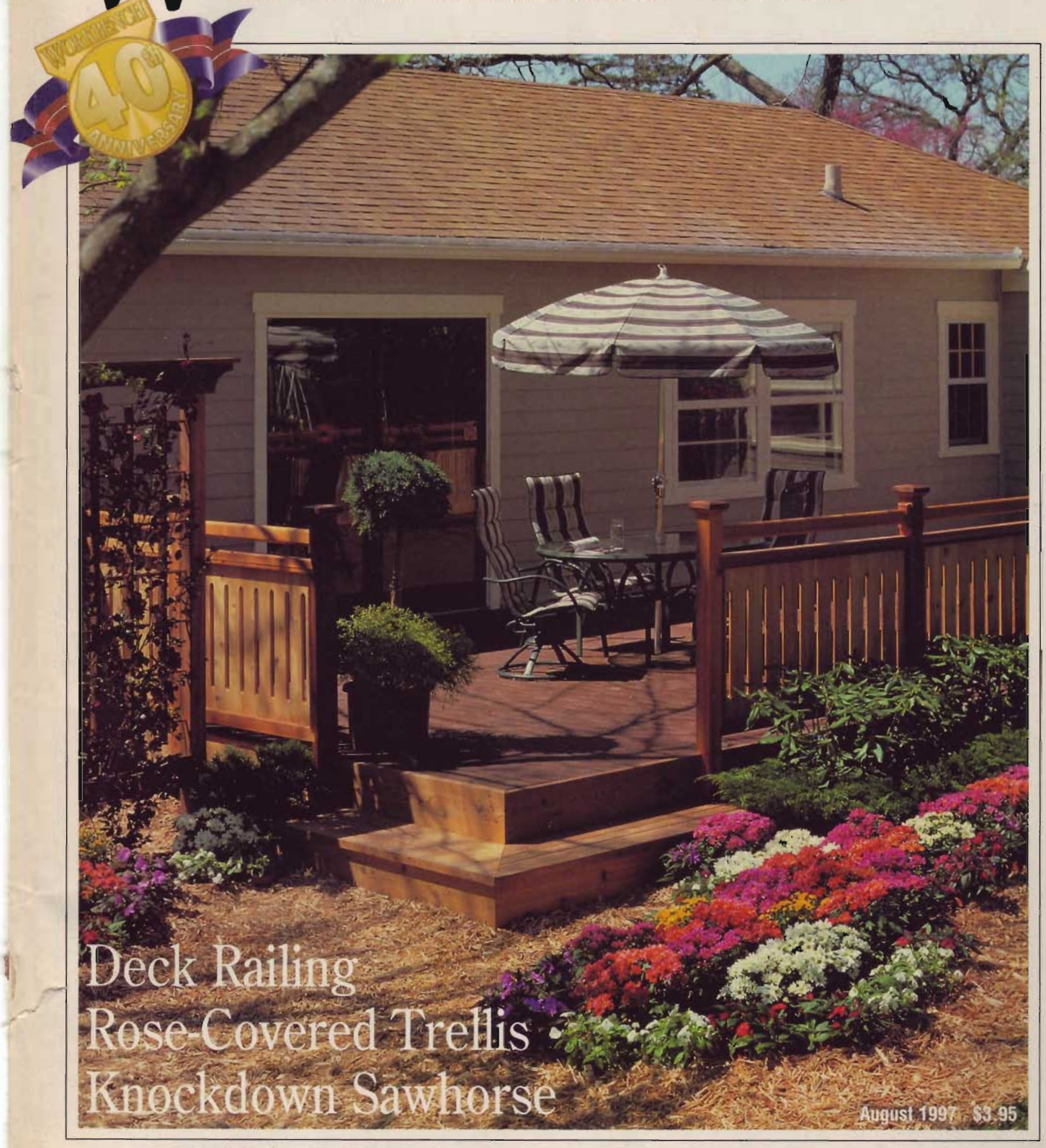
OUTDOOR ISSUE

OUTDOOR GLUES ■ WINDOW REPLACEMENT ■ CRAFTSMAN CRIB

WORKBENCH®

THE ORIGINAL HOME WOODWORKING AND IMPROVEMENT MAGAZINE



Deck Railing
Rose-Covered Trellis
Knockdown Sawhorse

August 1997 $3.95

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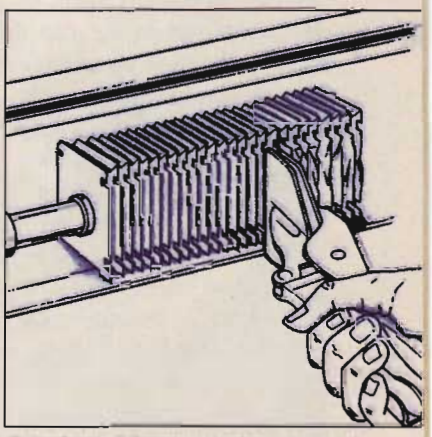

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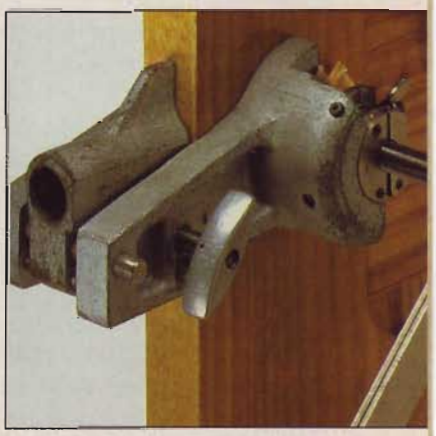

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It's Summer!

Don't you just love strapping on your tool belt? It gives me such a different feeling from being in my shop. My attention turns from precise joinery and carefully selected hardwoods, to rough toenailing and 2x lumber.

I guess it's a kind of confidence builder. The heft of the hammer and a pouch full of nails fill me with purpose, like I could create new buildings, even cities if I wanted to. Or at least a deck or backyard fence.

Don't get me wrong, I love the woodshop, too. But being out in the sun driving nails and cutting up framing lumber is just another kind of fun.

This Issue

Speaking of having fun with a tool belt, this issue brings you three projects that take full advantage of the warm summer weather.

First, we've breathed new life into a pretty drab old deck at the *Workbench* house. By adding a custom railing, this platform has been transformed from an eyesore into an inviting rest area (page 16). This project also offers a unique approach — most of the time inadequate decks are just torn down and a new one is constructed. That's expensive, wasteful, and often unnecessary. Our preference was to work with what we've got — just like most of you have to do with your home improvement projects.

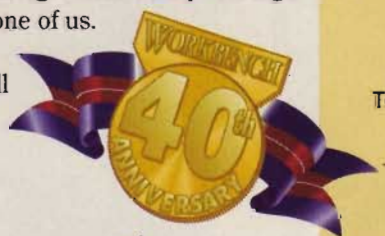
To complement the refurbished deck, we built a decorative trellis (page 28). It's a great weekend project that can be built using just portable tools. I recommend getting all the materials ready during the week, then rising early Saturday morning to start building. You'll have a completed trellis by suppertime. And if you're really ambitious, you may want to make yourself a pair of sawhorses (page 46) before you get to the trellis.

Our third outdoor project addresses a chore every owner of an older home faces eventually — replacing a window (page 22). New windows can be ordered to fit your old window openings, and they're a cinch to install. They also offer vastly improved insulation qualities, and are much easier to operate.

The Cavalry Arrives

Preparing the last few issues of *Workbench* has been a terrific experience, but I sure am glad to be getting some help. I have two new faces to introduce. Bill LaHay has joined the editorial staff. He comes to us with an extensive background in woodworking, home improvement, and journalism. Coming on board as Assistant Editor is Dave Stone. Dave was the customer service answer man for *Woodsmith*® and *ShopNotes*® magazines (our sister publications), so he knows his stuff. He also has one black fingernail from a hammer blow it took a few weeks ago. This surely is a sign that he is one of us.

Welcome aboard, Bill and Dave.



Chris Inman, *Editor*

Safety Reminder: Woodworking and home improvement are rewarding hobbies. But there is risk of injury. Use the guards and read the manuals that come with your tools and equipment. And if you're uncertain about a technique, find an alternative with which you are more comfortable. Please take safety seriously.

WORKBENCH

VOLUME 53 NUMBER 4

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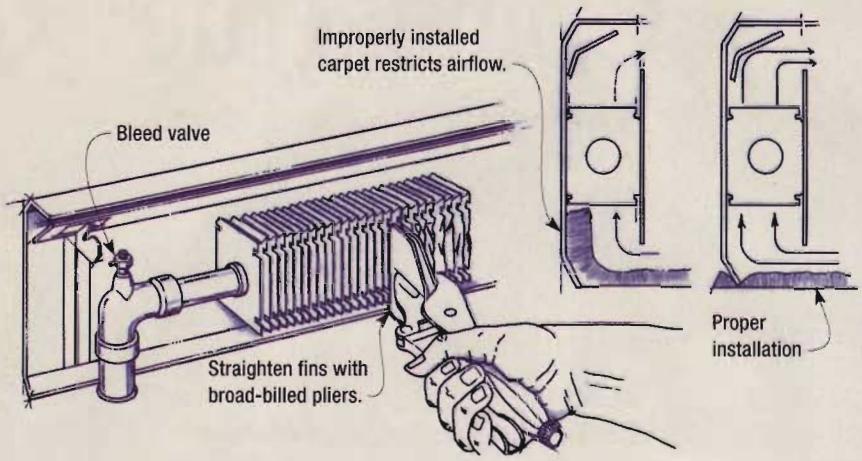
WORKBENCH (ISSN 0043-8057) is published bimonthly (Jan., Mar., May, July, Sept., Nov.) by August Home Publishing Company, 2200 Grand Ave., Des Moines, Iowa, 50312. *Workbench* is a registered trademark of August Home Publishing.

Subscription rates: Single copy, $3.95. One year subscription (6 issues), $15.95. Canadian/Foreign, add $6.00 per year. Periodicals postage paid at Des Moines, IA and at additional offices. **Postmaster:** Send address changes to *Workbench*, PO Box 37272, Boone, IA 50037-0272.

Printed in U.S.A.

Questions & Answers

Carpet May Affect Baseboard Heating



Q *We had wall-to-wall carpeting installed in our family room to make it warmer, but the room actually seemed colder this past winter! The hot water baseboard units felt warm, but the heat didn't seem to move. What gives?*

George Keller
Fort Wayne, IN

A There are several things you should check, but the prime suspect is faulty carpet installation. To understand how carpeting can affect heating efficiency, let's look at how your baseboard heater works.

The system relies on convection, the natural movement of air at different temperatures. Put simply, warm air rises, and cool air descends. In a baseboard heater, cool air that enters at floor level is warmed by the fins, then rises through the upper opening.

To operate properly, the air must have a clear path through the system. If the carpet installer simply pushed the carpet into the lower opening of the heater, it could be blocking the air current. Have the installer trim the carpet and tuck it under the bottom of the baseboard heater's back panel.

Excessively dirty or bent convector fins are other problems that can reduce your system's efficiency. Remove the front panel, then use the soft brush attachment on your vacuum to gently clean the fins. Straighten bent fins with broad-billed pliers. Don't overwork the metal — the delicate fins could break.

If these strategies don't work, check the heating system itself to make sure that it is operating properly. If you have air trapped in the system, remove it by slowly unscrewing a bleed valve while the system is running. You may also have a balancing valve in the supply piping that needs to be opened further.

If all of that doesn't work, you may need to raise the baseboard heaters higher on the wall to provide room for the air currents to flow properly. Of course, this is costly and involved, so try the easier steps first.

SHARE YOUR QUESTIONS

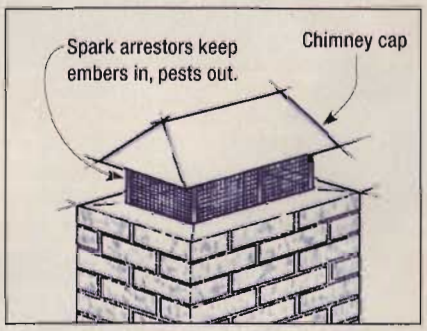
If you have a question about woodworking or home improvement, we'd like to see if we can answer it for you. Just write down your question and mail it to WORKBENCH Q&A, 2200 Grand Ave., Des Moines, IA 50312. Please include your name, address and daytime phone number in case we have any questions for you. If you like, Fax us at (515) 283-2003 or send a message to us at workbench@workbenchmag.com on the internet.

Chimney Caps

Q *Some of my neighbors have installed chimney caps. They look nice, but do they serve a practical purpose or are they strictly decorative?*

Matt Hoglund
Chicago, IL

A Chimney caps cover the top of the flue, and they do give a nice, finished look to a chimney. But their role is more than decorative. Chimney caps keep out rain and snow, and help prevent the wind from blowing down the chimney and stopping the updraft.



Chimney caps are also a good deterrent for birds, who find chimneys ideal for nesting sites. Birds' nests can block the flue, causing smoke or gases to back up into your home.

While keeping things out is the primary job of chimney caps, many also have metal screens or fins in the openings to keep embers in. Called spark arrestors, they stop hot embers that may drift up the flue from escaping and falling onto the roof, where they pose a fire hazard.

Correction:

On page 8 of the June, 1997 *Workbench*, I told Janet Makson how to check the water level in her forced hot water heating system. I said the level is low if the boiler altimeter reads 10 or *more* when the water temperature is 180° or above. I should have said the water level is low if the altimeter reads 10 or *less* when the temperature is 180° or more.

Q & A

Oil vs. Latex

Q Can I use a latex paint over an oil-based primer? How about an oil paint over latex primer? What are the rules?

Robert Hoag
Los Angeles, CA

A According to the folks at the Rohm and Haas Paint Quality Institute, virtually all types of paint will adhere to either type of primer.

Of course, the best advice is to follow all of the manufacturer's recommendations to make sure you get the best quality finish. For example, there are some oil-based paints that tend to crack prematurely if applied over a latex primer.

If you have questions about which types of paint and primer are best suited to your application (or about any other painting question), and you have a computer with internet access, check out the Paint Quality Institute at www.paintquality.com.

Choosing Screen

Q One of my window screens is torn and needs to be replaced. Should I use fiberglass screen again, or would aluminum be more durable?

Todd Sutphin
Madison, WI

A Aluminum or fiberglass screen will do the job, and both types are durable. You could use either, but there a few differences you should consider.

Fiberglass screens don't corrode over time like aluminum, although they tear easier. Also, they give your windows a darker appearance from the outside than aluminum, which you may or may not like. On the other hand, aluminum tends to show impact damage (from hands or hail, for example) more than fiberglass.

The last consideration is purely practical — unless you're changing all of your screens, you'll probably want to match the existing screen fabric.

Get Rid Of Mildew

Q One corner of my house is shaded, and mildew grows on the paint. How do I get rid of it before I repaint, and keep it from coming back?

Bill Barker
Omaha, NE

A You can get rid of mildew using a commercial cleaner available at paint stores, or you can make your own using one part household bleach and three parts cleaning solution, such as some dish detergent mixed with water. (Never mix bleach with an ammonia-based cleaner!) Scrub the area and rinse it with clean water.

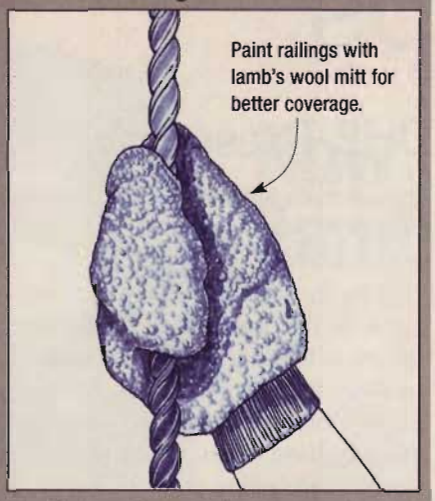
Repaint using a good quality outdoor paint that contains a mildewcide. You may still want to buy mildewcide separately and add it for more protection.

Mildew needs moisture to survive, so shady areas provide an ideal environment. If you can trim back trees or shrubs that are blocking the sun, you'll make it harder for mildew to return.

Proper Primers For A Rusty Rail

Q *I need to repaint a rusty wrought iron railing. Do I have to get all of the rust off first, or just the big flakes?*

Joe Bogatich
Akron, OH



A Removing rust is not fun, no matter how you do it. You can use a hand-held wire brush, chuck a wire wheel in your drill, or even remove the railing and have it sand-blasted. These are all time consuming, and except for sandblasting, may not remove all of the rust. Even if you can't remove it all, there are primers that help keep rust from returning.

According to the technical support people at Rust-Oleum, you should use a primer for clean metal if you remove most of the rust. If you knock off the flakes but not all of the surface rust, spot-prime any that remains with a primer for rusty metal. Then prime the rest with a clean metal primer. If you don't want to go beyond removing the crusty metal, use a rust-inhibiting primer. Apply primer for clean metal to the entire railing after the rust-inhibiting primer dries.

You can use a lamb's wool painting mitt to apply the primer and paint. This method is quicker than brushing, and more economical than spray cans. Dip the mitt into the paint, squeeze out the excess, and wipe it on the surfaces.

Putty Knives

Q *I went to the hardware store to buy a putty knife, and I was surprised by the variety available for such a simple tool. There were stiff blades, flexible blades, and blades of various widths made of plastic and metal. How do I pick the right one for the job?*

Mollie Logsdon
Austin, TX

A You want a flexible knife for applying or removing soft materials (such as wood putty), and a stiff knife to remove hardened materials (such as dried paint). Beyond that, it's a matter of matching the size and quality of the tool to the job at hand.

One job where quality absolutely matters is applying glazing putty to window sashes. The ideal tool for this job has a highly polished flexible blade that cuts away excess putty cleanly. A rough, low quality blade drags on the putty, leaving a torn surface, or even pulling the putty out of the sash.

Shop Tips

Double-Checking A Drill Press Table

I have a small bench top drill press with a table that tilts to accommodate drilling angled holes, which is very handy. Unfortunately, it doesn't have any stops or markings to let me know when I've got the table set back square to the spindle and bit.

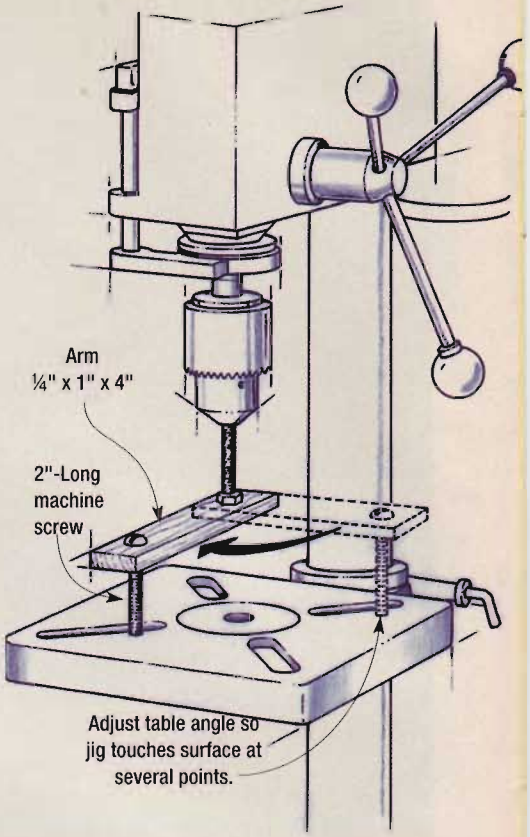
I've seen techniques using a square to set the table perpendicular to the drill press column. But I figured it was more important that the table be perpendicular with a bit, so I made a simple jig I could insert in the chuck to set the table correctly.

The jig took me no more than five minutes to put together. It's just a narrow piece of 1/4"-thick scrap wood that I cut about four inches long. I drilled a hole through the face near each end and pushed a 2"-long machine screw through each hole, pointing in opposite directions. Nuts hold the screws snug so they are roughly parallel.

To set the table, I tighten one of the screws in the chuck. Then I raise the drill press table until the screw sticking down from my jig just touches the table surface at one corner. I rotate the chuck by hand to four or five different positions, and adjust the table angle until the screw just barely touches the table at every point.

This process is easy, but I don't want to go through it every time I change the table angle. So once I have the table set, I drew a thin line with permanent marker where the table meets its mounting arm.

James Walker
Saskatchewan, BC



Bigfoot Ladder

The small feet of a stepladder have an annoying habit. They tend to sink into the ground, particularly if the soil is loose or damp. This can create some unwanted excitement, making a routine outdoor chore into an acrobatic adventure.

Basic physics tells you that the feet of the ladder sink because there are too many pounds of load per square inch of surface area. I realized that I couldn't instantly reduce the number of pounds on the ladder (I've been trying to do that for years). So multiplying the number of square inches of area for the ladder's feet was the only way.

I increased the size of my ladder's footprint by adding some tin can "shoes" to the ladder's legs. Punch or drill holes in each can's side, then use inexpensive bungee cords pulled over the bottom rung or brace to keep the cans in place. This way, you can also quickly remove the shoes when you need to move the ladder indoors.

To make my ladder as unsinkable as possible, I wanted a set of really big shoes. I cobbled them from 3-lb. sized coffee cans.

Cecil Bradford
Hammond, WI

Basketball Bowl

To repair cracks in the plaster walls in my home, I mixed my patching plaster in a plastic bucket. After any leftover plaster dried, I would knock it out of the bucket with a hammer — until I broke the bucket. I decided a flexible container would be better, but I couldn't find one.

So I cut an old, worn out basketball in half, making two bowls with stiff yet flexible sides. The bowls are about the right size to hold one batch of plaster, and when the leftover dries, I just crush the bowl, and all the dried material falls right out.

Jeff Miles
Marion, IA

SHARE YOUR TIPS, JIGS, AND IDEAS

If you have a unique way of doing something, we'd like to hear from you. Just write down your tip and mail it to WORKBENCH Shop Tips, 2200 Grand Ave., Des Moines, IA 50312. Please include your name, address and daytime phone number in case we need to reach you. If you like, Fax us at (515) 283-2003, or e-mail us at workbench@workbenchmag.com on the internet. We'll pay you $50-$150 if we publish your tip.

Use Mineral Spirits To Find Stray Glue

No matter how careful I am while gluing up a project, I always seem to miss glue smears and squeeze-out at joints. These spots are hard to see on the bare wood, but they'll stick out once stain and finish are applied.

To highlight these spots I've learned to use mineral spirits and a bright light. I like mineral spirits because it doesn't raise the grain or discolor the wood, and it evaporates quickly.

Use a rag to spread mineral spirits (I prefer the odorless variety) on the area you want to check. You don't need to soak the wood, just dampen the surface. Any stray glue spots on the wood will start to show.

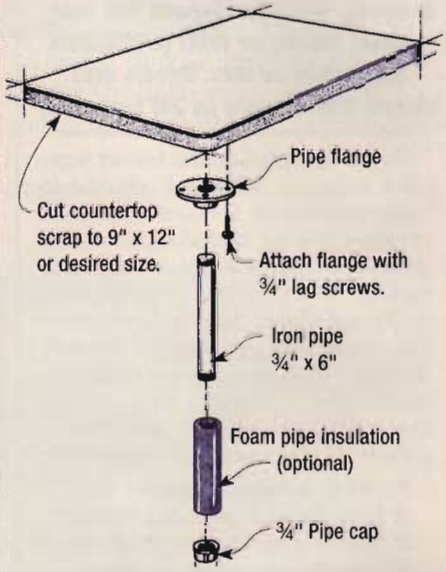
To make the glue more visible, hold a bright light close to the piece, and shine it across the surface. Glue smears reflect the light differently, and show up as dull spots

Mineral spirits also helps highlight scratches, and gives you an idea how your wood will look with clear finish.

Shirley Arnold
Brooklyn, NY

Masonry Hawk

I needed a masonry hawk to do some drywall work, but I couldn't justify the expense of buying one. I started feeling a little sorry for myself, until I figured out how to make one in my shop that would work just as well.



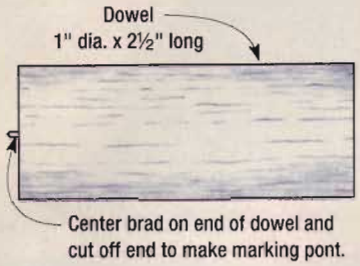
I got a scrap piece of laminated countertop for free at a local cabinet shop. Then I trimmed the scrap piece to a manageable size on my table saw, with the laminated face up to avoid chipping its edges. I made a simple handle from inexpensive pipe fittings I picked up at the hardware store and attached it with short lag screws.

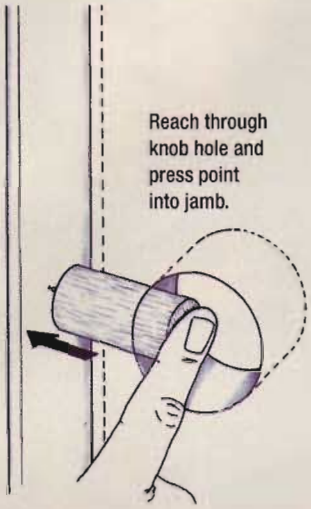
The sharp plastic laminate edge on my homemade hawk cleans my trowel nicely and holds up well. When the edges chip or get worn, I can just trim the top down a bit to expose a fresh edge, or remove the handle assembly and add it to a new piece of countertop.

M. Shambourg
Omaha, NE

Drill A Door Jamb

I recently purchased deadbolt locks for all my exterior doors. To be sure that they would work smoothly, I wanted a precision installation.





Each deadbolt lock came with a template to position it on the door, but no similar method for locating the strike plate on the jamb. I was worried about making a measurement error and positioning the hole and strike plate incorrectly. So I came up with a simple tool that perfectly aligns the hole in the jamb with the latch.

I centered a brad in one end of a short dowel the same diameter as the latch hole (1" in my case), then cut off the head, leaving a sharp point.

After drilling the holes in the doors, I put the dowel in the latch hole with the brad facing out. Then I closed the door tight, reached in through the knob hole, and pushed the dowel against the jamb. The brad left an impression showing me exactly where to center the strike plate.

Brad Hemmingsen
Denver, CO

Use Plane Shavings To Tighten Tenons

Some of my dining room chairs had become wobbly, so I had to re-glue the joints. I found some of the tenons on the rungs and their matching holes had worn, causing the rungs to fit loosely. I knew no matter how much wood glue I used, the chairs wouldn't hold for long.

To make the tenons fit tight again, I increased their diameter by wrapping them with thin shavings I planed off of some scrap wood. I spread glue on the rung's tenon and wrapped a layer or two of the shavings around it. Before the glue on the rung dried completely, I spread glue in the hole in the leg, and inserted the now tight-fitting rung.

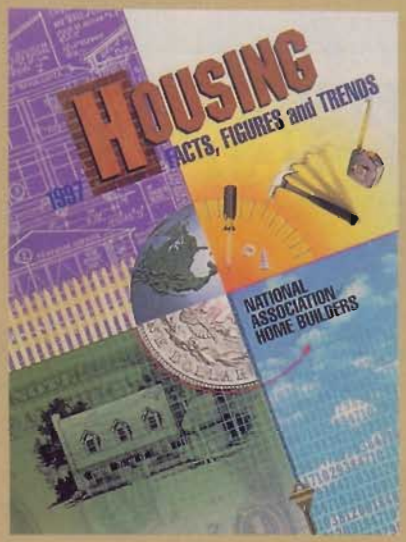
Lance Bergeman
Olympia, WA

Over The Fence

Builders' Group Tracks Home Facts

The National Association of Home Builders (NAHB) collected a wealth of data for the book *1997 Housing Facts, Figures and Trends.*

The report shows that updating and remodeling kitchens and baths adds the most value to your home. For example, a major kitchen redesign/remodel (involving replacement of all cabinets, countertops, plumbing fixtures, floor, and the addition of custom lighting, and a built-in microwave) carries a price tag estimated at $21,262. In some markets, you'll recover all of that — plus some — if you sell within the first year after completion. Later, you can recoup $19,000 (about 90% of the project cost). And if you do some of the work yourself, you'll conserve cash and may even be able to pocket a profit.



Other popular projects and their recovery value are: adding a master suite, 84%; bathroom remodel, 77%; window replacement, 74%; siding replacement, 73%; deck addition, 72%; and home office, 67%.

These and other remodeling projects will likely remain popular in the future, because nearly 30% of the nation's housing stock was built before 1940. In 1995, Americans spent an estimated $42.3 billion on home maintenance, and an additional $70.3 billion on improvements. Together, these account for $112.6 billion invested into existing housing.

New housing is also evolving to fit changing needs and desires. Today's typical new single-family home contains nearly 2,100 square feet of living area, an increase of almost 500 square feet from homes built 20 years ago. And more homes have a longer list of amenities such as fireplaces, two-car garages, and central air conditioning.

But while houses are getting bigger, the number of people per household is decreasing. In 1940, the typical household size was 3.67 people. By 1970, this had dipped to 3.14 persons, and the estimate for 1995 showed 2.62 people per household.

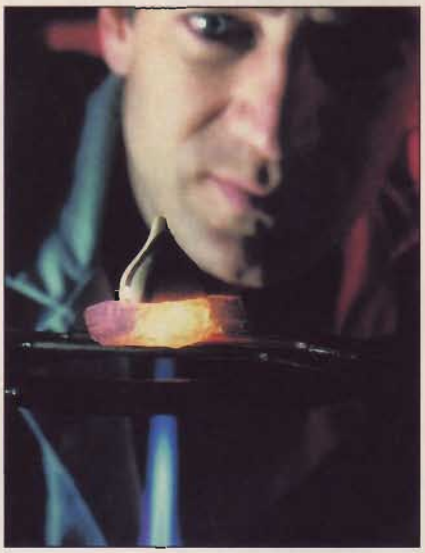
Over the last 20 years, the cost of the median-priced home has skyrocketed from $44,200 to $136,600. That made the corresponding monthly payment leap from $367 in 1976 to $1,033 in 1996. To afford that median home, a family in 1976 needed an income of $15,745; but it is now $44,267. This has created an affordability gap — 20 years ago, 44.8% of families could meet the income guidelines; today, it is only 36.3%.

Yet in the face of all these changes, the overall percentage of home ownership has remained remarkably stable. Since 1974, the overall rate has remained in a narrow range between 63.8% to 65.6%.

You can get a free copy of *1997 Housing Facts, Figures and Trends* by calling NAHB at (202) 822-0253, or by visiting the Association's web site at www.nahb.com.

NASA's Clear Goal

NASA scientists are working with a material called Aerogel that could one day be used to make household windows with outstanding insulating properties. A 1"-thick Aerogel window would have the same R-value as 15 panes of glass with trapped air.



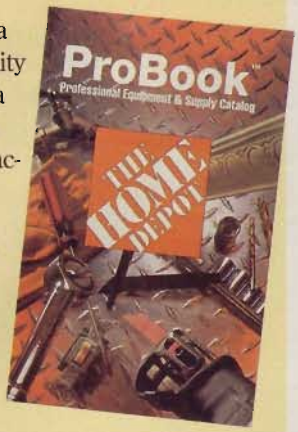
At only three times the density of air, Aerogel is the world's lightest solid — a block the size of an adult man weighs only one pound. But the product's nickname of "frozen smoke" gives you a clue to the shortcoming that prevents you from currently finding Aerogel windows at your home center. When manufactured on earth, Aerogel has a hazy appearance.

NASA's preliminary experiments with manufacturing Aerogel in a microgravity environment have been encouraging. The next major test will be conducted aboard the Space Shuttle Discovery, scheduled for launch in January, 1998.

No one is sure why Aerogel made on the ground has a smoky look. But NASA scientists hope that their experiments will provide information that will clear up the subject.

NASA would then report those results to American industry for earth-based manufacturing.

Phone Home



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Adding A Deck Rail

Backyard decks have so much going for them. They're relatively easy to build, and a great place to get together with your family and friends. They can also make small houses seem larger by connecting them to the world outside.

That decks are so popular is no mystery, but I've never figured out why so many are designed as afterthoughts. I've seen Tudor-style homes, Cape Cods, brick ranches — you name it — fitted with nondescript "kit" decks that look as if they were genetically cloned by a Scottish research team.

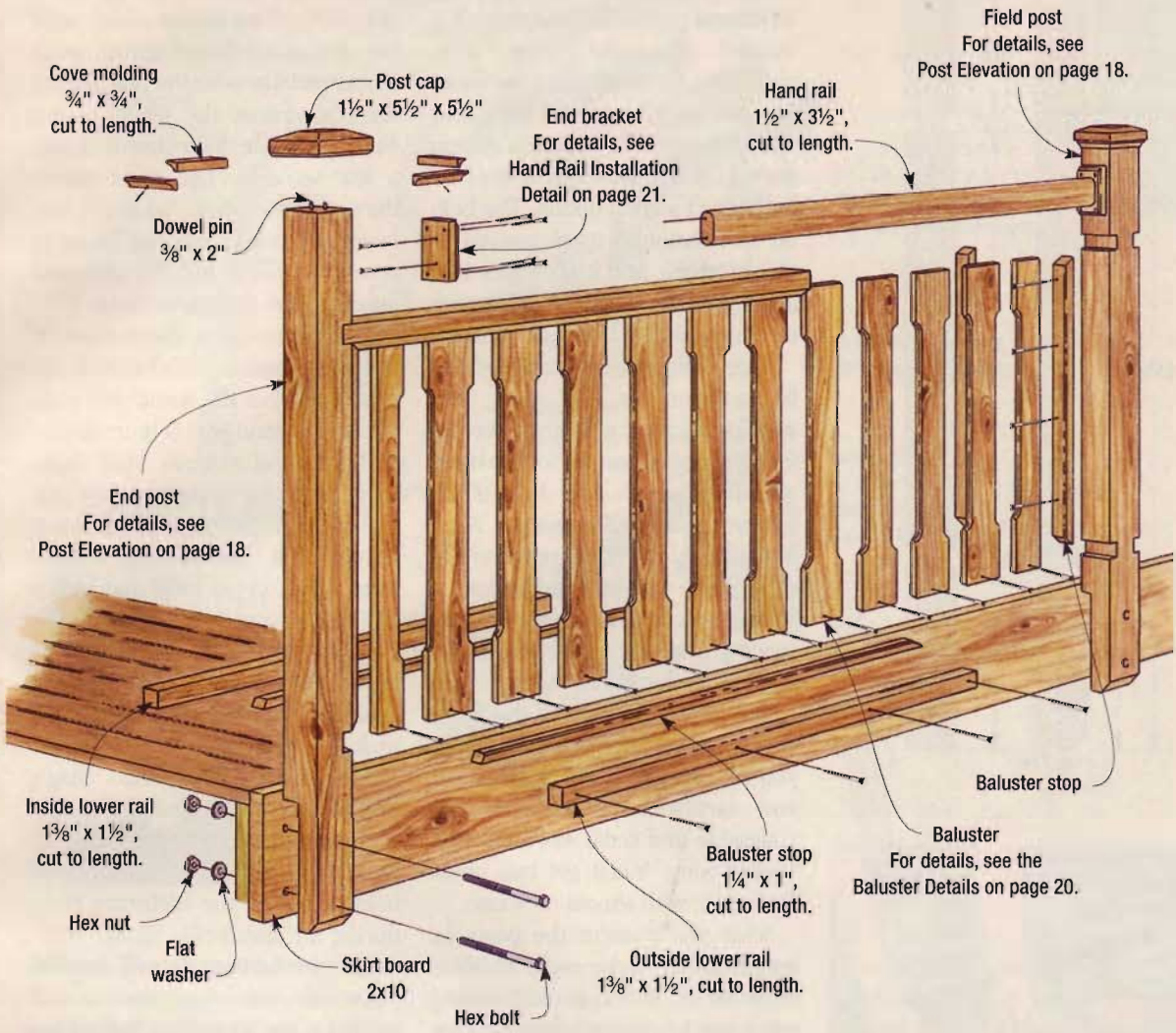
I can't argue with the durability and cost-savings of using pressure-treated lumber for the substructure and decking, but to me the railing always leaves room for something more creative. This was my goal when I tackled the deck on the *Workbench* house, a rectangular, single-level platform with no distinguishing feature except room enough to stage a halftime show for the Super Bowl. Adding a custom railing let me improve the deck I had rather than scrap it and start over, which would have been a lot pricier.

The platform's low height didn't require a railing, but without one it seemed to drop off into space like the deck of an aircraft carrier.

After a lot of thought, I decided a distinctive cedar railing would make the deck friendlier and tie it more to the look of the house.

Once I had the railing's design sorted out, I set aside some time to install new 2x10 cedar skirt boards around the perimeter of the deck (see the Deck Rail Construction View). This upgrade improved the look of the deck and let me straighten out the irregularities in

Deck Rail Construction View



the existing frame. Since the early spring weather was unpredictable, I grabbed a warm clear day to get this done, then went back into the shop to start making all the railing components.

I should add that a dust collection system, or excellent shop ventilation, is a must for this project. Western red cedar smells great, but the dust is toxic and produces allergic reactions in some people. What's worse, the sensitivity can increase with each exposure until you can't work the wood at all.

Milling Stock To Size

Compared to the precut 2x2's most lumberyards sell for use as deck rail balusters, the components for this railing design take a lot of time to prepare. But with the beauty and individuality of the custom look, there's no comparison.

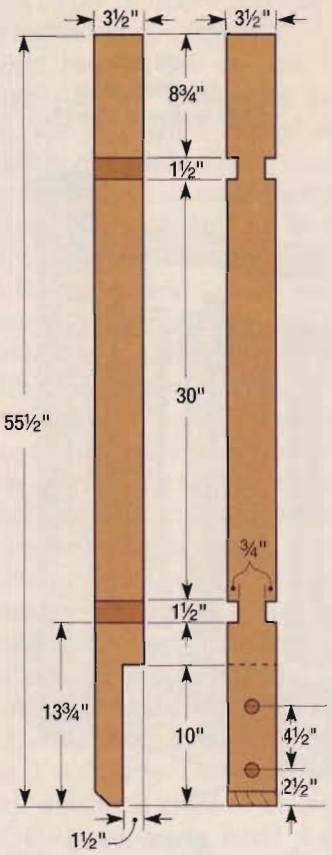
Because I wanted a good fit between all the different parts, I chose dimensions that let me mill the stock down to consistent sizes and true up the edges. The stock for the posts and rails was a little oversize, so I managed to get the thicknesses and widths I needed.

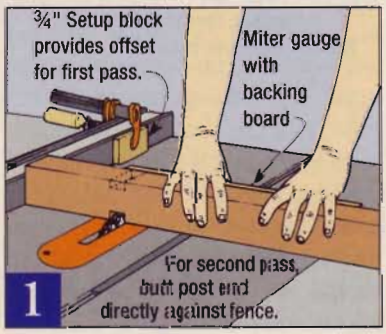
The 1x cedar stock you buy for the balusters is likely to be about $\frac{7}{8}$" thick, with one smooth face and the other rough-sawn. Mill the rough face off to get $\frac{3}{4}$" stock.

The dimensions here really aren't critical, as long as there's consistency among the parts that fit together. Do pay attention, though, to how wet the lumber is. If you feel wet sawdust coming out of the cut, set the boards aside in a vented stack and let them dry out for at least a couple of weeks (see bottom photo on preceding page). This method, called "stickering," uses small wooden spacers that allow air flow between the boards so they'll dry more uniformly.

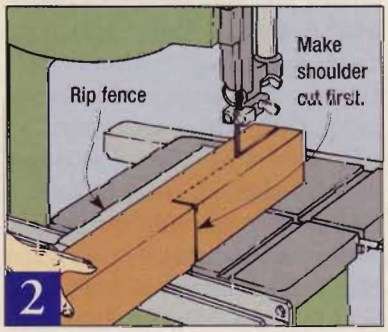
If you're wondering why I'd fuss over wood that's going to be outside anyway, that's a fair question. The reason is that as it dries, wood can shrink a lot in thickness and width (across the grain), but none in length (along the grain). The way this railing fits together, gaps would open up in the joints.

Post Elevations





Two passes over a ¾" dado blade will cut each 1½"-wide dado on the posts. Use the rip fence and the setup block as end stops.



A radial arm saw, table saw, or band saw can cut the shoulder on the post notches, but use a band saw for the rip cut.

Start With the Posts

Because the posts aren't just a design element but also the key structural part of my rail system, I wanted to make them first. Normally, I'd try to build the posts into the deck structure itself. But with this project I was retrofitting the railing onto an existing deck so that wasn't a great option. The bolt-on installation I used instead is plenty strong, and it allows for easier replacement if a post suffers rot or other damage later on.

This railing design may have to be modified for your deck, and your post layout is likely to be different. I just measured for the overall railing length and divided the distance into equal segments. Keep in mind that the lower rails have to support the weight of the balusters, so the practical limit for the post spacing is about 4 feet unless you beef up the lower rail stock.

The finished length of the posts is just under 5 feet, which means you'll have a pile of 3-ft. remnants if you start with 8-ft. timbers. Try instead to find cedar 4x4's that are 10 feet long. You'll get two posts from each with almost no waste.

After you crosscut the posts to length, mark each one to indicate its location on the deck. I added some quick layout markings at this point, to ensure that the notches and rail dadoes end up on the correct faces. While you're marking, keep in mind that end posts get dadoes on one side only.

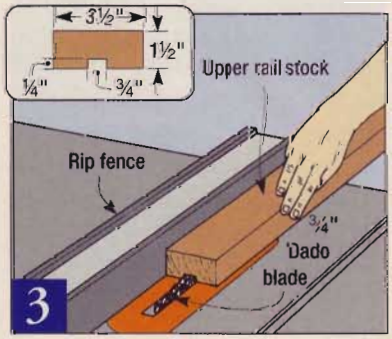
A simple table saw setup will help you cut the rail dadoes quickly. I installed a ¾" stack dado, then clamped a short ¾"-thick setup block at the front of the rip fence (Figure 1). Two passes — one with the post end indexed off the setup block, and one with the post butted directly against the fence — cut each 1½"-wide dado cleanly in just a few seconds. The same procedure works for both the upper and lower rail dadoes, but you'll have to reset the fence for the different spacing from the posts' ends.

For the notch at the bottom of the posts, make the shoulder cut first, then clear the waste with a rip cut on the band saw (Figure 2).

Before you remove your dado blade from the table saw, you can use the setup for two other procedures. First, find a scrap 2x6 at least a foot or so long and mill a 5½"-wide recess on one face (see the Bevel Jig Detail). When you get around to cutting the bevels on the post caps later, this jig will help you make the cuts safely.

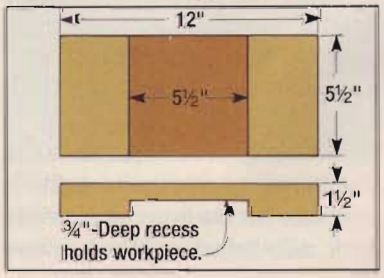
Next, lower the dado blade height to ¼" and mill a center groove in the underside of the top rails (Figure 3). This groove will help you align the balusters later, during the installation phase.

The remaining details on the posts are the counterbores and holes for the mounting bolts, plus two indexing holes for mounting the post caps. Drilling the end of a long workpiece such as a post is either awkward or impossible on most drill presses, but boring these dowel holes freehand is risky. Since they have to match a pair of holes in the cap, accurate placement is a must. The solution was a simple two-sided jig that I made from a piece of ¾" particleboard



With the dado height set to ¼", mill a groove in the underside of the top rail. This groove will help align the balusters later.

Bevel Jig Detail



and some 1/4" hardboard (see the Cap Jig Detail). I cut the particleboard block 5 1/2" square — the same size as the post caps — and attached hardboard cleats to the sides so the cap would nest snugly in place. On the bottom face of the jig, I built up a hardboard rim to create a shallow 3 1/2"-square pocket. This pocket fits over the top end of the post. The 3/8"-diameter holes, which should be bored on a drill press if possible, serve as a guide for hand-drilling both the post and the cap (Figures 4 and 5).

Making the Post Caps

Select some flat 2x6 cedar stock for the post caps and cut a 5 1/2" square piece for each post. After you drill the dowel alignment holes, grab the bevel jig you made earlier and head for the table saw.

To cut the bevels on the caps, tilt the blade away from the rip fence 15°, leaving room for the bevel jig and the workpiece (Figure 6). After you insert a post cap into the jig, the entire assembly can slide along the rip fence, keeping the cap steady and allowing your hands to stay clear of the blade. Rotate the cap a quarter-turn for each pass until every edge is beveled.

I also routed a small chamfer on the underside of each cap. Like most small workpieces, the caps are easier to machine on a router table rather than freehand.

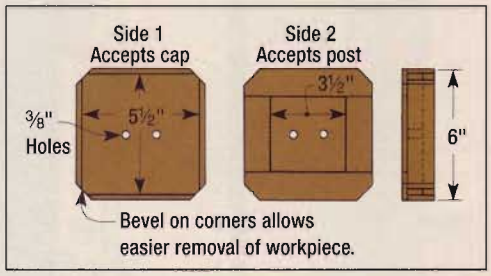
Once you've sanded the saw marks off the caps, they can be glued to the posts. I used polyurethane glue to both set the dowels and to attach the caps and posts. These are awkward assemblies to clamp, so I just stood them on end upside-down and let the weight of each post provide the holding power while the glue set. Gravity is one of the few shop tools you get for free, so I figured I might as well use it! It also came in handy for attaching the small cove molding (underneath the caps), which I mitered, then glued and nailed in place while the posts were still upended on the shop floor.

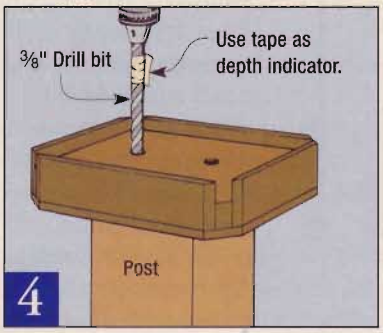
Routing the Rails

While the glue cures on the post assemblies, you can prepare stock for the handrails. At this stage the lumber should already be milled to thickness and width, but remember to leave the lengths rough until the installation — you'll need to custom fit each handrail.

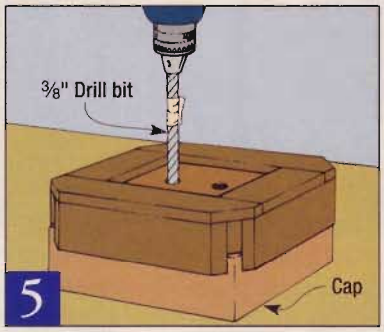
I wanted the handrail to be inviting to the touch, and to me that meant a rounded contour that would be both comfortable to grip and resistant to splintering at the edges. I set up a large round-over bit in my router table (see the Handrail Detail). The cutter's 3/4" radius made for nice half-round edges both top and bottom (Figure 7). You have to be careful here so the bearing overlap on the second pass doesn't leave a ridge along the center of the edges. To get around this, you can set up your router table fence flush with the bearing on the bit like I did, or just use a 1/2" or smaller radius bit that will leave a flat area along the center of each edge.

Cap Jig Detail



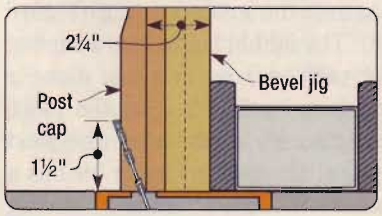


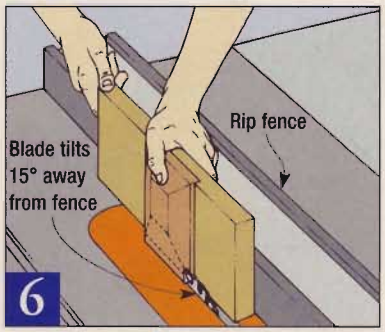
The guide holes in the drilling jig keep the bit aligned and the spacing accurate. A shallow pocket on one side nests over the post end.



The same jig reverses for drilling the dowel alignment holes in the post caps. A hardboard rim holds the workpiece captive.

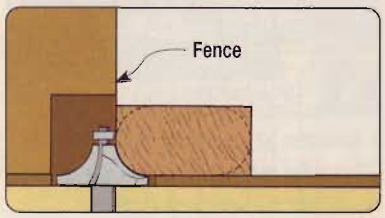
Post Cap Detail

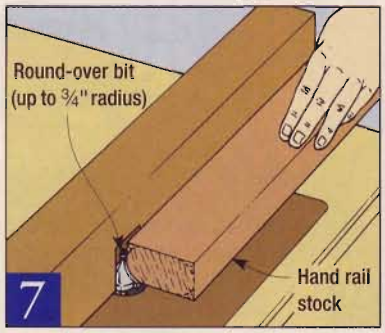




The bevel-cutting jig holds the cap in place and keeps your fingers away from the blade. Tilt the blade away from the fence.

Handrail Detail





Use a large round-over bit to shape the handrail edges. A router table setup will save time and allow use of a larger bit.

Shaping the Balusters

Because of the number of pieces involved, cutting the balusters and routing them to shape is the marathon phase of this project, especially if you've got a long railing to build. It was mid-afternoon by the time I had all the blanks milled and cut to length (see the Baluster Detail), so I decided to postpone the shaping work until the next morning, when I was fresh. Long repetitive work sessions really scrub the fun right out of my woodworking, and they also invite mistakes and accidents.

I used the time off productively, though, exploring designs for deck furniture I can build later.

The next morning I got back into my production mode to start routing the balusters. Just like the spacing between the posts, you can modify the baluster shape to suit your taste. My first designs had a lot more curves built into them, but I simplified the final one to blend with the look of the *Workbench* house.

It took 95 individual balusters to make the railing on my deck, so rather than clamp and freehand rout each piece, I used a jig and a router table (see the Baluster Jig). A flush-trim bit shaped the cedar while the hardboard template rode against the guide bearing (Figure 8). The jig holds the board captive at each end, so you can make a pass on each side, pop the piece out quickly, and install the next piece. (If your trimming bit has a shank-mounted bearing, simply invert the assembly so the jig is below the workpiece.)

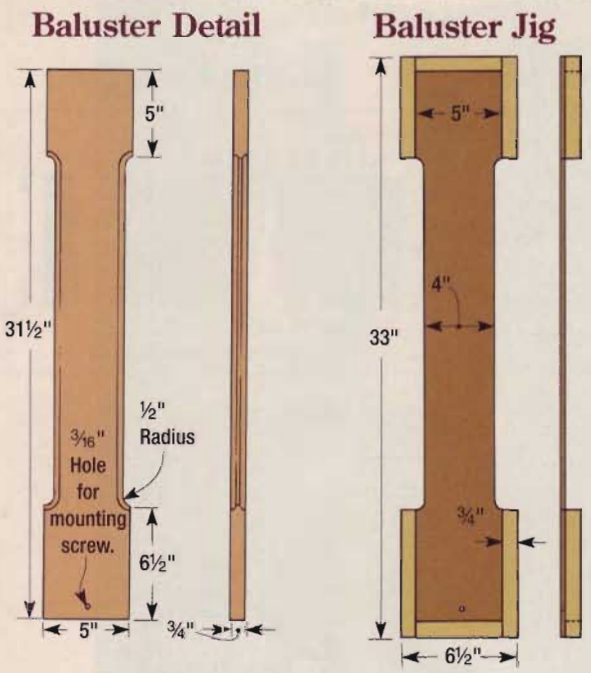
After shaping both edges of each baluster, you can also rout the decorative edge detail (Figure 9). I used a 1/4" cove bit and, though it added a little more time, I used the jig again because the indexing cleats prevent tearout at the edges. After the shaping is done, drill the holes for the mounting screws.

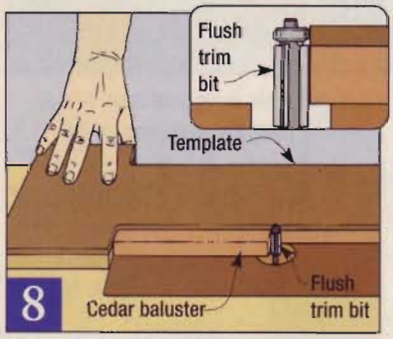
Now just rip the stock for the baluster stop molding and rout a chamfer along one edge. Leave the molding in rough lengths for now. With that done, you can gather your materials on the deck and start putting it all together.

Plumb the Posts First

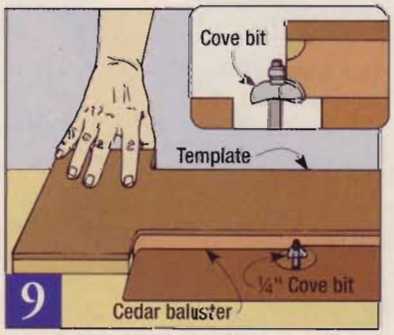
For the installation, use the same sequence that worked for making all the parts. I had already measured for the railing layout, so I clamped each post in place (a few needed shimming to stay plumb). I used the two pre-drilled holes near the bottom of each post as a guide to bore through the deck skirt for the mounting bolts (Figure 10).

If you have an end post that attaches directly to the house, you can cut away the siding and place the post in the recess, or leave the siding intact and scribe and notch the post to nest directly against it. In either case, caulk the joint after securing the post with some long deck or lag screws. You can also fasten a couple of tapered cleats to the siding and anchor the post to those — a solution that allows air flow and leaves the siding intact.

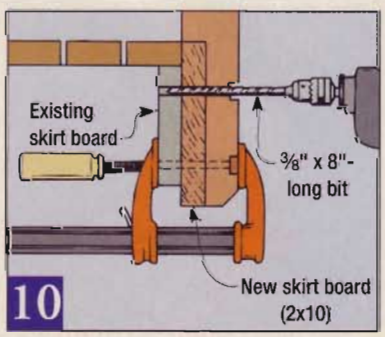




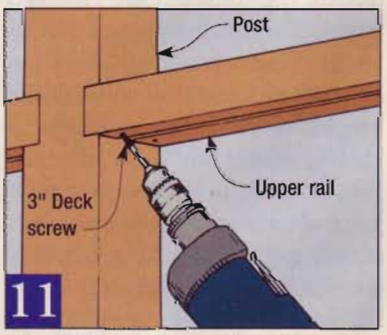
A flush-trim bit, guided by the template jig, will trim the balusters to shape. Cleats on the jig hold the workpiece in place.



Switch to a cove bit for routing the decorative edges on the balusters. The jig isn't necessary, but it helps prevent tearout.



To install the mounting bolts, clamp each post in place and drill through the skirt boards. Check each post for plumb.



After you trim the upper rails to length and drill angled pilot holes near the ends, glue and screw them to the posts.

You're likely to have slight variations in the post spacing, no matter how careful you are. Having left the rails and the baluster stop molding a little long pays off here, allowing you to trim them to fit for each section of railing. The inside lower rail goes in first, then the 2x4 top rail, both glued with polyurethane adhesive and fastened from underneath with 3" deck screws (Figure 11).

At this stage you can start installing the balusters. For this project, placing the first baluster in the center and building outward to each post worked best. I could then compensate for spacing differences by ripping the end balusters to fit.

The groove in the underside of the top rail really earns its keep during this part of the installation. It automatically aligns the balusters as you fit them in place, so all you have to do is drive a single screw at the bottom of each one (Figure 12).

I recommend using a 16d nail as a spacer between balusters to allow for drainage and air circulation. Years ago I built a deck rail and forgot this feature — an oversight I regretted. The lumber dried unevenly, creating gaps between some boards while others stayed tight. You're better off allowing for the wood movement that's bound to happen, so small differences aren't noticeable and water doesn't get trapped.

As you install the balusters, you'll notice that they're about 1/4" short at the bottom. This is a deliberate offset, intended to help keep water from draining around the rails and wicking up into the end grain of the balusters. After they're all in place, fasten the outside lower rail with 3" deck screws (Figure 13).

The molding I used for trim around the balusters is cosmetic rather than functional. I mitered the ends and fastened each piece with 1 5/8"-long deck screws — no glue — so future repairs or replacement would be easy (Figure 14).

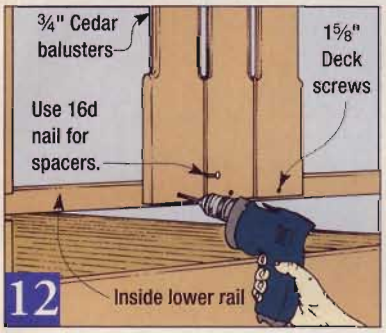
Unless you have a pneumatic finish nailer that will fire corrosion-resistant nails (stainless steel, aluminum, or plastic), I don't recommend nailing the trim in place, because the pounding of a hammer will be a little rough on all the work you just installed.

Finish With the Handrail

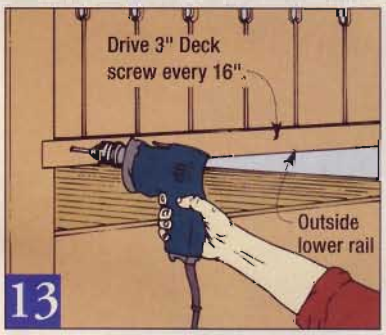
You're almost there! All that remains is the handrail installation. Remnants of the 3/4" stock I used for the balusters worked fine for making some simple end brackets, and I routed the 1/4"-cove detail around the edges.

The simplest method of fitting each handrail is to set a pair of end brackets on edge on a top rail (against a post), then butt the handrail stock against the opposite post and mark it where it overlaps the brackets. Cut the rails to length and use polyurethane glue and two 1 5/8" deck screws to secure each bracket (Figure 15). Then screw the assembly to the posts (see the Handrail Installation Detail).

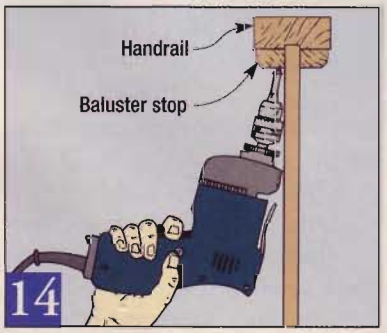
Untreated cedar fares well in all but the most brutal of climates, so the decision to use a finish is up to you. If you want to match paint on the house, a solid-color exterior stain is a good low-maintenance choice. I opted for an exterior penetrating oil from General Finishes. It shows off the rich colors of the cedar but requires minimal maintenance. It may be wishful thinking, but from now on I'd like to spend more time relaxing on my deck than working on it!



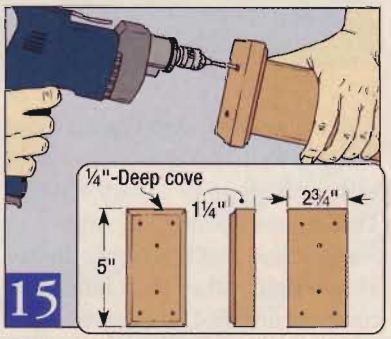
Insert the top of each baluster into the upper rail, then screw the bottom to the lower inside rail. Use 16d nails as spacers.



Once the balusters are installed, you can fasten the outside lower rails in place. To allow for later repairs, don't glue them.

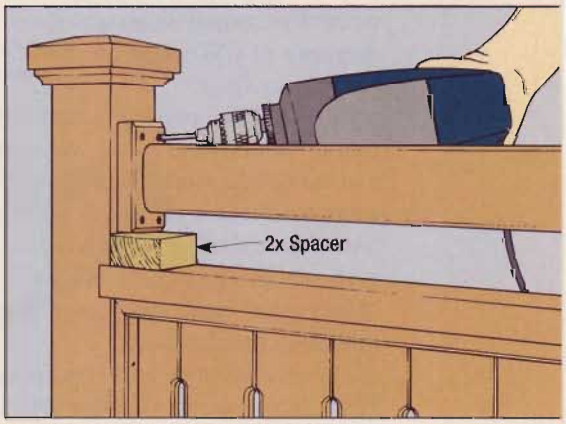


Screwing the baluster stops in place makes it easy to remove them without damage. Air-nailing (no glue) is a second option.



After you cut the handrails to length, use glue and screws to fasten the end brackets. The coved edge matches the balusters.

Handrail Installation Detail



Use a 2x spacer block to position the handrail end brackets, then fasten them to the posts with four 1 5/8" deck screws.

Replacing a Window

I have a friend whose passion for home renovation inspired a theory. His list of projects never ends, he says, because just as he completes one job, the old stuff around it always

looks shabby. Paint the ceiling, and suddenly the light fixture's got to go. Install new kitchen cabinets, and the old vinyl floor now looks like it was trampled to death by the Budweiser Clydesdales.

There are only two solutions to this problem, he tells me — never start remodeling, or never stop. Now that I've renovated some of the *Workbench* house, I know just what he means. Thankfully, I like the work and the results, so I'll keep going.

My latest adventure involved putting in a replacement window. It was surprisingly easy, in part because I didn't have to disturb my new siding or the interior wall.

Ease of installation is one of the key virtues of a replacement window. The old framing, jambs, and casing stay intact while the "performance" parts — the sash, seals, and glazing — get replaced by newer and more efficient components. (For a primer on various window parts and their names, see Anatomy of a Window on the following page.)

The window I needed to replace was a double-hung wood window in a small bathroom. Double-hung windows feature an upper and a lower sash, both of which travel vertically in a wood or metal track. They're the best candidates for this type of replacement.

The new window is a Precision Fit™ Replacement Window from Pella Corp., one of a handful of large manufacturers that offer wood replacement windows. Most companies offer sash replacement kits, but Pella designed this series with "single-unit construction." This means the sash are fitted into a sub-frame that's ready to install as one unit, rather than individual components that you have to put together. I like this approach because it keeps the installation very simple and allows a tilting sash feature for easier cleaning, but the average cost (about $350) is higher than most sash kits.

Replacement windows are custom-fitted items, either made to order or offered in sizes to match most existing windows. If you're doing the installation, check the manufacturer's guidelines for measuring your old windows correctly.

The measuring procedure for the old window may vary with different replacement systems, but the basic dimensions you'll need are the width between the two side jamb faces, and the height between the sill and the head jamb. When installation day arrives, carefully unpack the window, check the dimensions against what you ordered, and read through the manufacturer's instructions *before* you begin.

Out With the Old

For some people, demolition work involves just two tools — a hammer, and a bigger hammer — but a little more finesse is needed here. Remember, you'll need to keep some of the old materials to reuse, so don't ruin them.

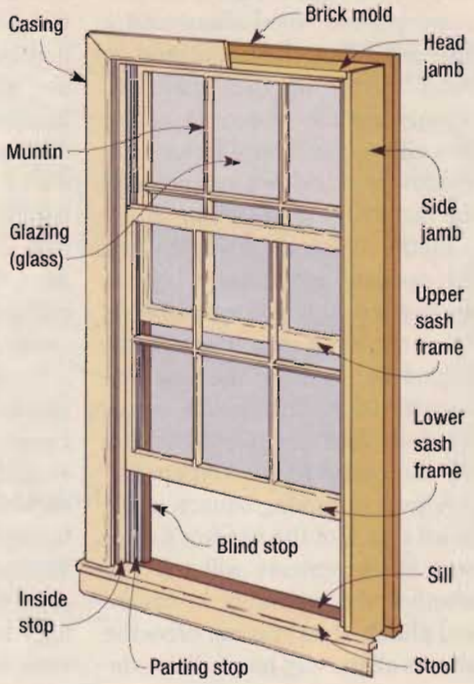
The inside stop molding is part of the track for the lower sash, and it has to come off first (Figure 1). Use a utility knife to score the paint where the stop meets the jamb, then use a small flat bar to pry the molding loose.

Removing the inside stop will free the lower sash unit, but you'll also have to snip the sash cords or springs used to keep it open. Older windows will have cotton cords with iron weights suspended behind the jambs. Some newer models will have a flat steel spring that provides the lift tension. In either case, the lower sash will come free when you cut those connections.

The jambs on older all-wood windows have wooden center strips called parting stops, so named because they separate the upper and lower sash. Pry these out before you try to remove the upper sash. If your window has a metal sash track like mine, use a pair of putty knives as wedges to help pop the upper sash out (Figure 2). Then remove and discard the metal track (Figure 3).

With both sash out, remove any sash balance or pulley hardware that's in your way, and tuck some fiberglass insulation through the holes, filling in behind the jambs.

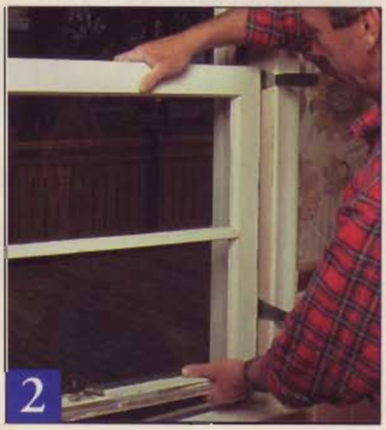
Anatomy Of A Window



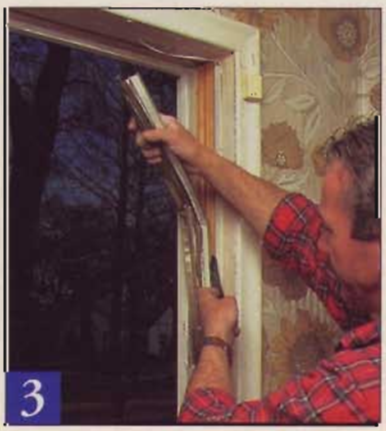
The blind stop, the outermost molding of the sash track, stays intact. It will provide support and a sealing surface for the frame of the replacement window.

Scrape any paint ridges or debris from the blind stop, then do a test fit with the new window. Set the bottom of the window on the existing sill and tilt it up into place. Once you're sure you've got a square fit with a little clearance at the top and sides, remove the window and caulk the inside faces of the blind stop (Figure 4).

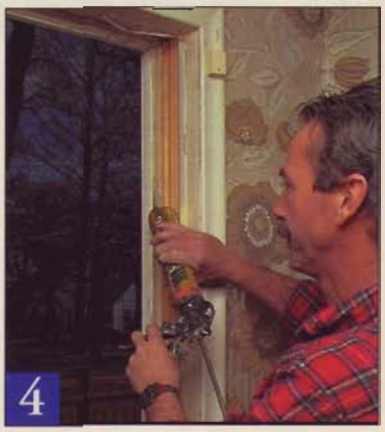
After scoring the paint or finish with a utility knife, use a small flat bar or putty knife to pry the stop molding from the window jamb.



If your old window has a metal jamb liner instead of a parting stop, you may have to wedge the top sash free with putty knives.



Remove and discard the old metal jamb liner. Try to pull it straight out so it doesn't bind or damage the surrounding wood.



After scraping paint ridges and other debris from the inside of the blind stop, apply a bead of caulk to help seal the new window.

In with the New

As you start the installation, have some tapered wood shims and a little more fiberglass insulation on hand. Some of the insulation belongs on the underside of the new sill, so you'll have to turn the window upside down and press fit the material in place (Figure 5).

Fit the replacement window into the opening and press it against the bead of caulk you applied earlier on the blind stop. Place shims behind the jambs of the new window at each installation screw location, then partially drive the top and center screws (Figure 6).

A level, a framing square, and a quick check of the window's diagonal measurements will tell you whether the assembly is square and plumb, then you can drive the screws all the way home. Raise the lower sash before driving the installation screws near the bottom of the jambs. Finally, check that both sash travel freely, then use a putty knife to stuff some insulation between the new window and the old jamb (Figure 7). Avoid cramming the fiberglass tight, or you'll lose the air space that does the actual insulating. Also, don't use expanding foam. It can distort the window frame as it swells, plus it's a lot messier.

Finally, nail the inside stop molding back in place (Figure 8). Here's a tip for reusing the old stop: If any of the finish nails came off with the old molding, use pliers to pull them *through* the wood. Trying to back them out usually pops bigger holes from the molding's face. And in case you're nervous about swinging a hammer next to your new glass, cut some cardboard from the packing box and use it to shield the window. This simple precaution is worth its weight in peace of mind, even if you've got a good hammer arm.

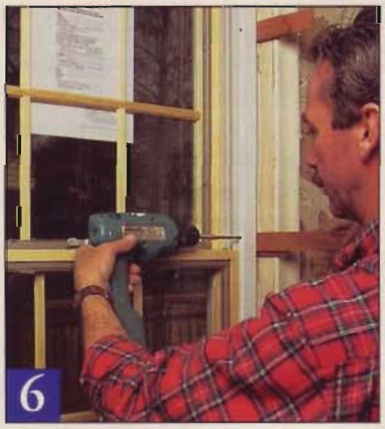
Some putty for the nail holes and a little touch-up paint will wrap up the work on the inside. To ensure a weathertight installation, go outside and run a bead of exterior caulk along the perimeter of the new window (Figure 9).

Sources

Because replacement windows are a customized product, I recommend getting them from a local retailer who can help with questions or take care of any problems that come up during installation. Below is a list of manufacturers that offer wood replacement windows or sash kits through dealers across the country.

- Andersen Windows Inc. (800) 426-4261
- Crestline (800) 552-4111
- Kolbe & Kolbe Millwork Inc. (800) 955-8177
- Loewen Windows (800) 245-2295
- Marvin Windows & Doors (800) 346-5128
- Pella Corporation (800) 847-3552
- Weather Shield (800) 222-2995
- Wenco (800) 877-9482

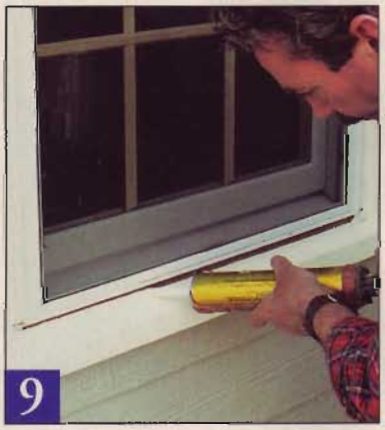
Before you set the new window in place, turn it upside down and tuck a layer of fiberglass insulation under the sill.



Place wood shims between the new window frame and the old jamb (at the screw locations), then partially drive the screws.

Once you've checked the window for square, tighten the screws, then cut the shims off and press in some insulation.

Nail the inside stop molding back in place. If swinging a hammer next to glass makes you nervous, use a cardboard shield.



For a weathertight installation, apply a bead of exterior caulk around the perimeter of the window. The sill may need a filler strip.

Window Plant Tour

I've always tried to figure out how things work, and over the years I've even managed to solve a few mysteries. But some still have me stumped — how do they suspend a cat's-eye in the middle of a marble, anyway?

Every day, I see home improvement products that make me want to know more. A few months ago, Pella Corporation invited me to one of their plants so I could see firsthand how their Precision Fit™ Replacement Windows are made. Their windows sure aren't the simple panes of glass glazed into a wood frame that I grew up with. Needless to say, my visit was an eye-opening experience.

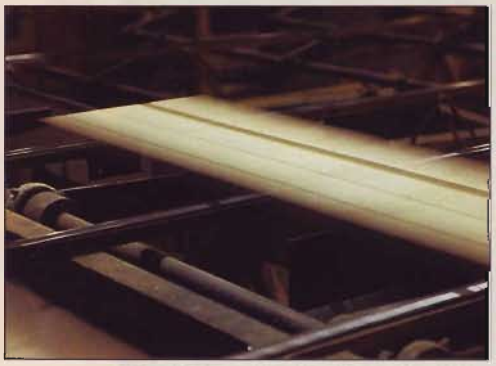
The Lumber Warehouse

The first thing you have to do when you arrive at the Pella plant is drop any illusions you may have about a mom-and-pop operation. This is a big place, and it's just one of three plants in the company.

Once you're inside the first building, which is the lumber warehouse, you'll be struck by a second impression — the powerful scent of pine. Every day the warehouse receives truckloads of wood, mostly Ponderosa and Sugar Pine from the western U.S. The rest is Eastern White Pine, primarily from Canada.

Pella keeps millions of board feet of softwood lumber on hand, and, on average, cuts over 100,000 board feet of that supply daily. With that much cutting going on, you can imagine the volume of sawdust that's produced. No wonder the place smells like pine. By the way, most of that sawdust gets delivered to a processor for recycling into other products.

Conveyors move lumber over a moisture sensor. Boards that meet the standards line up for evaluation at the shadow line station.



Thin wires move under bright lights to cast shadows on each board. This determines the best arrangement of cuts at the ripsaws.

Short stock passes through a finger-jointing machine. After the joints are milled, the stock is glued into longer pieces.

Processing the Lumber

Once a pallet of lumber leaves the warehouse, it goes to the ripline. Those of us with home shops know how much time it can take to figure out how to cut a board to get the most use out of it. At the Pella ripline, these decisions are made in seconds.

The wood is tipped onto a conveyor that houses a moisture sensor. Any boards with excessive moisture content are rejected. Boards that pass inspection move on to the shadow line station, where a keen-eyed operator quickly determines how the wood should be ripped for maximum yield. Using thin wires suspended below a set of bright lights, the operator casts a set of shadows onto each board. The wires are adjusted to represent the optimal cutting layout, then the operator sends that information to the ripsaws via computer. All this takes about 20 to 30 seconds.

After the wood is ripped into narrow pieces, it's bundled into batches and sent to the chopsaws. Each chopsaw operator cuts around all the knots and defects to get completely clear pieces of wood. There are sawing stations dedicated to each of Pella's most commonly used lumber dimensions. To ward off fatigue, each chopsaw operator controls a saw for one hour using his left leg, then turns around to another saw that he controls with his right leg for an hour.

From the chopsaws, the wood is sent to one of three places. Waste pieces go to the "wood hog," where they're chipped for the recycling processor. Pieces long enough for use in a window sash or frame are routed directly to the assembly building. And short pieces are detoured to finger-jointing machines where their ends are milled and coated with glue, and then the segments are clamped together into usable lengths. According to Bob Rote, my tour guide through the Pella plant, finger-jointed wood is stronger and more stable than solid wood, making it well-suited for structural parts hidden in the window frames behind jambs or sill cladding.

Much of the lumber, whether solid or segmented, is cut to order for custom window sizes. Once it's ripped to width, it must pass through molding machines that mill the profiles. From there, the wood is cut to length and sent to a tenoning machine if required.

Glass and Metal

Lots of wood is fine, but a window isn't worth much without glass. So while all the wood is being machined in one area of the plant, the glass for that window is being cut and processed in another area.

More than once, I've tried cutting glass for my own projects, and I readily admit that I do not have a knack for it. But to watch these guys is to see that cutting glass can become as second nature as tying your shoes.

Surprisingly, these large pieces of plate glass are easy to maneuver due to air jets that blow through the cutting tables. Once the glass is positioned, an automated carriage with a glass-scoring tool — similar to the kind you can find at any hardware store — is programmed to score the pieces to size. The operator then snaps the

An operator makes snapping glass appear effortless. Even large pieces cut cleanly after the automated carriage scores a line.

glass. It looks easy, but I know I would still end up with cracks and chips all over the place.

The cut glass travels to an assembly line where the panes are sandwiched around an aluminum frame edged with a thin line of butyl caulk. A press forces the glass panes tight against the frame to seal the sandwich. Then clear argon gas is pumped through two holes in the frame into the gap between the panes. Argon, which is heavier than air, insulates the window, helping to keep hot or cold air from transferring to the inside pane of glass. After capping the holes in the frame, a heavy application of polysulfide is slathered on the outside edges of the sandwich.

Some of the parts for the windows are painted, like the jambs and aluminum cladding. These extrusions are hung from hooks over 25 feet off the ground, then sent through a paint line. The metal is electrically charged to attract primer and paint, creating a very tough bond. After each layer of finish goes on, the pieces travel through a drying oven.

An aluminum frame mounted between the panes of glass creates the gap for the argon gas. Foam inserts prevent light from glancing between the panes on windows with mullions.

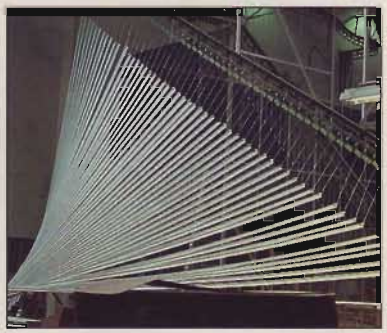
Completing a Window

At this point, all the parts — wood, glass, and metal — end up in the assembly building. With dexterity and speed, assemblers join sash rails and stiles around the double-paned glass, and apply aluminum cladding over the outside sash surfaces. After constructing the window frames (the jambs, sill, and cap), the sash are swung into place and cables are pulled from the frames and secured to the sash (the cables assist the sash's vertical movement). While all this is underway, other assemblers are busy mounting the sash locks and handles.

A thorough inspection results in a few adjustments, then the window is readied for shipment. Bob told me that a Precision Fit™ Replacement Window takes only seven business days to complete, from the time the order is received at the plant to when the window goes on a truck for shipment.

As I left the Pella plant with the window for the *Workbench* house, I could only imagine what exorbitant amount of time I would have spent crafting it by hand. You can say "they don't make them like they used to," but in this case that's a blessing.

A coat of polysulfide applied to the edges of the aluminum frame seals the argon gas in the insulating gap between the panes.



Jambs gracefully exit the paint booth before they're bundled and carted to a sawing station where they will be cut to length.

The jambs mate to wood back-up pieces (mostly finger-jointed material). Adding weather seals and sash hardware is next.

Mounting painted aluminum cladding to the exterior surfaces of the sash protects the wood during foul weather.

Screws join the jambs to the sill and cap, then the sash clip into the frame. The cables fasten to the sash, providing lift.

Rose-Covered Trellis

I once owned a turn-of-the-century Victorian home with a wonderful front porch. From my rocking chair I could say hello to neighbors passing by, and wile away evenings watching kids race after each other during kick-the-can contests. I also enjoyed the climbing rose that covered a wire trellis on the west end of the porch. The plant was always overflowing with lush red blooms and hardy green foliage, which helped screen the porch from harsh late afternoon sunlight.

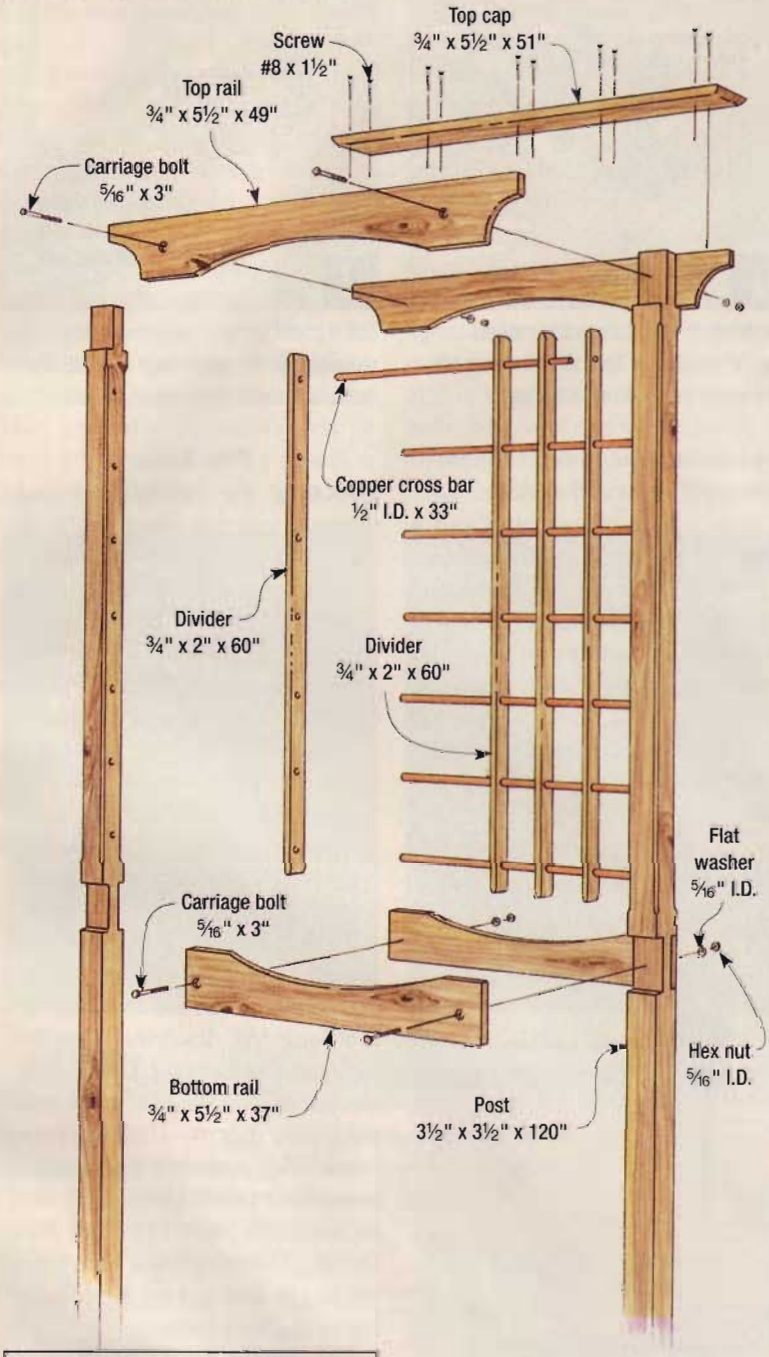
The layout and shading needs of the deck on the *Workbench* house are vastly different from those of my old Victorian. But there are good reasons to build a trellis, even if the beauty of a climbing rose isn't enough. For one thing, I wanted to hide an unsightly air conditioning compressor that's next to the deck. Second, positioning the trellis near the compressor could partially block out the deck from the street.

So with these benefits in mind, I built a free-standing trellis using #2 Western red cedar purchased at my local lumberyard. In addition to the cedar, I came up with the idea of using copper plumbing pipe in the design for the trellis crossbars. In time, the copper will age to a mottled blue-green color, adding an interesting contrast to the oil-finished cedar.

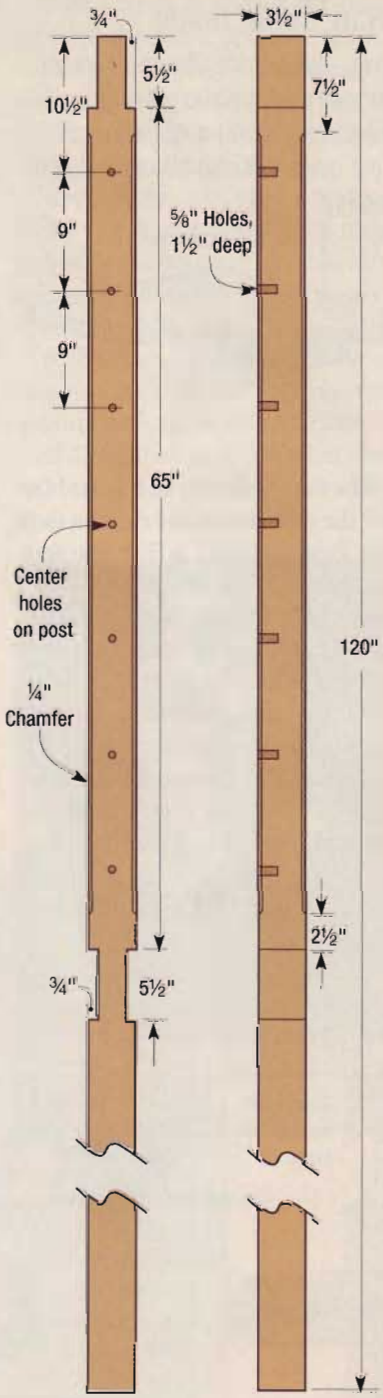
I did run my plans by the folks over at *Garden Gate™* magazine. They loved the idea and assured me that as long as the copper doesn't contact the roots, a plant will do fine on this trellis.

Trellis Construction View

OVERALL SIZE: 5½" x 51" x 120¾"



Post Details



Divider Detail

What You'll Need

Lumber

(2) 10 ft. 4x4 Cedar posts
(2) 8 ft. 1x6 Cedar
(1) 6 ft. 1x6 Cedar
(1) 3 ft. 1x10 Cedar

Hardware

(4) 5/16" x 3" Ext. carriage bolts
(4) 5/16" Exterior flat washers
(4) 5/16" Exterior hex nuts
(7) ½" Dia. x 33" Copper pipe
(8) #8 x 1½" Ext. wood screws

Getting Started

Once I got the green light from the gardening experts, I set out for the building center (see the Trellis Construction View). I selected the straightest ten foot 4x4s I could find, and chose 1x cedar that did not have any large knots — those could weaken the wood.

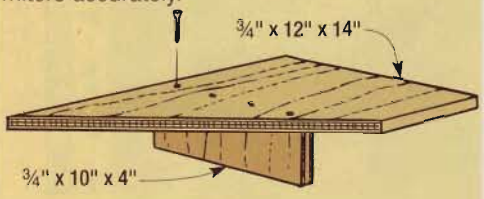
While you're at the building center, pick up a clear exterior finish. You'll need at least a quart to cover the trellis with the recommended three coats.

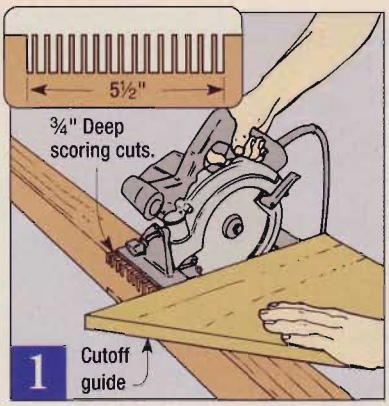
After returning home with your building materials, the first order of business is to get your tools ready. You'll need a circular saw, a hammer and chisel, a saber saw, a hacksaw or tubing cutter, and a drill. Oh, you'll also need a shovel to dig the holes.

PRO TIP

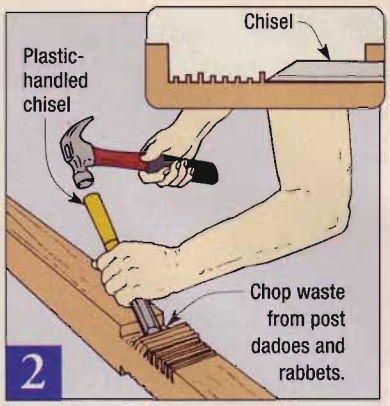
Circular Saw Cutoff Guide

Using a sawing guide made of scrap plywood ensures that your cuts are straight and square to the stock. Cutting a 45° angle at one end of the guide will also allow you to cut miters accurately.





Cut kerfs for the dadoes and rabbets using your circular saw. The closer the cuts are, the easier it is to remove the waste.



Use a chisel to clear away the waste remaining in the joints. Pare down to the saw blade depth to complete the job.

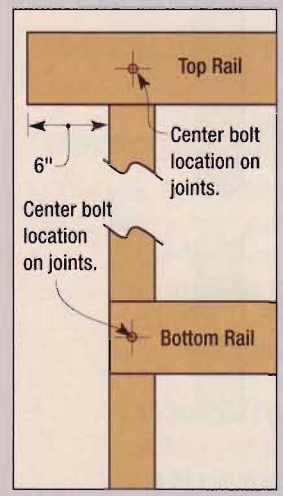
Starting with the 4x4 posts, lay out the rabbets and the dadoes (see the Post Details). Adjust the foot plate on your circular saw for a ¾"-deep cut, and make a pass at each layout line to define the shoulders of each joint (Figure 1). For dead-on square cuts, I recommend building the jig shown in the Pro Tip.

After cutting the shoulders, make a series of scoring cuts in each rabbet and dado. The closer together the cuts are, the easier it will be to remove the rest of the waste.

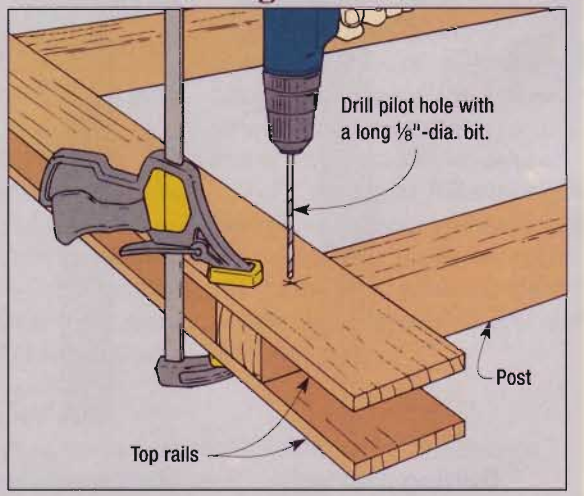
Now grab a sharp chisel and a hammer to knock out the remaining waste (Figure 2). Chop the waste about ⅛" above the cheek of each joint. That way you can avoid having your chisel accidentally dig deep into your wood. Once the bulk of the waste is gone, use your chisel to shave the dadoes and rabbets flat and level.

Drilling The Trellis Bolt Holes

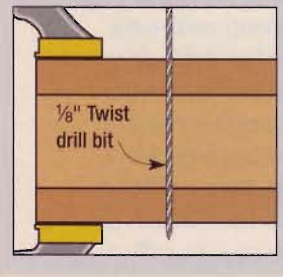
Rail Detail



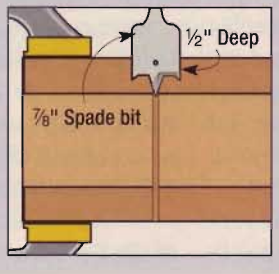
Drilling Detail



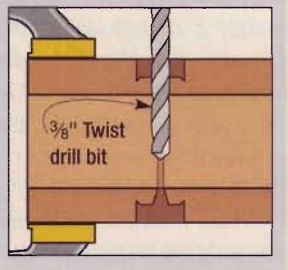
Pilot Hole Detail



Counterbore Detail



Bolt Hole Detail



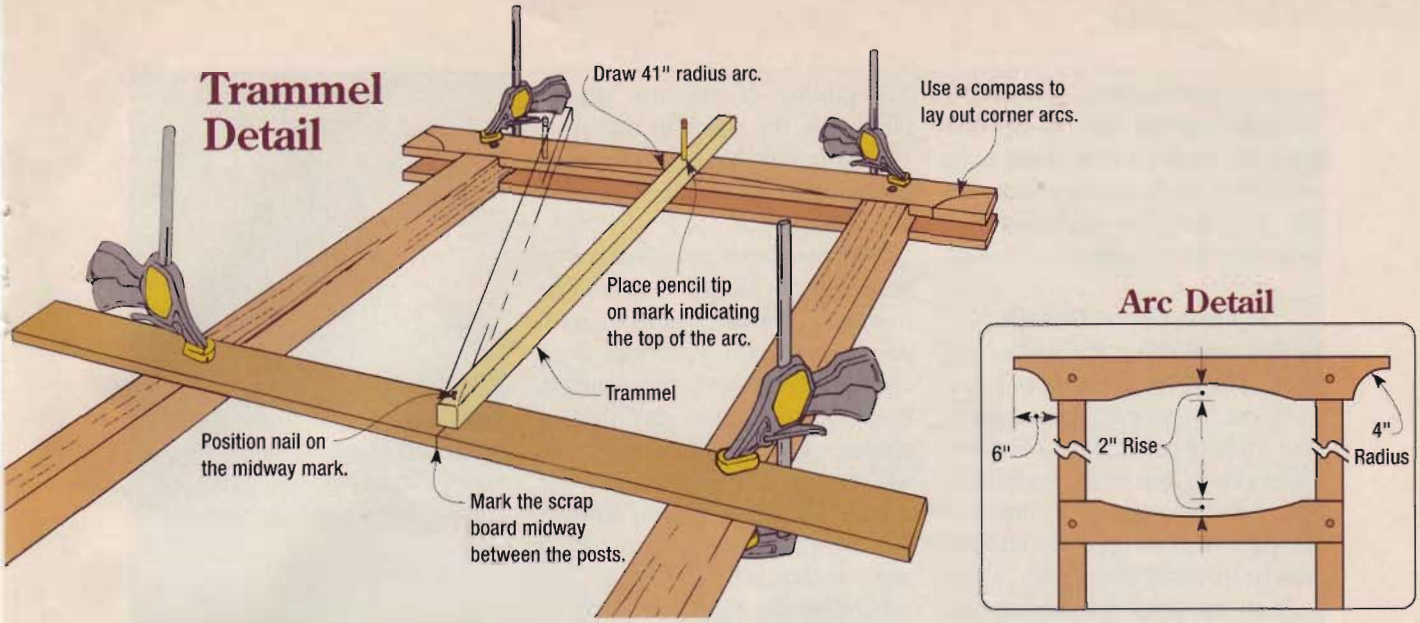
The Rails

Following the rabbet and dado cleanup, you can move on to the rails. Rip your stock to width, if necessary, and cut the four rails to length. Then clamp them into position on the posts. If you have any trouble, use your chisel to enlarge the rabbets or dadoes for a snug fit.

Make sure the top rails overhang the posts equally (see the Rail Detail), then check the frame for square and tighten the clamps. Now lay out the bolt hole location at each joint.

To drill accurate bolt holes, I followed a multi-step process. First, I drilled a hole at each location with a 6"-long ⅛" diameter twist drill bit (see the Drilling Detail). You can purchase a long ⅛" bit at most hardware stores. Drilling these small holes pinpoints the bolt hole locations on both sides of the trellis assembly (see the Pilot Hole Detail). The pilot holes then guide the larger drill bits for the counterbores and bolt holes.

For drilling the counterbores, I used a ⅞" spade bit (see the Counterbore Detail). As for the bolt holes, you may think that a brad point will give you the best results. In my experience, however, a twist drill is better (see the Bolt Hole Detail). With its blunter point, a twist drill will center itself on the ⅛" pilot holes you drilled earlier. Using a ⅜" bit, drill from both sides of the assembly so that the holes meet in the middle.



With the posts and rails clamped together, mark the rise of the arcs on the rails. Next, clamp a scrap board across the assembly to provide a platform for the trammel to pivot while drawing the arc on the top rail. Then adjust the scrap board and draw the arc on the bottom rail.

Forming The Arcs

As long as the trellis is still assembled, I suggest drawing the curved cutout lines on one top rail and one bottom rail. The radius for the arcs is 41". There are a variety of techniques for drawing an arc (see *Laying Out an Arc* on page 36). For this project, I used a shop-made trammel that served my purposes just fine (see the Trammel Detail).

To make the trammel for drawing these arcs, first cut a 45"-long piece of scrap 2x2 stock for the trammel beam. Next, drill a hole near one end of the beam for the pencil. Make sure the pencil fits snugly in the hole. Now, drive a nail through the beam 41" away from the pencil. Don't knock yourself out here — any arc radius close to 41" will look just fine.

Lay out the rise of the arcs on the rails (see the Arc Detail). Then clamp a piece of scrap wood across the trellis assembly to support the nail end of the trammel beam. Mark the scrap board midway between the posts. Now set the pencil point on the rise lay out mark you just made on the top rail, and press the nail into the midway line you just drew on the scrap board. Draw the arc, then reposition the scrap board and repeat the procedure for drawing the arc on the bottom rail.

The tighter arcs at the ends of the top rails are easy to draw with a compass (see the Arc Detail).

Now you can disassemble the trellis, clamp the rails into pairs, and cut the curves with a saber saw. Follow up with sandpaper to smooth the edges.

Drilling More Holes

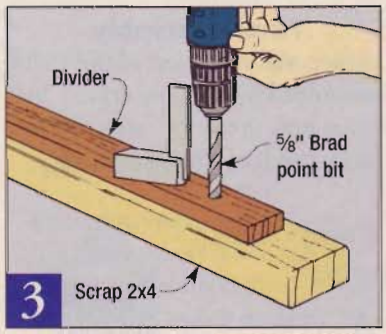
Building the trellis using only portable power tools has its advantages. I was able to do all the work in my garage and backyard, and avoided carrying long, heavy stock into my shop.

After you cut all the dividers to size, however, you may want to use a drill press to bore the holes for the copper tubing. For those of you who don't have a drill press, I can assure you that I got very solid results from a portable drill.

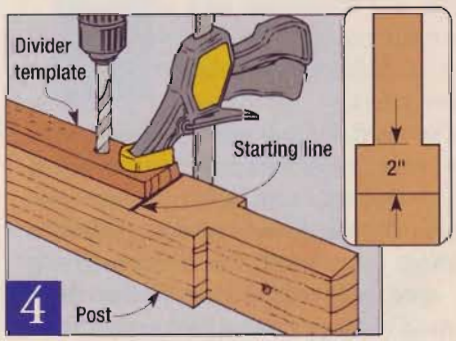
Begin by laying out hole locations on one divider (see the Divider Detail on page 29). Next, to prevent tearout, set that divider on a scrap 2x4 and drill the $^5/_8$" holes (Figure 3). Be sure you keep the drill square to the stock. You might find it helpful to set a square on the divider to start each hole.

Drilling holes in the other dividers and in the posts can now be completed quickly and easily if you use the first divider as a template. Lay the template on another divider, making sure the ends and edges are aligned, and set them on the scrap 2x4. Drill the holes, then repeat this procedure for the remaining dividers.

As for the posts, you'll need to draw starting lines before you can clamp the template into position (Figure 4). Next, lay the template



After laying out hole locations on the first divider, drill them with a brad point bit. A square will help you drill accurate holes.



Center the divider template on the post and align its top end with the starting line. Now you can drill the holes in the post.

on one post, aligning its top end with the starting line. Center the template on the width of the post, clamp the stock together, and drill the $1\frac{1}{2}$"-deep holes. Follow this procedure for the other post as well.

A Few More Details

Before assembling the trellis, you need to complete a few more steps. First, cut the copper pipe to length. Use a tubing cutter if you have one, otherwise a hacksaw works just fine. I do recommend chamfering the pipe ends so they slip into the post holes easily (Figure 5).

Next, cut stock for the cap and rout its bottom edges with a $\frac{3}{8}$" roundover bit (see the Top Cap Construction View and the Roundover Detail). Use the same bit to rout all the edges and ends of the dividers, but switch to a 45° chamfering bit to rout the edges of the posts (see the Post Details).

After you compete the routing, remove lettering on the pipe using steel wool and lacquer thinner — be sure to wear rubber gloves.

Final Assembly

Earlier, you had most of the trellis assembled while you drilled bolt holes and drew the arcs, so you know much of what lies ahead.

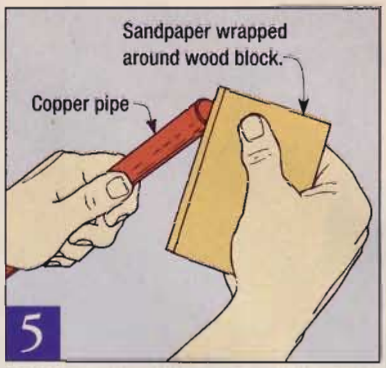
Begin by driving the copper pipes into the holes in one post. Use a hammer, but protect the end of the pipes with a piece of scrap wood (Figure 6).

With the pipes installed in one post, you can tap the dividers into position. This takes time because you have to work your way along each divider to keep the progress even. Once you have the dividers spaced evenly, add the second post to the assembly. Several bar clamps will come in handy for forcing the post onto all the copper pipes at one time.

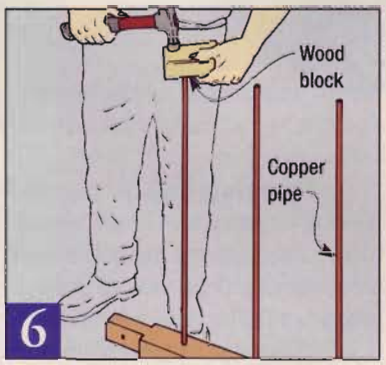
Now set the rails on the assembly to see that the bolt holes still align. Make any adjustments, tap the bolts into the holes, then run the washers and nuts onto the bolts to secure the rails to the posts. Complete your trellis by screwing the top cap to the top rails.

Digging the Holes

As I mentioned earlier, I applied several coats of clear exterior finish to the cedar parts of the trellis. After it dried, the one remaining step was digging the holes and sticking the trellis in the ground. I decided not to use concrete for setting the posts because I don't think it's necessary in this case. And, to tell you the truth, I wanted to hedge my bets and allow for moving the trellis if the first location proved to be a bad choice.



Wrap 120-grit sandpaper around a wood block and chamfer the ends of each pipe. Chamfers ease the pipe installation.



Protect the pipe with a wood block while tapping them into the post holes. Make sure the pipes are fully seated in the holes.

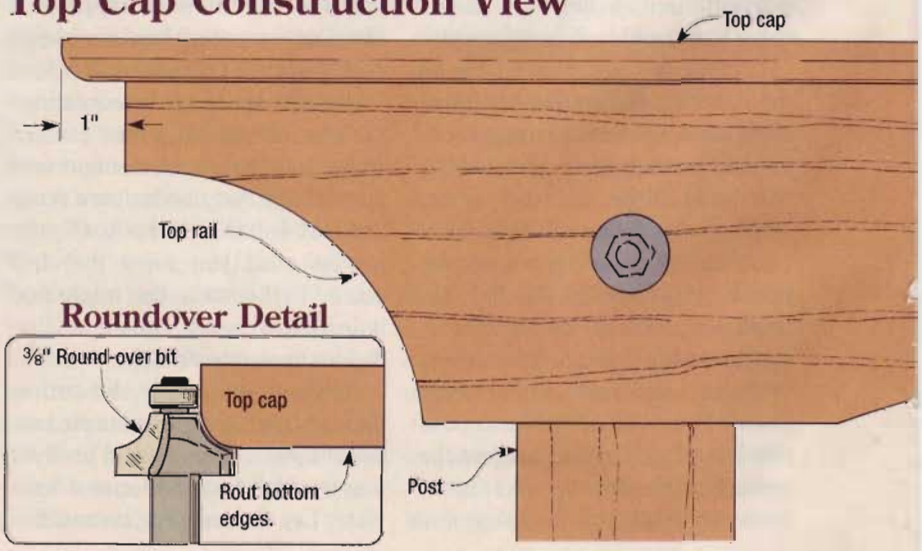
Of course, my trellis project wasn't complete without a climbing rose. So I rushed out to a nearby nursery and selected a rose with red blooms. Later, after the rose is well established, I know I'll be hard pressed to choose between that old Victorian porch and this charming deck setting.

Aging Compound For Copper

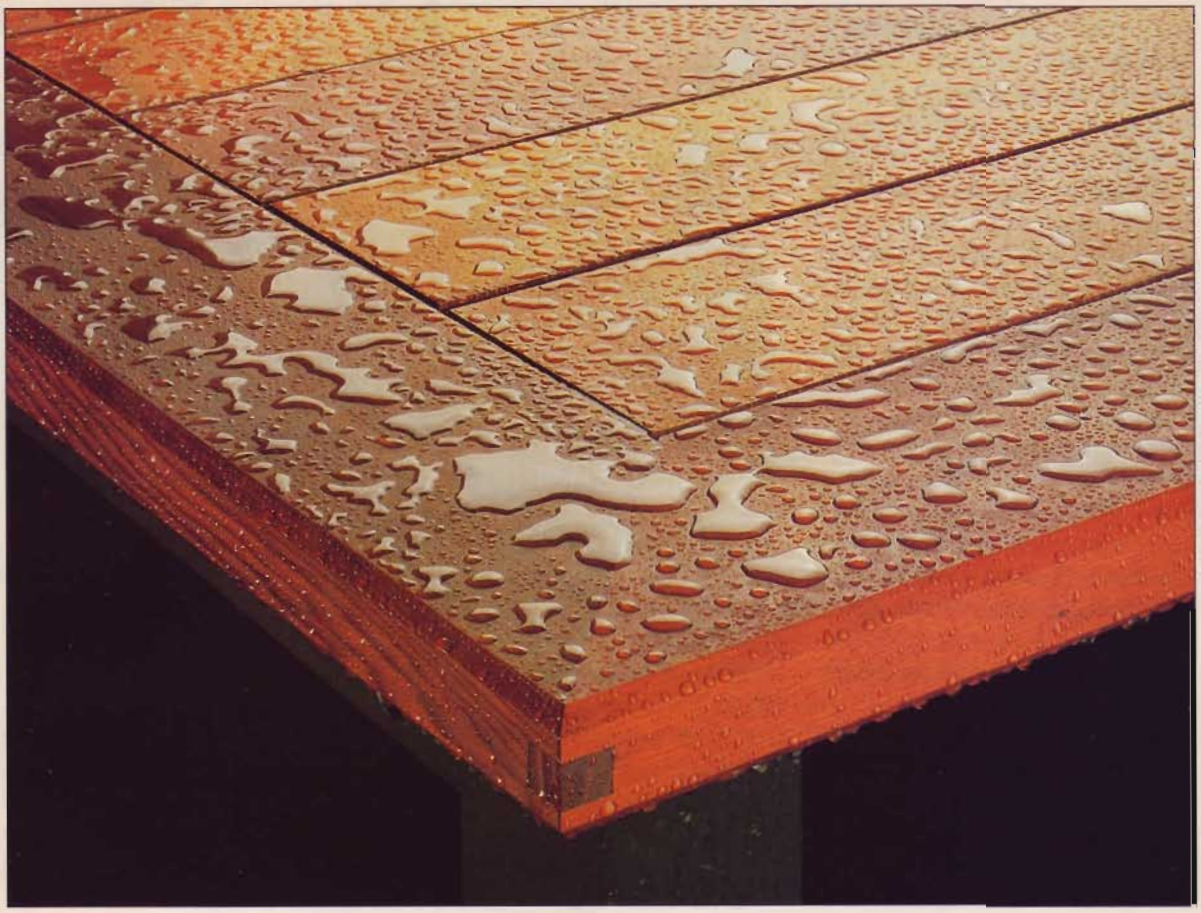
You may not want to wait for your copper to age to a beautiful green patina. If that's the case, you can apply a product that will prematurely age the surface of the pipe to get the same effect.

I've used a liquid called Patina Green. You have to make sure the copper is free of grease, oil, and lacquer before you brush on the liquid. A coat or two is enough to react with the metal to give it an aged look within three or four days, instead of the year or so it takes for this to occur naturally. To find out where you can buy this product in your area call Modern Options at (415) 252-5580.

Top Cap Construction View



Roundover Detail



Outdoor Glues

When I chose Western red cedar for the deck railing at the Workbench *house, I knew what to expect from the wood. Picking out the right glue was a different* story, because the choices weren't as clear. When I turned to the manufacturers for some help with the basics, here's what I learned.

Just as you wouldn't consider a jointer plane and a block plane interchangeable, you have to think about glues as specific tools, not just goop that gums up your sanding belts or gets used up like stain or screws. All adhesives have what's called a task range, a set of duties they're designed to perform under certain conditions. Respect those limits and your woodworking projects will live long and prosper, all else being equal. Ignore them and you may be remembered for creating some of the world's most expensive kindling.

There are always variables built into assembling any project — wood species, joinery, the type of fasteners involved, if any, and the likelihood of future wood movement from normal moisture cycles. Throw exterior use into that mix and your headaches grow, because exposure to the elements can undo work that would easily survive indoors.

When I first started working with wood, yellow and white PVA (polyvinyl acetate)glues were all I knew. Even today, yellow glue can handle almost all of my furniture projects, but I've learned that

Adhesion, Specifically

While the mechanical bonding of glue inside wood pores does contribute to the strength of a glue joint, it's not nearly enough to do that much work. The real muscle comes from chemical bonding, known as specific adhesion.

When this occurs, chains of adhesive molecules (called polymers) become intertwined with molecular chains in the wood (also called polymers). With more durable exterior glues, these microscopic bonds can cross-link and become so complex that water and other solvents can't unravel them, so the wood stays put despite the weather. Even for the chemists who formulate adhesives, the process remains a bit of a mystery.

some materials and applications, such as plastic laminates or wood veneers, require something better suited to the task, and that's really true for exterior projects.

Resistance to water is the most obvious virtue of an exterior glue, but that's only part of the job description. Outdoor wood doesn't just get wet. It also dries out and gets wet *again*. It bakes and freezes, shrinks and swells, and generally gets no respect from the elements. You can't always control how wood gets treated after it leaves the relative safety of the shop, but you can give it a fighting chance by knowing what adhesives to use and why. To that end, here's a look at the most common and practical solutions for home shop woodworkers.

Cross-Linking PVA's

Yellow glue, commonly known as aliphatic resin glue, is descended from white glue but formulated to develop tack more quickly and resist creep (the tendency for wood joints to move due to flexibility in the glue). Exterior PVA glues, like Elmer's *Weather-Tite* and Franklin's *Titebond II*, are another variation on this theme. They behave a lot like regular yellow glue, so the learning curve is virtually nonexistent.

These glues are known as cross-linking PVAs because of the way they form bonds (see *Adhesion, Specifically* on the preceding page). They're nontoxic and formulated to be water-resistant, not waterproof — a distinction also relevant for other types of exterior wood glues. Continuous immersion or below-the-waterline marine use are off-limits, but PVAs are fine for outdoor furniture, cutting boards, and other items that get just an occasional soaking, especially if mechanical fasteners are used to reinforce the joinery. Gap-filling properties are negligible.

One-Part Polyurethanes

Polyurethane adhesives (shown above) are the new kids on the glue block, and the subject of both hype and confusion. Developed in Europe as an alternative to epoxies, they hold up well in immersion tests and are promoted as waterproof, but that designation reflects a standard that isn't used in North America. The U.S. Forest Products Laboratory (FPL) in Madison, Wisc., is currently conducting its own tests, and so far has said only that polyurethanes are not rated for structural bonds, the kind necessary for glue-laminated beams and other high-stress architectural elements.

Aside from excellent water-resistance, polyurethane glue has other virtues. Open time is generous, the glue expands and fills small gaps as it cures, and the dried residue sands and machines away easily without clogging abrasives or damaging cutting tool edges. It will bond wood, metal, stone, ceramic, glass, and some plastics, and far from interfering with the glue bond, the presence of water actually helps the adhesive cure. It's also tolerant of temperature swings and doesn't interfere with stains or finishes.

Drawbacks include higher cost than PVA glues, an isocyanate component that can cause respiratory or skin reactions, and clamping times of up to 5 hours. (Excel Xpress, a gel glue with a 40-minute clamp time, is an exception.)

Two-Part Adhesives

The required mixing and relatively high cost of resorcinol adhesives and of epoxies might be drawbacks to their regular use, especially when a lesser glue will do. But when a wood assembly absolutely has to stay together under extreme conditions, nothing else can boast the track record of these two workhorses.

Part liquid resin and part powdered catalyst, resorcinol glue undergoes an intensive chemical

reaction as it cures, producing a complex chemical bond that's impervious to water and most common solvents. Resorcinol requires a minimum working temperature of 70°F and long clamp times, but the FPL says for continuous immersion in water and for structural bonds, no other wood adhesive currently available matches its performance.

Epoxies rival resorcinol in their ability to produce a waterproof bond, and some types designed for marine use even cure under water! They can also be formulated to harden in as little as five minutes, though this short set time can sometimes compromise the bond strength. Disadvantages include high cost and toxic fumes.

Specialty Adhesives

If standard categories don't seem appropriate for a given project, specialty adhesives might have the properties you're looking for.

Cyanoacrylates (such as Super Glue) excel at waterproof bonds on tiny surface areas, but the brittle glue line doesn't tolerate wood movement well. For detailed inlay gluing, especially of non-wood materials, they're a useful tool.

Construction adhesives (commonly packaged in caulking cartridges) are usually used along with nails or screws to secure decking, plywood sheathing, and other materials. These adhesives also bond to masonry and to ferrous metals. Although they provide instant tack, curing fully can take days.

Also, there are products like Weldbond, a proprietary PVA glue and sealer formulated for exterior use on wood, stone, concrete, and other materials.

With these and other adhesives, respect their limits and choose appropriate applications. Always read the label to learn what the product is designed to do and under what conditions.

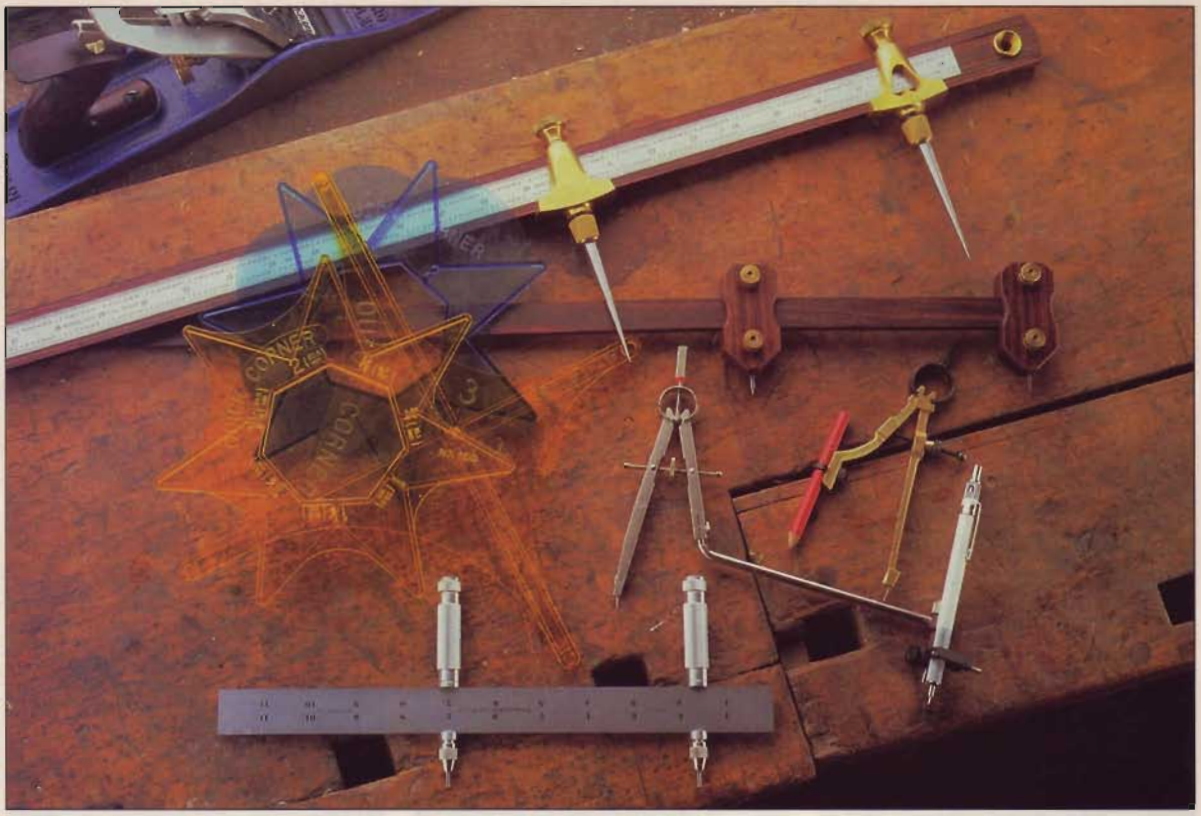
At-A-Glance — Applications & Properties

Glue Type	Min. Working Temp.(°F)	Open Time* (mins.)	Clamp Time (hrs.)	Comments
Cross-linking PVA	55-60°	5-15	1	Good water resistance; inexpensive; nontoxic.
Polyurethane	40-50°	15-30	1-5	Excellent water resistance; works well on oily woods; no mixing.
Resorcinol	70°	5-15	4-10	Forms waterproof structural bonds; mixing required; emits formaldehyde fumes.
Epoxy	32°	5-120	0-1	Forms waterproof bonds; good gap filler; emits hazardous fumes.
Cyanoacrylate	40°	10-30 seconds	N/A	Very fast setting; brittle joints; good for small repairs and inlay.

For availability of these types of adhesives, see the source list at right.
**Open Time begins when the glue is applied and ends when it starts to set up.*

Sources:

- AmBel Corp./Excel (polyurethane); call (800) 779-3935
- Chemrex/PL (polyurethane); call (800) 433-9517
- DAP/Beecham Inc. (PVA and resorcinol); call (800) 634-8382
- Devcon (epoxy); call (800) 933-8266
- Elmers Products Inc. (PVA, polyurethane, and cyanoacrylate); call (800) 948-9400
- Frank Ross & Sons (Weldbond); call (416) 282-1107
- Franklin Int'l./Titebond (PVA, polyurethane); call (800) 347-4583
- Gorilla Group (polyurethane); call (800) 966-3458
- Loctite Corp./Wood Wizard (polyurethane); call (800) 562-8483



Laying Out an Arc

A straight line may be the shortest distance between two points, but an arc is a much more scenic route. And when you select the curved path, you have a wide variety of choices.

You can draw arcs with commercially available tools, like the examples in the photo. Or you can apply easy-to-build shop-made solutions.

Choosing among these tools and methods is a matter of "appropriate technology" — a buzz phrase that means the common-sense approach of matching tools and processes to the job at hand.

So I'm not saying that any tool is better than the rest— no single one will meet all your needs. Instead, it's really a matter of balancing the size of the job and the need for precision with your budget.

Where To Get'em

- General No. 842 spring-bow compass, about $5, and model 524 trammel point set, $12.25, widely available at hardware stores or contact General Tools Manufacturing, Inc., 80 White St., New York, NY 10013; or call (212) 431-6100.
- Quick Corner templates, $19.95 plus $3 shipping, for a set of four (including a chamfer template not photographed), contact Streamline Manufacturing, 210 E. 1000 So., Brigham City, UT 84302; or call (801) 723-8665.
- Rotring model 530-136 bow compass with extension bar, about $30.75, at drafting and art-supply stores, or contact Koh-I-Noor, 100 North St., Bloomsbury, NJ 08804; or call (800) 877-3165.
- Precision Trammel Set model PT-1, $210, contact Bridge City Tool Works, Inc., 1104 NE 28 Ave., Portland, OR 97232, or call (800) 253-3332.
- Beam Compass Kit No. 769100, $5.95 + shipping, call Woodsmith, (800) 444-7527.

Store-bought Tools

The least expensive style of arc tool I would recommend is a spring bow compass. The threaded adjustment mechanism fine-tunes a setting and holds it reliably to draw circles up to 8" in diameter.

The Rotring bow compass with extension bar is the next step up in capacity, enabling you to easily draw circles up to 18" in diameter. The draftsman-quality fit and finish of its components make it accurate.

For even larger circles, you can use trammel points. The Bridge City set (top in photo) has a one meter (39.37") beam. The Woodsmith 24" beam compass (middle) is built from a kit. The General model 524 (bottom) features two heads that fit onto a wood or metal strip you provide.

The colorful plastic Quick Corner templates offer a fast way to draw various-sized arcs at the corners of your workpieces.

Tape Measure Circles

A carpenter friend of mine recently demonstrated an easy way to use a tape measure as a compass. At the pivot point, drive a box or common nail (7d size or smaller), and use its head to catch the slot in your tape measure's hook. (I've always wondered what that slot was for.) Hold your pencil against the tape at the desired radius to draw the arc.

Hardboard Strip Trammel

For more precision, you can make a trammel from a 1"-wide strip of $1/8$"-thick hardboard. Drill one $1/8$" hole for the pivot point and another $1/4$" hole at each desired radius. This setup is particularly helpful for drawing a series of arcs or circles that are concentric (with the same centerpoint). The jig costs nearly nothing to make, is easily stored on a nail, and is durable enough for repeated use.

Two Nails With Strip

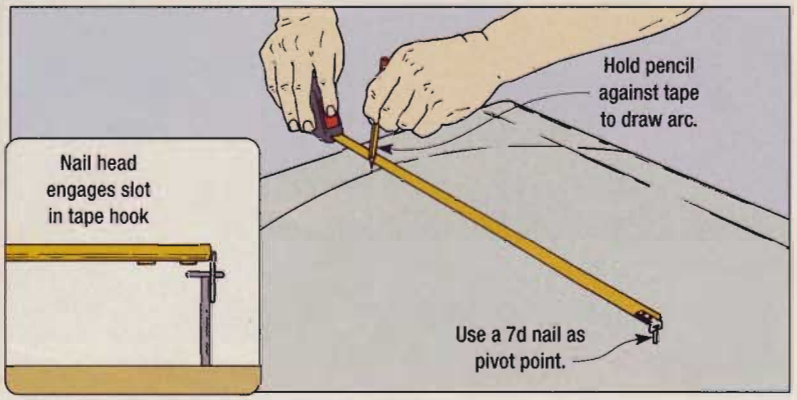
For some projects, you need to create a smooth arc of a specified rise between two points. The plans usually don't tell you the radius of the circle — and I suppose that calculating it would require some fancy math skills.

Here I opt for the low-tech route, tapping nails at the end points and springing a metal rule or thin strip of wood between them to reach the arc's high point. But this method has its drawbacks — sometimes there's no place to drive the nails, and it can be hard to spring a smooth curve while drawing it at the same time. To overcome those shortcomings, I designed an arc jig.

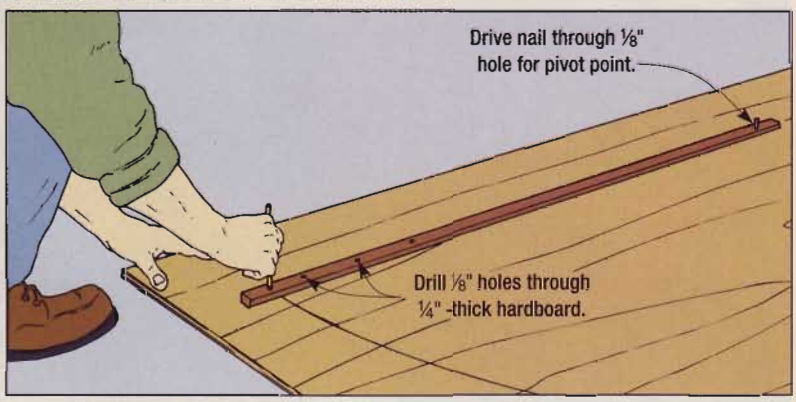
Yardstick/Turnbuckle

I made my arc jig from a yardstick, nylon string, and a turnbuckle. Center the adjustment holes in the yardstick so the tension won't twist the wood. Cut slots with a coping saw to catch the knotted string. The adjustment holes allow you match the jig to your needs, and the turnbuckle provides micro-adjustable precision.

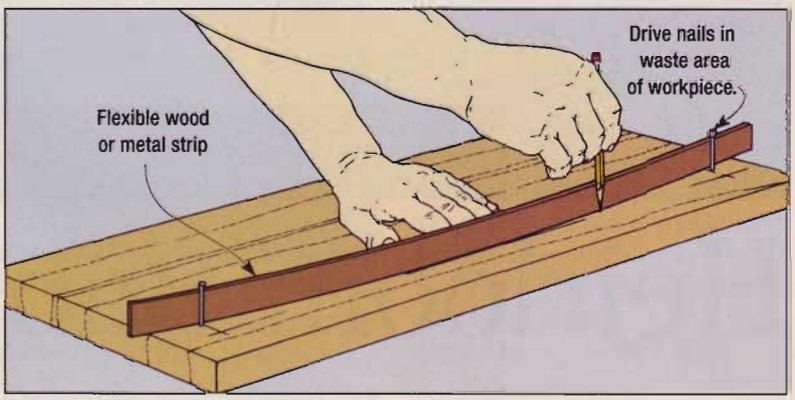
Tape Measure and Nail



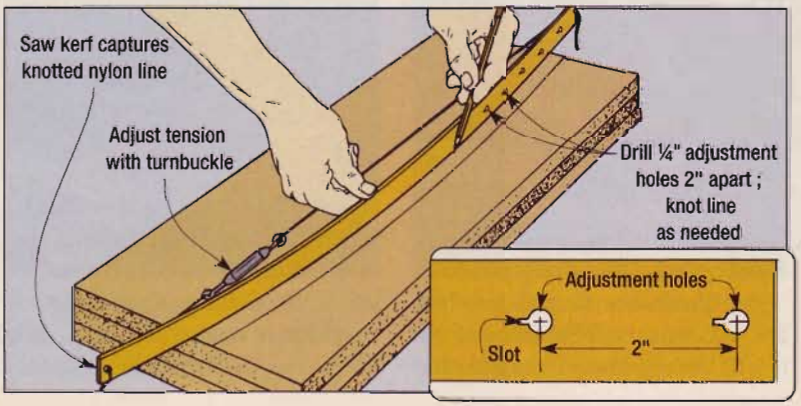
Hardboard Strip Trammel



Two Nails With Strip



Yardstick With Turnbuckle



Heirloom Baby Crib

In today's world, it seems that many people are dedicated to making things so fast and so cheap that nearly everything is available in a disposable version. You can buy throwaway cameras, contact lenses, flashlights, paintbrushes, and razors.

But there are occasions when fast and cheap fall far short of the mark. Welcoming a baby into the family is one of those times. And building a crib for that baby is a chance to make something special. Taking pains to use first-rate materials and quality craftsmanship will ensure that your gift lasts for generations.

Get Your Hardware First

The hardware for this project permits either side to drop down (see the Crib Construction View). I considered having only on side move, but the few dollars I could have saved would only introduce complications. For example, the sides would no longer be identical, which would mean fewer standardized machining operations. Besides, an heirloom project like this crib will be in the family long into the future. So investing in versatile hardware makes solid sense.

Whatever hardware you choose, it's a good idea to have it on hand before you start construction. That way, you'll be certain that the final assembly will go smoothly.

Crib Construction View

OVERALL SIZE: 45" x 34¼" x 56⁹⁄₁₆"

What You'll Need

Lumber

16 bd. ft. of 8/4 Maple
9 bd. ft. of 4/4 Maple
1 bd. ft. of 8/4 Cherry
1 bd. ft. of 4/4 Cherry

Hardware

This project is based upon the hardware available in the kit described in the upper right corner of this page. Have your hardware on hand before beginning this project to verify dimensions as needed.

Other Considerations

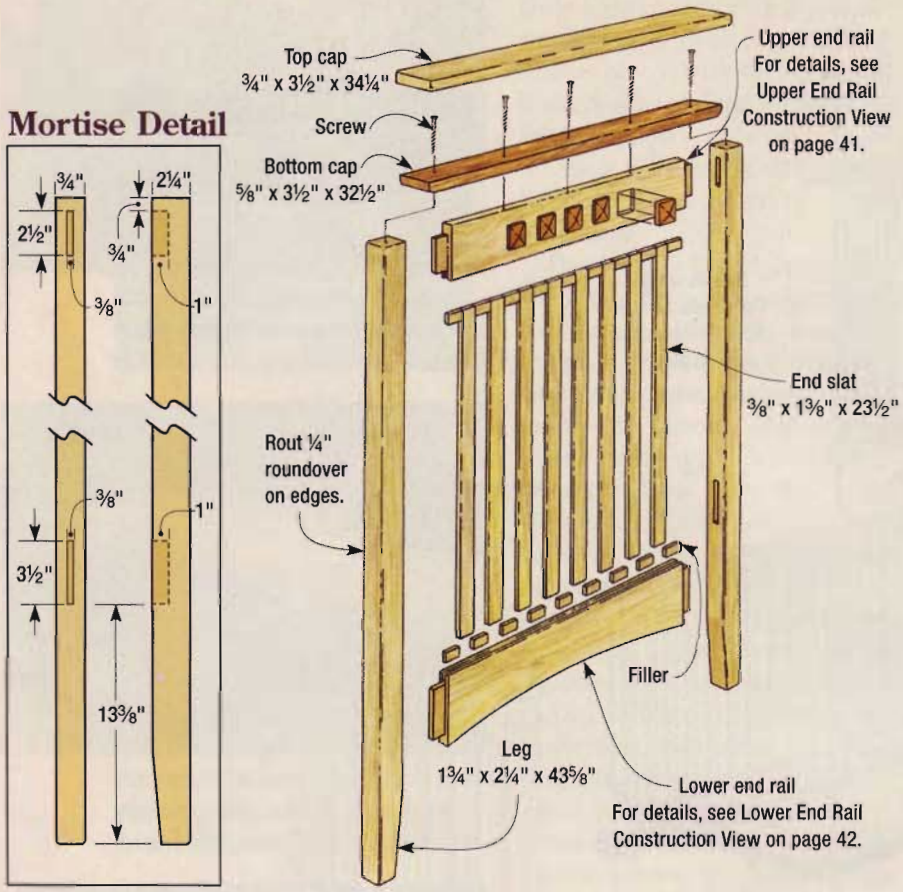
Every project made for children requires careful attention to safety issues. And with a crib, those concerns are absolutely vital. The United States Consumer Product Safety Commission publishes guidelines for the design and construction of cribs. You can be sure that I studied them thoroughly before putting pencil to paper designing this project.

The guidelines cover such detailed items as the strength and spacing of the slats, the height of the mattress, and the make-up of the posts. Therefore, I'll warn you against altering this design unless you thoroughly research the subject yourself.

In addition to the construction, a crib also needs a durable finish to stand up to the demands of an active child. So I applied five coats of General Finishes wipe-on varnish, then topped it with two coats of furniture-grade paste wax.

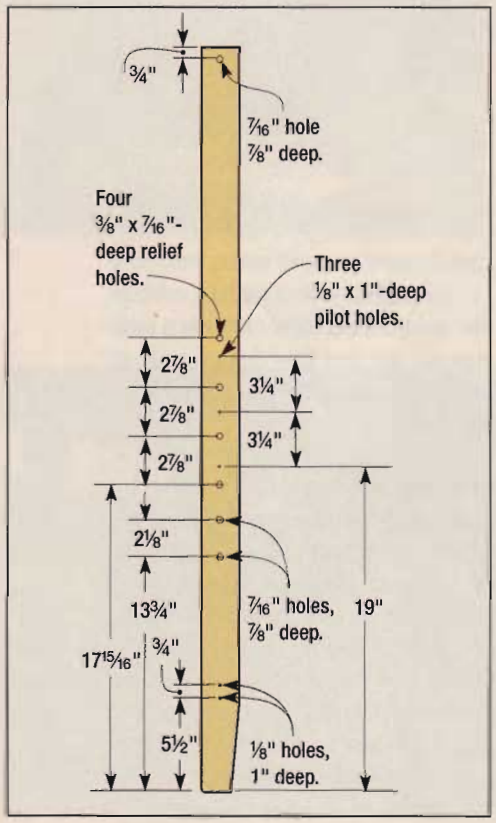
You don't need to use a special food-grade finish for this project. Since the banning of lead from the painting scene, all modern finishes are non-toxic when fully cured.

End Construction View



Mortise Detail

Drilling Detail



Start With the Legs

To get started on my crib, I ripped four legs to width, then cut them to length (see the End Construction View). Next, I laid out the mortise locations on one face of each leg (see the Mortise Detail).

I formed the mortises by using an edge guide with my plunge router and a carbide up-cutting spiral bit (Figure 1). Unlike regular bits that chop the wood, spiral bits cut with a shearing action that produces smooth mortise walls. As an added bonus, spiral bits pull the chips out of the mortise.

Before squaring the rounded corners of the mortises, take a few minutes to sharpen your chisel. Paring maple end grain with a freshly-honed chisel is a joy. A dull chisel, on the other hand, just makes it hard work.

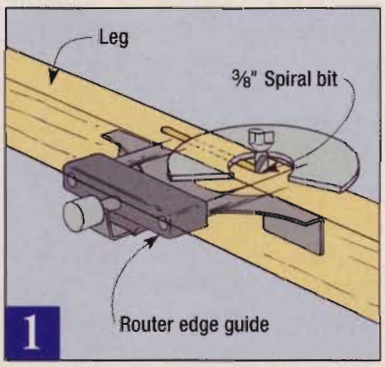
My crib design calls for tapering the bottom of each leg (Figure 2). After laying out the tapers (on the mortised sides only), bandsaw them to shape, then plane and sand them smooth.

At this point, it's easy to use a drill press for boring all the pilot holes in the legs for the hardware (see the Drilling Detail). If you wait until after assembling the legs with other parts, you'll have to use a portable drill — a much less accurate operation. These pilot holes must be square to the legs to guarantee the success of the hardware installation later on.

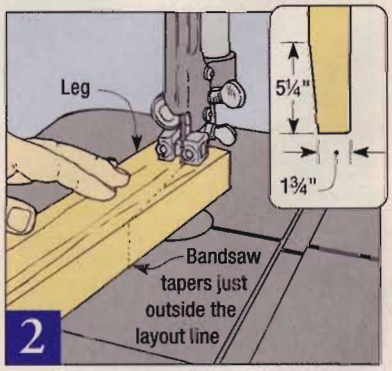
To complete the legs, I routed a ¼" roundover along the edges of each one. I then sanded the legs to final smoothness, and carefully set them aside.

Upper End Rails

I decorated each side of the upper end rails with five pyramid-shaped blocks set into square mortises (see the Upper End Rail Construction View). Although this involves several steps, none of them is particularly difficult. And



Carefully center the mortises in the width of the legs. I used a ⅜" up-cutting spiral bit for fast cutting and efficient chip ejection.



Bandsawing is a quick way to taper the legs. Cut just to the waste side of the layout line, then plane and sand to the mark.

I've found ways that will make the job easier for you. You'll have to work carefully to achieve precise fits, but I think the results are worth the effort.

There are two essential factors for making the mortises. The first is cutting oversized $^3/_4$" × $4^1/_4$" × 29" pieces for the upper end rails, and ripping each into three sections (see the Upper End Rail Detail). I ripped each section slightly wider than its finished dimension to allow for jointing the edges. Take care to joint the sections to their exact widths.

The second key factor is making a jig to cut the rail mortises (see the Step & Repeat Jig). This jig will space the mortises evenly and allow you to cut them to a consistent width.

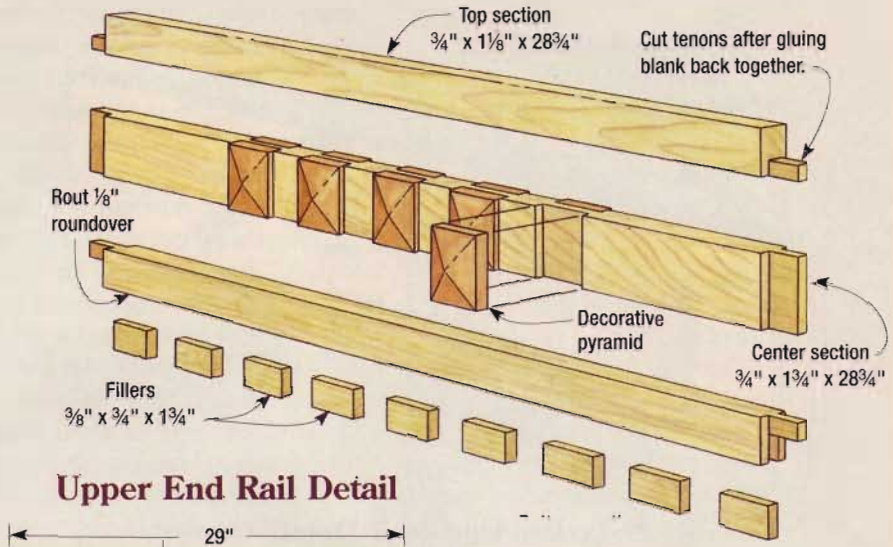
Now cut the jig face and the indexing key, then set these parts aside and install a $^3/_8$" dado blade.

Cut the first pairs of dadoes in each center section (Figure 3). Make sure the outside edges of these cuts are precisely $1^3/_4$" apart — this determines the accuracy of all the mortises.

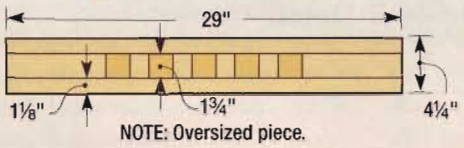
Returning to the jig, cut a $^3/_8$"-wide dado in the jig face, and glue the indexing key into it. Screw the jig face to your miter gauge with the key exactly $2^3/_4$" from the blade (Figure 4). This sets the spacing between the mortises.

Use the jig to cut the edges of the mortises (Figure 5). Then remove the jig and clean out the remaining waste with the dado blade.

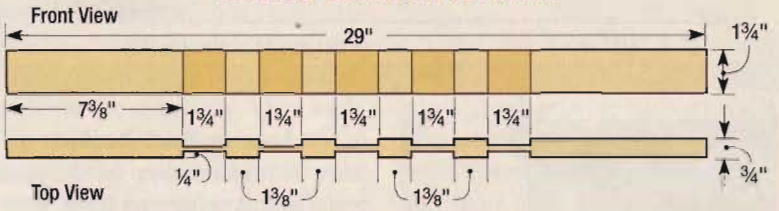
Upper End Rail Construction View



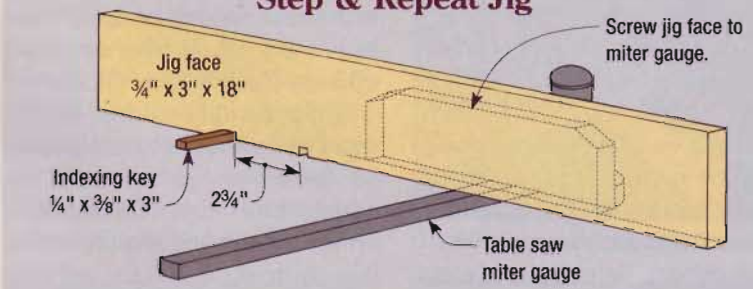
Upper End Rail Detail

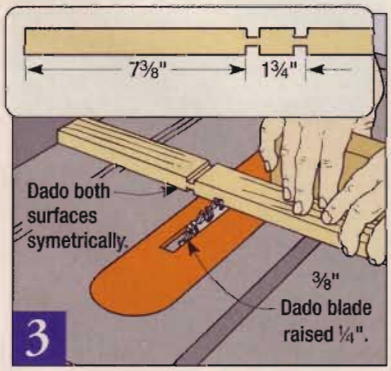


Center Section Details

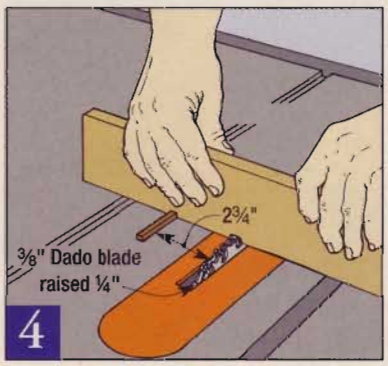


Step & Repeat Jig

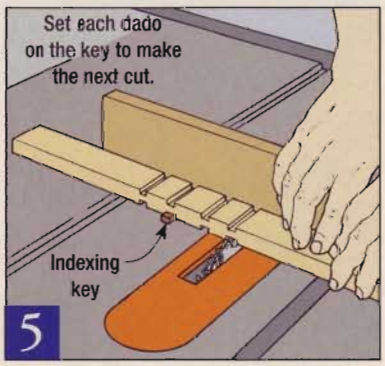




Cut the first dadoes so that their outside edges are exactly $1^3/_4$" apart. Make test cuts in scrap stock to get the set-up right.

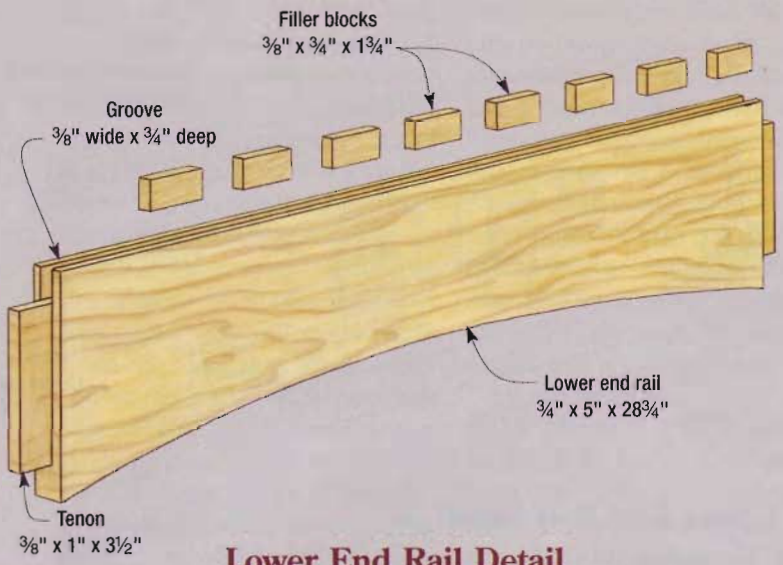


The spacing from the dado blade to the key is another critical measurement. Screw the step-and-repeat jig to your miter gauge.

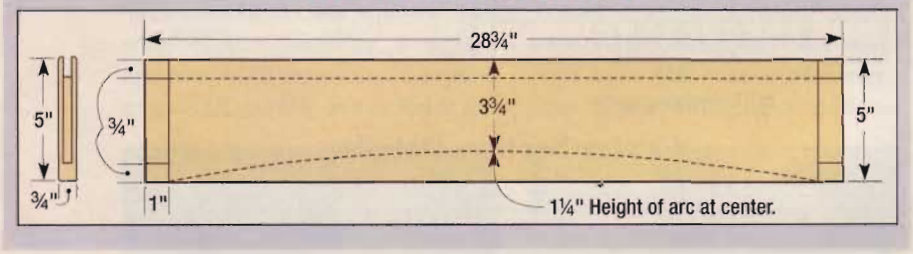


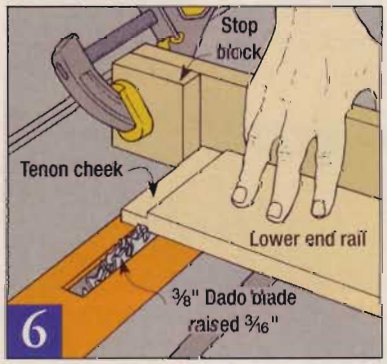
Use the jig to make cuts on both sides of the center section. Then remove the jig, and cut the waste to complete the dadoes.

Lower End Rail Construction View



Lower End Rail Detail





Clamp a stop block to your wooden miter gauge extension. This method helps ensure that all the tenons are identical.

Lower End Rails

After cutting mortises for the pyramids in the center sections, carefully glue the three sections of each upper end rail back together. Make sure all surfaces are flush while you're tightening the clamps.

While the glue dries on the upper end rail assemblies, rip stock for the lower end rails (see the Lower End Rail Construction View). Later, when the upper end rails are ready, cut all the end rails to length at the same time. Be sure you center the pyramid mortises in the upper end rails.

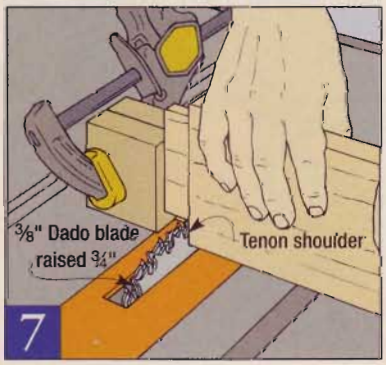
Machining tenons on the ends of the rails (see the Lower End Rail Detail) is easily accomplished after clamping a stop block to a wooden miter gauge extension (Figure 6). I like this set-up because it helps prevent tearout. In the interest of efficiency, use a 3/8"-wide dado blade for cutting the tenons, because in a few minutes you'll be plowing 3/8"-wide grooves for the slats.

Cut the tenon cheeks first, then adjust the blade height and cut the shoulders (Figure 7). After completing the tenons, plow the grooves for the slats (Figure 8).

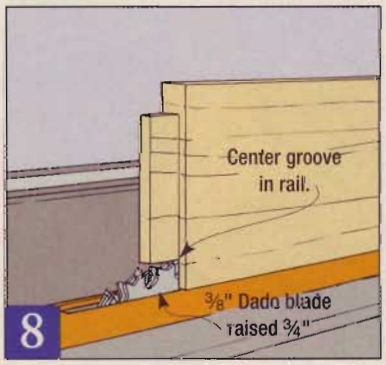
Laying out the arc on the lower end rails can be done in a variety of ways (see *Laying Out an Arc* on page 36). I chose to use a jig made with a yardstick and turnbuckle (Figure 9). Lay out the arc, then bandsaw both pieces at the same time by holding them together with double-faced tape. Cut just outside the line, then refine the curve with a sanding drum.

When I tried to separate the rails, I found that the tape had stuck more strongly than I expected. Instead of resorting to brute force, I dripped lacquer thinner into the seam between the rails. It loosened the tape's grip enough for me separate the pieces of wood.

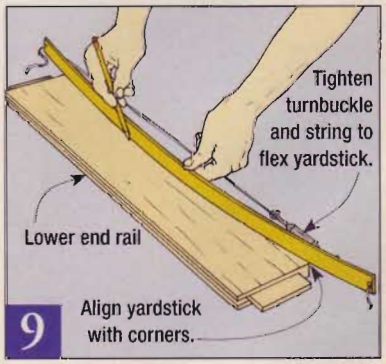
After routing roundovers along a few edges of the upper and lower end rails (see the Construction Views), I sanded these parts and set them aside.



Raise the dado blade height to 3/4", and make the shoulder cuts to complete the tenons on the upper and lower end rails.



Leave the height of the 3/8" dado blade unchanged. Position the rip fence to center the groove in the upper and lower end rails.



Lay out the arc on one of the lower rails, then use double-faced tape to join both rails. Bandsaw, sand, and separate the parts.

Mass-produce the Slats

Making the slats is an assembly-line operation, and once you find the rhythm, the job goes surprisingly fast (see the Slat Details).

Instead of using 3/8"-thick stock for the slats, I ripped 3/8"-thick slats from a 1 3/8"-thick plank. I did this for two reasons. First, thick material is more readily available than 3/8" stock, and because I have a thickness planer, milling the wood down to the correct thickness was no obstacle. And second, the straight-grained slats that come off the plank are generally stronger than the plain-sawn slats I would probably get from thin stock.

To begin, cut enough 30"-long sections of your thick plank for all the slats, plus a few extra. Thickness-plane the sections to 1 3/8"-thick, then prepare to rip slats from the stock. I recommend using your band saw, instead of the table saw, to rip this stock. I don't have an industrial-sized table saw, and have learned over the years that ripping thick maple strains the motor's limits, and sometimes leaves burn marks. A band saw, on the other hand, rips efficiently with less horsepower.

Set your band saw's rip fence to cut slats 1/16" thicker than the final 3/8"-thickness. This allows for thickness-planing the pieces to their final dimension. Rip a slat off each edge of each section, then run the edges of the plank stock over the jointer to re-establish flat surfaces for the next set of ripping cuts. I cut fifty-two slats following this procedure.

When thickness-planing the slats, I was having trouble with snipe at the end of each piece. I discovered that feeding a second slat into the planer just before the back end of the first one passed under the cutterhead helps eliminate the problem. If your thickness planer won't let you run slats side-by-side, try running them end-to-end to reduce snipe.

Test-fit the Slats

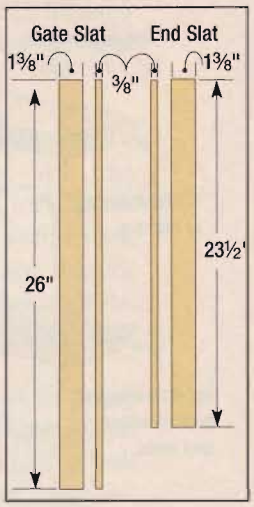
I was glad that I made a few spare slats because some were ruined when the thickness planer chipped out unruly grain. But I found a good use for the damaged material. It was perfect for the fillers, so I ripped them to width, then crosscut them to length (Figure 10).

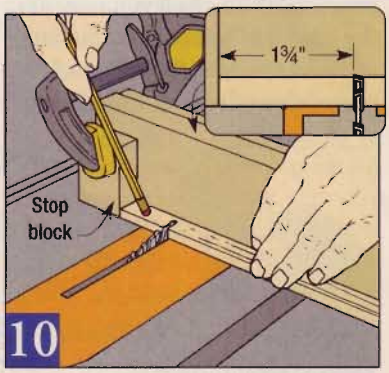
After crosscutting slats to length for the end assemblies, mock up the assemblies to see if all the parts fill the upper and lower end rail grooves from end to end. In my case, it worked out. But if you need to make adjustments, cut four filler strips that are slightly longer or shorter than the others, and use them at each end of the grooves.

To allow lots of time during the glue-up of the end assemblies, I used polyurethane glue, which is slow-setting. By using the glue sparingly you'll avoid the mess of excessive squeeze out. Denatured alcohol is the usual clean-up solvent for polyurethane adhesive — check your glue bottle's label to be sure.

Spread glue in the rail grooves, then slip the slats and fillers into position. Then put glue in the leg mortises and mount the legs on the rail tenons. Snug the joints with pipe clamps, and use a framing square to check the assembly before letting it dry (see the End Assembly Detail). To avoid damaging the posts, I recommend using softwood clamping pads.

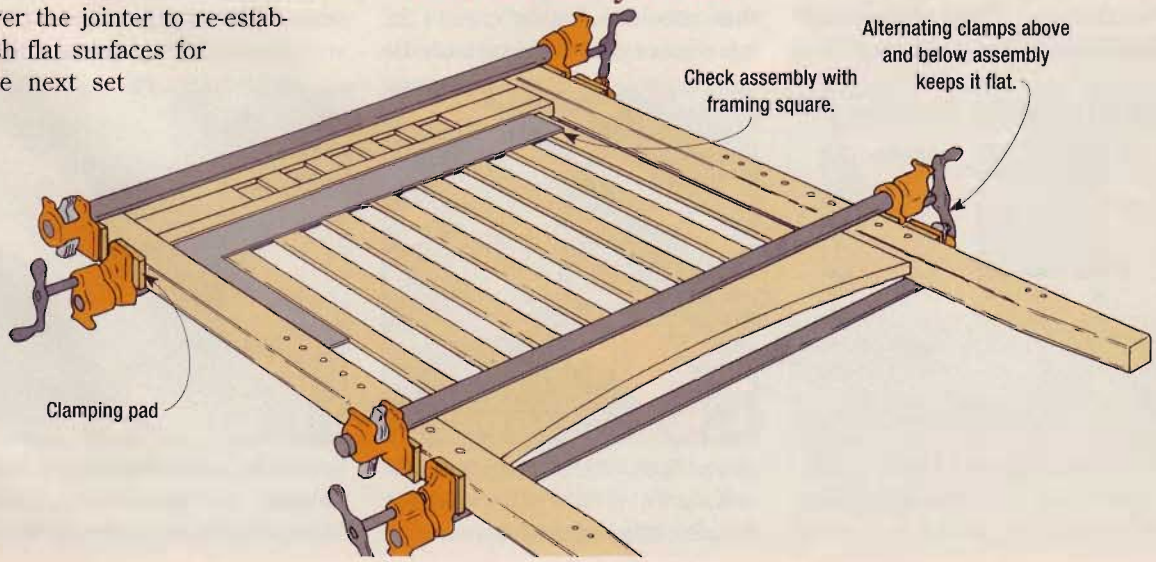
Slat Details



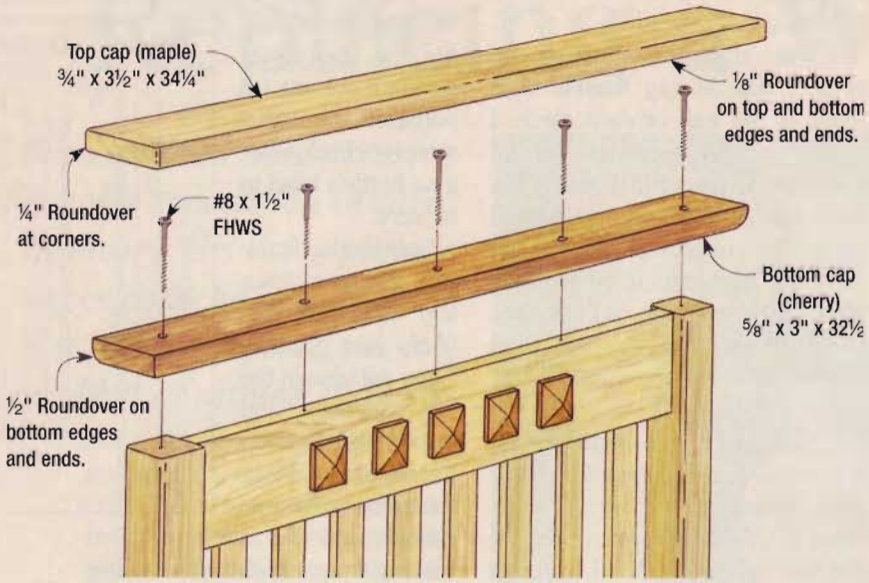


Use a pencil to keep your fingers safely away from the blade when cutting the fillers. A stop block ensures identical length parts.

End Assembly Detail



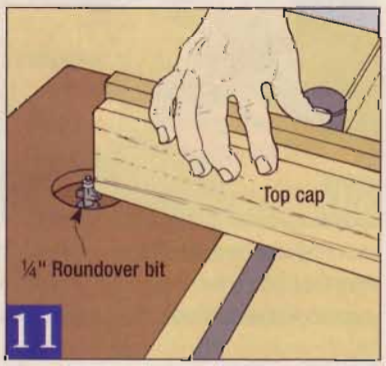
Cap Construction View



Top and Bottom Caps

Before moving on to the gates, you might as well complete the end assemblies. After all you only have the caps and pyramids remaining.

The caps are made up of two pieces (see the Cap Construction View). The top cap is ¾"-thick maple, and the bottom cap is ⅝"-thick cherry. I planed the bottom cap stock to the proper thickness, then ripped and crosscut all the cap stock to size.



Stand the top end cap on edge to rout the roundovers at the corners. A back-up block prevents tearout where the bit exits the wood.

Routing the edges of the top and bottom caps requires three sizes of roundover bits: ⅛", ¼", and ½". Use your router table for all these operations.

Begin with the ¼" roundover bit to rout each corner of the top cap. To do this, stand the top cap on edge while pushing the corners through the bit (Figure 11). Profiling the rest of the top and bottom cap edges with the other roundover bits is routine work.

Sand the top and bottom caps, then attach the bottom caps to the top edge of each end assembly. Be sure to drill counterbored pilot holes for the screws, and I recommend using glue on the joints as well. Once the bottom caps are secure, glue the top caps to the bottom caps, carefully centering and clamping them into position.

Shaping the Pyramids

Making the decorative pyramids from end-grain cherry provides a rich contrast with the pale maple used to make the rest of the crib (see the Pyramid Details).

To safely make the pyramids, start with a piece of perfectly squared-up cherry about 30" long. It's important that this piece is square so it fits the mortises you cut earlier in the upper end rails.

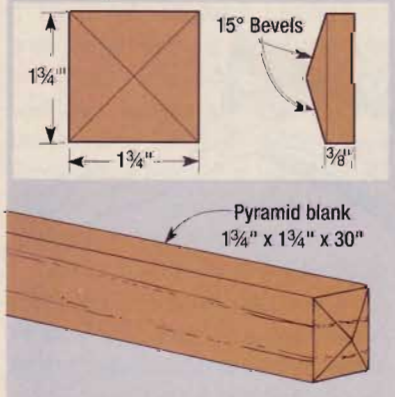
Use your table saw to cut the bevels that form the pyramids (Figure 12). Before each pass through the blade, butt the end of the cherry stock against the setup block clamped to the rip fence. Rotate the stock one-quarter turn before each cut. Cut both ends of the cherry stock the same way.

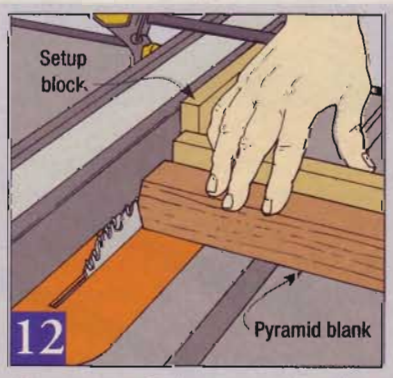
Now separate the pyramids from the blank using your band saw (Figure 13). Here again, a setup block gives you consistent results.

You can then go back to your table saw and shape another pair of pyramids, and so on until you have the 20 that you need.

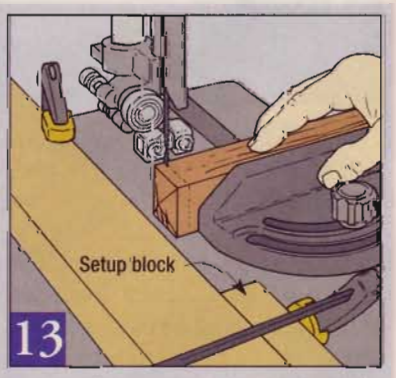
Sand the pyramids lightly — to preserve their crisp faces and snug fit — then glue them into the upper rail mortises. Use glue sparingly to avoid having any squeeze out.

Pyramid Details





Tilt your blade 15° to cut pyramids on both ends of a 1¾" × 1¾" × 30" cherry blank. For safety, keep blade projection minimal.



Bandsaw the pyramid blocks from the blank, then repeat. Use a set-up block to let the part fall free, without binding against the fence.

Gate Assemblies

The gates are the last remaining assemblies to construct. Begin by ripping and crosscutting the upper and lower rails for each gate (see the Gate Construction View). Then drill a 3/8"-diameter hole near the end of each rail for the crib rods (see the Hole Detail). To prevent splintering, you can chamfer the rim of each hole with a countersink bit. Next, use a dado blade to plow a groove in each rail for the slats and fillers.

The shape of the teething rail requires that the top edge of the upper gate rails be rounded over (see the Roundover Detail). I chose to rout the bottom edge of the lower rails in the same fashion. Chuck a 1/2" roundover bit in your router table and set the bit so only 3/8" of its cutting edge is above the table (Figure 14). Then set up a fence on your router table and rout the partial roundovers.

The teething rails also require a set of kerfs in both upper gate rails (see the Kerf Detail). Set your table saw fence and blade height, and cut the shallow kerfs (Figure 15). Avoid making the fit of the teething rails too tight — adding a few coats of finish can change the fit.

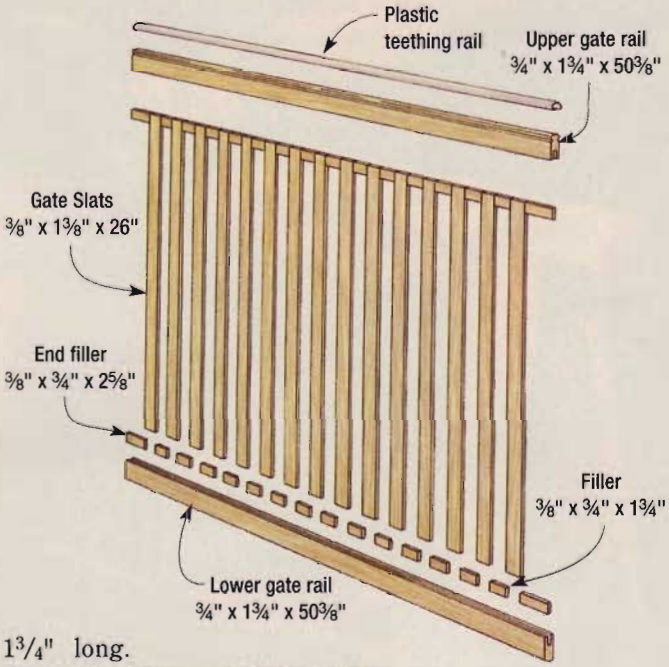
Wrapping Up

Crosscut all the gate slats to length, then cut the fillers to length. You'll need eight end fillers 2 5/8"-long to use at each end of the gate assemblies — the rest are 1 3/4" long. Test-fit the slats and fillers in the rails, and re-cut the end fillers if the assemblies aren't quite right. You might find, as I did, that an extra set of hands is helpful during this assembly process.

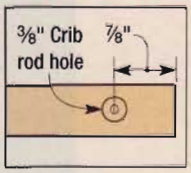
Provided that the gates are just the way you want them, you can tear down the assemblies in order to glue them together permanently. Once you have them reassembled, check for square before tightening the clamps. After removing the clamps, use a handheld drill to extend the crib rod holes through the end fillers.

Sand the crib up to 220-grit paper before you do the finishing. I wiped-on five coats of varnish, then installed the hardware (see the Hardware Assembly Detail). With the first click of the gate shoes against the stabilizing bars, your heart will leap with pride. A job well done makes all the effort worthwhile.

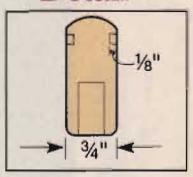
Gate Construction View



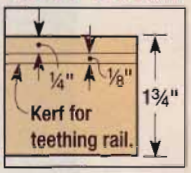
Hole Detail



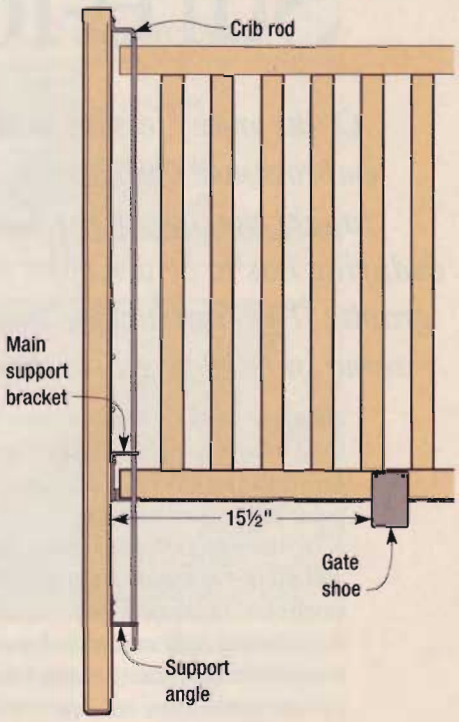
Roundover Detail

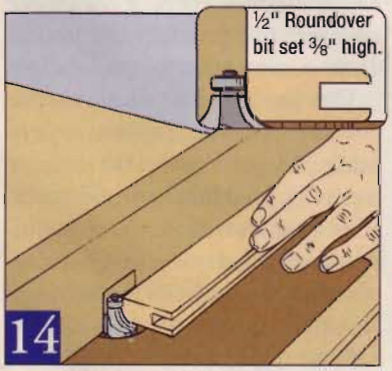


Kerf Detail

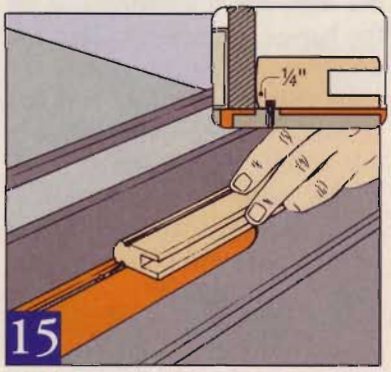


Hardware Assembly Detail





To rout the top edges of the upper rails, and the bottom edges of the lower rails, set the fence so it's flush with the bit's bearing.



Position the 1/8"-deep kerfs so the teething rails can easily fit onto the upper rails. Cut a test piece first to ensure a good fit.

Sure-footed Sawhorse

Of the many lessons home improvement projects have taught me, one of the most enduring has to be a respect for gravity. The "instructors" have come in various guises, from annoying paint runs to a serious fall from a ladder, but a pair of collapsing sawhorses once drove the point home unmistakably.

In the interest of saving time and money, I bought a set of metal sawhorse brackets and nailed them to 2x4 legs and crossbars. It was obvious from the start that these sawhorses weren't very rigid, but I just wanted something "quick and dirty." And that's exactly what I ended up with. After I stacked a few dozen plywood cabinet sides into a towering load on the horses, I reached to shut the table saw off. As the whir of the blade faded, I heard an ominous creaking sound — the kind nails make when they're saying goodbye to wood — then turned to watch the entire stack of material tumble onto the floor as the sawhorses collapsed.

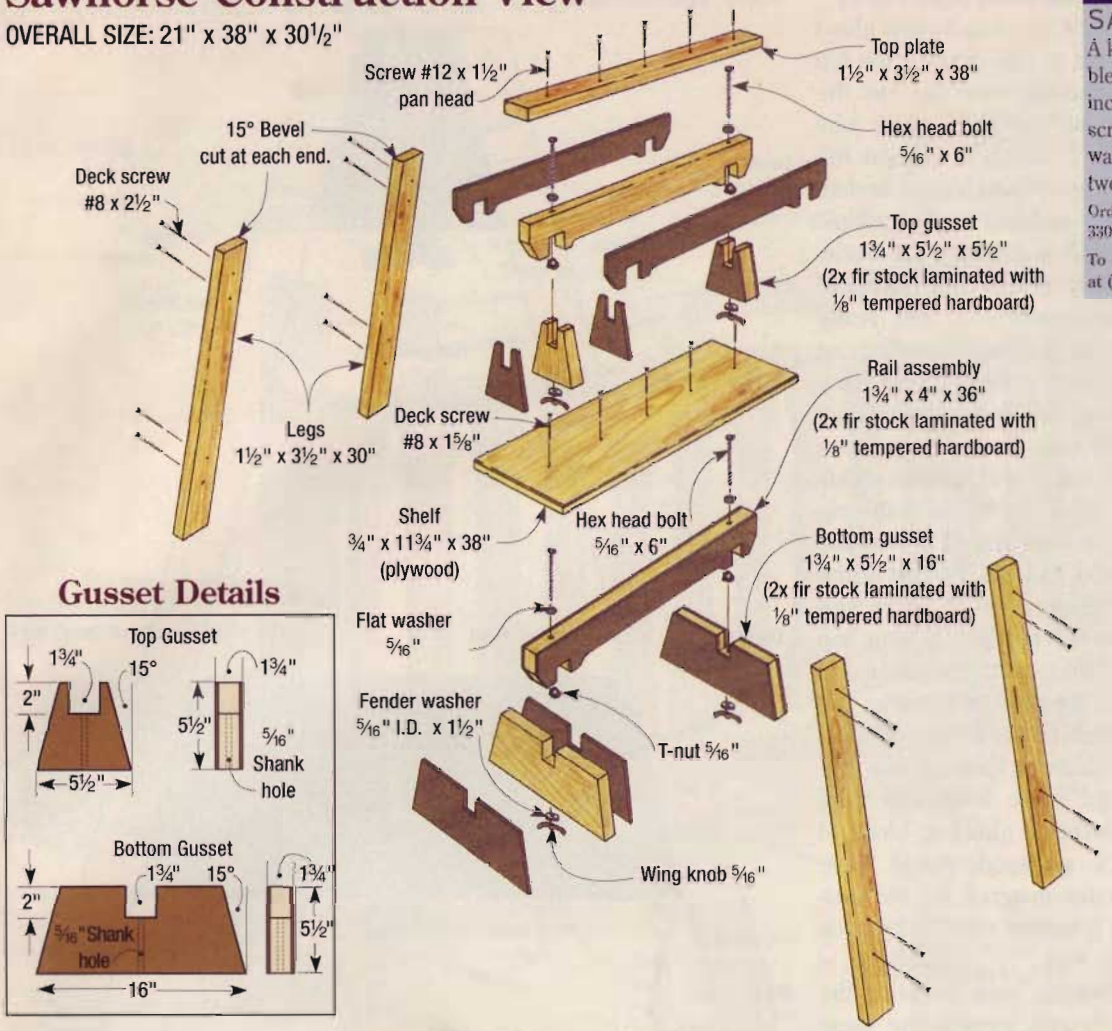
At first I blamed the mishap on cheap hardware, but the fault was really mine. I took those beasts of burden for granted, mistaking their simple task for an easy one.

Nowadays I pay a lot more attention to sawhorse design. My latest model has some of my favorite features — a replaceable top plate, a lower shelf for keeping my power tools off the ground, and knock-down construction for portability.

The fundamental requirement, of course, is to hold a lot of weight safely. All good sawhorse designs meet this goal head-on, and several techniques help out here — cutting deep notches for interlocking lap joints, using bolts to cinch the assembly tight so the knock-down feature won't mean a sloppy fit, and laminating some key parts with hardboard to avoid stress failures along the wood grain.

Sawhorse Construction View

OVERALL SIZE: 21" x 38" x 30½"



Gusset Details

PROJECT SUPPLIES

SAWHORSE

A kit has been assembled for this project. It includes the knobs, screws, nuts, bolts, and washers for making two sawhorses.

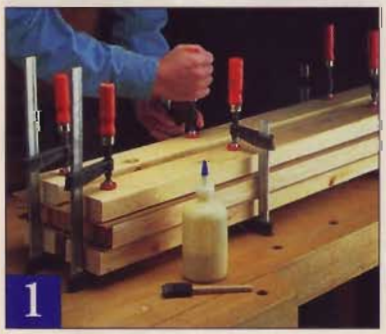
Order number
330200 ..... $16.95

To order, call Workbench at (800)311-3994.

Make The Laminations First

The glue on the laminated components needs time to set, so start with those first. Each pair of horses requires four rails. If you can find reasonably flat 2x10 Douglas fir, it's simpler to laminate the hardboard onto the full width (Figure 1), then rip the individual pieces to size (Figure 2).

You'll also need to laminate some additional stock for the gussets. Again I used an oversize blank so I could cut the assembly to size later. The small size and angled ends of the top gussets don't leave much room to cut the notches safely (see the Gusset Details), so I drew layout lines for each pair onto a single wide blank, alternating the angled edges. This saved material and allowed me to cut the notches before sawing the gussets apart. The bottom gussets, on the other hand, are larger and easier to handle, so I went ahead and trimmed their ends at a 15° angle. A simple jig fastened to the table saw's miter gauge helped control the cut (Figure 3).



When you laminate the hardboard skins onto the rail and gusset stock, use clamping cauls to distribute the pressure evenly.

Rip the rails from the oversized glued-up blank. Cupped or twisted stock may require multiple passes to produce square edges.

With a simple positioning jig fastened to your miter gauge, you can safely trim the ends of each gusset at a 15° angle.

Deep Notches Are Next

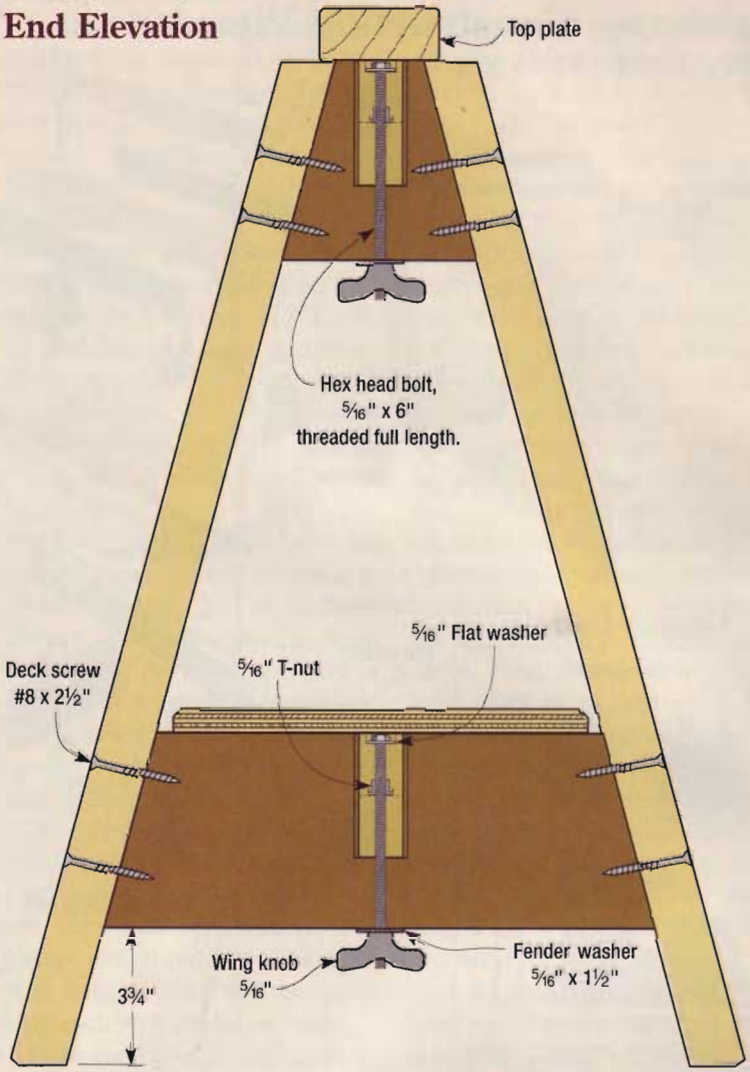
With all the laminated parts glued up and cut to size (except the top gusset blanks), you can cut the notches for the interlocking joinery. The 2" depth is beyond the reach of most dado blades, including mine, so I just made multiple passes with a standard 10" blade. Each pair of sawhorses requires 16 of these notches — not really enough to warrant building an involved jig, but more than I wanted to mess with for layout marking. I avoided both chores by first cutting the inside and outside shoulders of each notch using the rip fence as a stop, then I moved the fence away and cut the rest of the waste (Figure 4). After you machine the notches in your top gusset blanks, cut them apart using the same jig you used to trim the angled ends on the bottom gussets.

About halfway through this project I did some head-scratching over whether a glued-up block of $^3/_4$"-thick plywood would have been better material for the gussets. As it turned out, the 2x stock covered with $^1/_8$" hardboard is plenty strong, and keeping the stretchers and gussets the same thickness makes cutting the notches simpler. If you really want to build in more beef, you can laminate a plywood sandwich *and* hardboard skins together for the best of both worlds — added strength and stability plus consistent dimensions.

Drill for Hardware

After I tested the joints for a snug fit, I set up my drill press to bore holes for the knock-down hardware. For me, this feature is the icing on the cake, because it locks everything together tightly but doesn't forfeit portability.

Start with the stretchers, which must be counterbored for the bolt heads and the T-nuts (Figure 5). Then drill a $^3/_8$" through-hole for the bolt shanks. The counterbore inside the center of each notch, where the T-nut nests, is more of a



What You'll Need

(for a pair of sawhorses)

Lumber	Hardware
(1) $^1/_8$"-thick 4x8 hardboard	(8) $^5/_{16}$" x 6" Hex head bolts
(4) 8 ft. 2x4 Fir	(8) $^5/_{16}$" T-nuts
(1) 8 ft. 2x8 Fir	(8) $^5/_{16}$" x $1^1/_2$" Fender washers
(1) 8 ft. 2x10 Fir	(8) $^5/_{16}$" Flat washers
	(8) Wing knobs for $^5/_{16}$" bolts

Positioning the rip fence as an end stop lets you make the outside cuts for the notches; a few cleanup passes finish the job.

Counterbore the stretchers so the bolt heads and the T-Nuts will nest below the surface, then drill for the bolt shank.

shallow relief, just enough to let the metal flange of the T-nut retreat below the wood surface. The gussets don't need the counterbore treatment, but you will need to drill a 3/8" hole down through the center of each one (see the Gusset Details on page 47). I used the stretchers as a drilling guide by fitting the pieces together and continuing the hole with a portable electric drill. With a standard-length drill bit, you'll have to drill as deep as you can, separate the pieces, and finish the hole through the gusset alone. While everything's apart, you can also add details like the beveled corners and jig-sawn contours on the stretchers (Figure 6).

After you tap the T-nuts home in the stretcher notch, you can thread the bolts through, cinch them tight, and they'll stay captive whenever you disassemble the sawhorse. In case you didn't notice already, this step will remind you that the 5/16" × 6" through-bolts have to be threaded along nearly their entire shank. A well-stocked hardware store or fastener supply house will usually carry these in either a hex-head or slotted-head version, but if they're scarce where you live, the *Project Supplies* kit on page 47 has them packaged with all the other necessary hardware for the sawhorses.

Cutting 2x4 stock for the legs and top plate is straightforward. Just remember to cut the top and bottom ends of the legs at a 15° angle to allow for the splay when they're assembled. The splayed stance, along with the interlocking notches, is what makes these sawhorses stable and sure-footed.

Assembling the A-frames

Corrosion-resistant deck screws and exterior glue (either an outdoor yellow glue or a polyurethane adhesive) keep the legs secured to the gussets. Chances are, if I'm working outside and get caught in a sudden downpour, I know I'll be rescuing power tools first, so I don't want to worry about the sawhorses getting a little wet.

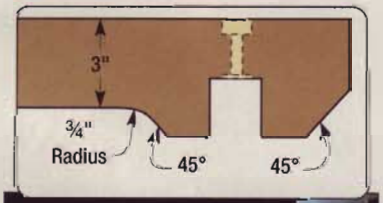
My first assembly attempt was a little awkward, especially trying to place the gussets accurately on the inside faces of the legs. To compensate for the offset in material widths, I ripped a couple of 7/8"-thick spacers to prop the gussets off the surface of my assembly bench (Figure 7). This centered and aligned the gussets while I drove the screws home. If glue and a good grip won't keep the gussets from shifting, clamp some stop blocks just below the gussets.

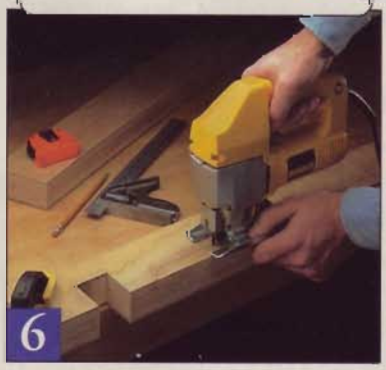
Once the glue dries on those assemblies, the sawhorses can go together. Fit the stretchers into the A-frames, then crank the wing knobs to lock everything together.

Next, cut the plywood shelf to size and fasten it to the stretcher with five 1 5/8"-long decking screws.

Mounting the top plate calls for a little variation on that theme (see the Top Plate Mounting Detail). The plate's likely to get cut up a bit, and I didn't want to ruin a saw blade on exposed screw heads. I gave myself some leeway by counterboring a 1/2"-diameter hole about halfway through the plate, followed by a clearance hole for the screw shank. Then I ran some pan-head sheet metal screws through the top plate into the rail. The plate can be replaced if it gets chewed up over time, but the chances of a saw blade colliding with a screw head are a lot lower.

As for the contour on the underside of the stretchers, I thought it might save some weight and give me a little extra room above the shelf. One of my woodworking buddies ribbed me about it, saying he'd never seen an authentic Arts and Crafts-style saw horse, complete with cloud-lift motif. But after he borrowed them one weekend for a building project, he dropped the sarcasm long enough to tell me what I already knew — this is one trick pony.

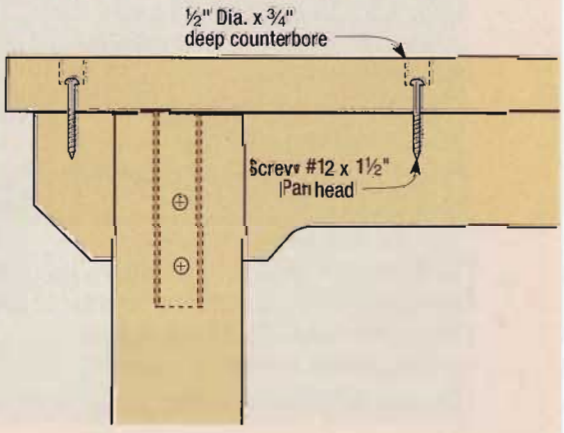




The cloud-lift contour on the rails can be cut with a jig saw, or, since they're nonfunctional, left out of the design altogether.

A pair of 7/8"-thick spacers will help align and center the gussets while you're assembling the A-frames. Use exterior glue here.

Top Plate Mounting Detail



New Tools

Small Biscuits for Detailed Joinery

The Ryobi Detail Biscuit Joiner cuts slots for small "Accu-Biscuits" that add strength to glue joints too small for standard biscuits.

Biscuit joining is one of the quickest ways to make strong, durable wood joints. The biscuits help align the pieces, and add extra glue surface to the joint for a stronger bond.

Unfortunately, standard biscuits are just too big for many projects, such as small picture frames.

To solve this problem, Ryobi has introduced its new Detail Biscuit Joiner. It cuts slots for special "Accu-Biscuits" that come in $5/8$", $3/4$", and 1" lengths. These biscuits can be used where standard biscuits won't fit.

Features on the DBJ50 include a reversible 90°/45° fence with calibrated depth settings, a 3.5 amp motor, and steel blade. It comes with an assortment of Accu-Biscuits.

Retail price is about $70. Contact Ryobi America Corp. at (800) 525-2579.

Precision Plane

The new Lie-Nielsen Low Angle Adjustable Mouth Block Plane beds the iron at $12\frac{1}{2}$° to produce a slicing cut, reducing the chance of tear-out in some situations. The plane also has a mouth opening that adjusts for fine or coarse work. The plane body is ductile iron that won't crack if dropped like gray iron. Other parts are all cast from bronze and brass.

Lie-Nielsen builds planes to exacting standards. Unlike cheaper planes, this one comes with a flat sole and a well-honed iron. At $145 it's not cheap, but it works great, looks good, and it's built to last. Call Lie-Nielsen at (888) 327-2520.

Double-Duty Craftsman Drill Press

One tool I've always wanted for my shop is an oscillating spindle sander. These sanders have a drum that rotates and moves up and down. This gives a more aggressive sanding action, and prevents the scarring that can occur using just a rotating drum. But instead of buying one, I made do for years by chucking a sanding drum in my old drill press.

I checked out some bench top spindle sanders, but decided they were priced too high for my budget, especially since I wanted other tools — like a new drill press. The ideal solution for me was to find two tools in one.

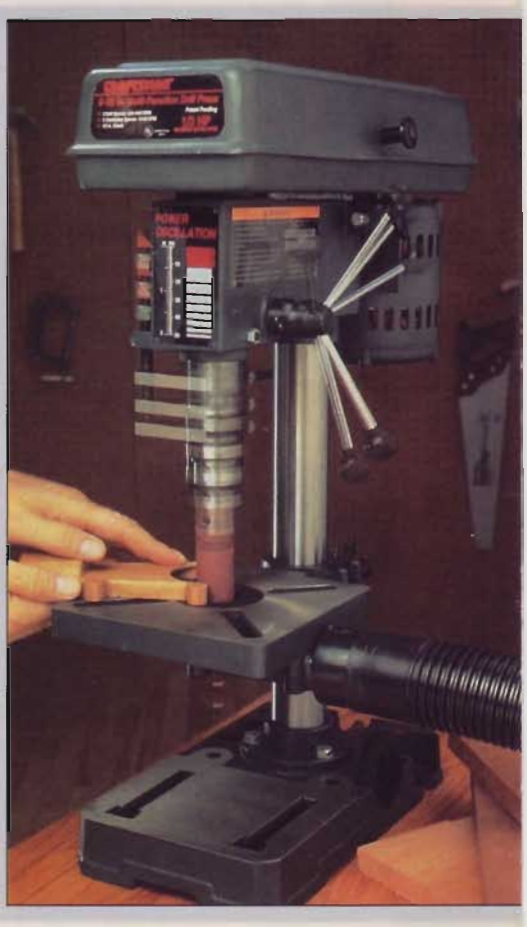
Then I saw the new Craftsman Multi-Function Drill Press from Sears. This drill press also works as an oscillating sander.

In the drill press mode, the Craftsman works like most others. Its capacity is $8\frac{1}{2}$" from the column to the center of the chuck. Maximum drilling stroke is $1\frac{3}{4}$". A depth-stop rod with an indicator allows you to set hole depths for drilling multiple holes.You can adjust the spindle speed from 620 to 3100 rpm.

What makes the oscillating action possible is an O-ring belt you attach between the spindle and a third pulley. This activates an arm that starts the spindle oscillating. In this mode, the spindle moves up and down $1/2$". Moving the drive belt changes the spindle rotation speed, varying the number of oscillating strokes from 12 to 62 per minute.

Changing modes is easy, and takes less than a minute. The table accepts inserts with varying hole sizes to support your workpiece when using drums of different diameters. You can store the inserts and other accessories in the tool's base.

The Multi-Function Drill Press sells for $159.99. It comes with a dust collection hookup and a mandrel that accepts optional sanding drums. You'll find it in Sears stores and Catalog. For information, call (800) 377-7414.



Left/Right Tapes

The numbers on most tape measures read from left to right, which means if you're a right-hander like me, you may have to compromise. You either mark with your left hand, or hold the tape in your left hand and read it upside down. I've gotten used to measuring this way, but some people find it awkward.

To make things easier for right-handers, Lee Valley Tools has introduced right-to-left-reading tapes in 10-ft., 25-ft., and 33-ft. lengths. A 10-ft. left-to-right version is also available. Prices are $3.95 to $7.95. Call Lee Valley Tools Ltd. at (800) 871-8158.

Dremel Sander Handles Contours

Just about every project that needs sanding has odd-shaped or tight areas that I can't get to with my regular sander. And hand-sanding is difficult and time-consuming. Most detail sanders sand with a vibrating motion, so they are pretty much limited to use on flat surfaces.

The new Dremel Contour Sander operates with a reciprocal (back-and-forth) motion, making it possible to sand a variety of shapes.

The Dremel comes with ten sanding tips in convex, concave, and angled shapes, plus a flat, diamond-shaped pad for flat surfaces and inside corners. Sandpaper tubes that fit over each contoured form are available separately, or you can cut adhesive-backed sandpaper to fit.

Dremel designed its sander for ease of use. It weighs just $1^3/_4$ pounds, has well-placed switches, a 10-ft. cord, and a lever that releases the sanding tips to make changes easy. Sanding speed is variable from 4,000 to 8,500 strokes per minute.

You'll find the Contour Sander at stores nationwide for about $79. That price includes the sander, ten contour tips, the flat detail pad, and sandpaper samples, all in a protective plastic case. For more information Contact Dremel at (800) 437-3635.

Cool Cordless Metal Cutter

With the rising cost of framing lumber, metal studs are showing up in more new homes, and they are sold in some home centers. They work well, but you'll need more than a hacksaw to cut them accurately.

Power (hot-metal) cutters that are typically used by contractors wear away the metal, leaving a rough cut. To avoid this problem, Panasonic has introduced the Professional Cordless Metal Cutter (model EY3502).

I tried the tool on metal studs and threaded rod. Although the cut edge on the threaded rod was sharp enough to slice into a finger, I turned on a nut without filing or rethreading the rod. The tool also cuts rebar and metal conduit up to $1^3/_8$" in diameter.

The street price for the cordless metal cutter, two batteries, a 15-minute recharger and a case is about $300. For more information, call Panasonic at (800) 338-0552.

SandFlex Blocks

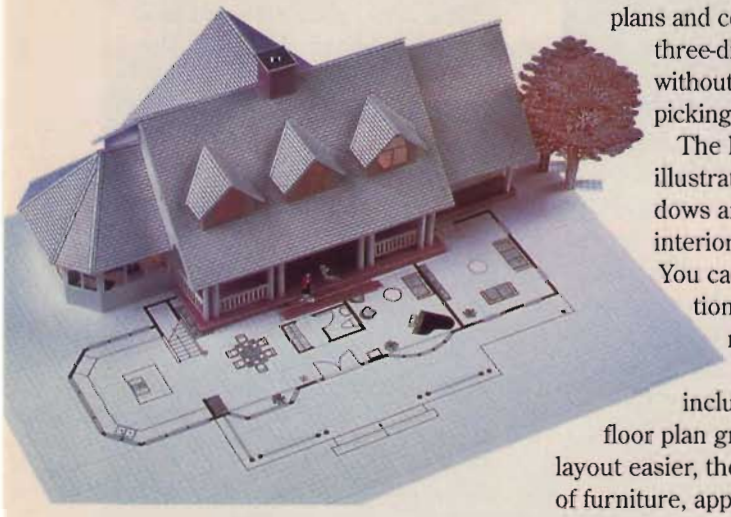
The humidity in my garage shop is always changing, so it takes constant maintenance to keep rust and corrosion from forming on my tools.

SandFlex Blocks from Klingspor are designed to make this maintenance chore easier. These rubber blocks are impregnated with fine-, medium-, or coarse-grit silicon carbide grains. I used a fine grit block to clean light rust off of my table saw top, and a coarse block was great for cleaning rusty antique tools. They sell for less than $6 each. Call Klingspor at (800) 524-6758.

Home Products

A Three-Dimensional Home Designers Kit

If you've ever planned a remodeling project, addition, or the building of a new home, you know it can be difficult to visualize the result before construction begins.



Two new products from Design Works may help you to see clearly what's in your mind's eye.

With this 3-D Home Kit from Design Works, you can design scaled floor plans and construct a 1/4"-scale three-dimensional model without hiring an architect or picking up a hammer.

The kit includes realistic illustrations of siding, windows and doors, roofing, interior walls, and stairs. You can use the illustrations to build your model home. Plus, Design Works includes a scale ruler and floor plan grid. To make room layout easier, there are illustrations of furniture, appliances, cabinets, and kitchen and bath fixtures you can place on the floor plan.

Also included with the kit is a booklet on basic design considerations, with all mathematical information and formulas you'll need to use.

For planning on a two dimensional scale, Design Works also offers separate Quick Planners for the kitchen, home office, bathroom, and home. All of the Planners come with reusable symbols that you can move around as many times as needed until you get the exact layout and design you want. With the Planners you also get a 1/4" layout grid and design booklet.

The 3-D Home Kit sells for $29.95, and the Quick Planners are $18.95 each. You can get them in home centers and bookstores, or directly from Design Works. Call (413) 549-4763.

New Maytag Front-Loading Washer Conserves Water

Several months ago in *Workbench*, I told you about research done by Maytag Appliances on the use of high-efficiency washing machines. That research concluded that the use of high-efficiency washing machines could save from 3,500 to 6,000 gallons of water annually per household.

Now you can take advantage of Maytag's research. Their new high-efficiency washing machine, called the Neptune, will be available by late summer or early fall. In addition to high-efficiency, this new machine offers the largest capacity of any residential washer on the market, as well as a number of other features designed to make washing easier.

The first thing you may notice about the Neptune is its front-loading design. Look inside, and you may think something is missing. There's no agitator inside the tub. Instead, the Neptune tumbles clothes in the same way as a dryer. This treats clothes more gently, since they aren't being pulled and pushed by the agitator. Clothes get picked up and plunged into the water, while baffles pick up additional water and pour it over the clothes. Maytag claims tumbling not only requires less water, but also gets clothes cleaner.

The Neptune washer from Maytag uses less water than a conventional washer, and features a front-loading design. A matching dryer is also available.

How much less water does the Neptune use? According to Maytag, washing one load a day in the Neptune, instead of in a conventional washer, will save as much water in one year as you'll drink in a lifetime.

Water isn't the only resource the Neptune is designed to conserve. Because less water is required, you'll use less gas or electricity to heat it. You should also reduce the amount of energy required to heat your dryer, because the Neptune's spin cycle removes up to 30% more water than a conventional washer does.

The Neptune washer and its matching dryer feature ergonomically designed controls. Both also offer doors you can reverse to open from either direction, an industry first.

The Neptune washing machine sells for $999. The matching dryer is $499. For more information, call Maytag toll-free at (888) 4MAYTAG, or check out the Neptune web site at http://neptune.maytag.com.

Pool Safety Warning System

A swimming pool is a great place for family recreation and entertainment, but it's also a potentially dangerous place for children when they are left unsupervised. In fact, over 4,000 children drown every year in unattended swimming pools.

The Pool S.O.S. is designed to help prevent these tragedies by sounding a loud (85 decibel) built-in siren if a child accidentally falls in.

When you're not using the pool, float the alarm on the water. Its dumbbell shape keeps it floating steadily to prevent false alarms. If a child falls in, the waves strike a sensor, activating the loud siren instantly.

The warning system is factory-set to react to the impact of a 40 pound child. At that setting it can withstand up to 40-mph winds without sounding any false alarms. The system's sensitivity is also adjustable.

The Pool S.O.S. is approved by the American Red Cross and runs on a 9-volt battery (housed in a waterproof compartment). Included with the system are postcards you can give to your neighbors to let them know what to do if they hear the siren.

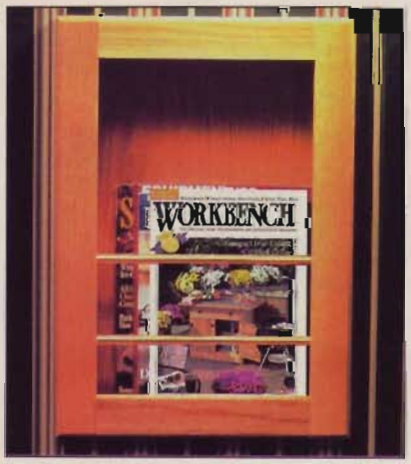
The Pool S.O.S. sells for $59.95. For more information call Misty Parker Gifts at (603) 464-4839.

Paper Stripper

New DIF Gel Wallpaper Stripper from Zinsser is formulated to make removing wallpaper easy and to eliminate the mess caused by steam or liquid strippers.

Here's the theory: Gel clings to vertical surfaces and stays wet longer, so enzymes in the stripper have time to penetrate and break down the adhesive. Wallpaper will be ready to remove in 20 to 30 minutes.

DIF GEL is nontoxic, and available at home centers and paint, wallpaper, and hardware stores for about $13 a gallon. Call (908) 469-4367 for a free consumer information booklet.



Magazine Keeper

Let's face it. People read in the bathroom. But there's seldom a place to keep reading materials.

The In-Wall Magazine Case from Arbor Hill fits between wall studs to provide out-of-the-way book and magazine storage. Oak or white-lacquered models with matching wood rails sell for $69.95. With brass rails the price is $79.95. Contact Arbor Hill at (800) 834-2504.

Ames Garden Cart Carries Big Loads

Hauling your supplies to the garden usually means making several trips. With the new Planter's Wagon from Ames, you can haul up to 200 pounds of gardening essentials in one trip.

The molded plastic wagon has a center tray to hold pots, soil, mulch, and flower flats. You can fold the handle down to use as a seat while you work. Compartments in the rear and side provide storage for hand tools and other necessities, while side clips hold long-handled tools.

For traveling over rough terrain, there are large rear wheels on steel axles, and the swiveling front wheels allow easy turning. Sockets around the rim accept side stakes to secure bags of soil or mulch.

The Planter's Wagon comes fully assembled and is available in home and garden centers for around $90. For more information, contact Ames at (800) 624-2654.

Lock Boring Unplugged

My partner and I instantly recognized the muffled boom as a blown electrical transformer. "Squirrel, probably," he said. I nodded grimly. Both of us knew that we wouldn't finish the trim carpentry today without electricity. And by the time the general contractor got through with us, we would envy the squirrel's fate.

In minutes, we had used up all the air in our compressor and our pneumatic nail guns sputtered to a stop.

At that moment, a voice from behind us asked, "Mind if I take a peek?" It was almost like the elderly neighbor was requesting permission to board a ship. He looked around quietly for a minute, then asked, "Why don'cha drill the doors while you're waitin'?" After my partner silently pointed to the limp power cord on our 1/2" drill, the neighbor smiled and said he'd be right back.

When he returned and opened the gray sheet metal box, we saw the label pasted inside the lid identifying this tool as an Elgin model 5617 Lock Boring Set. "Got it at Sears Roebuck in the 1940's, back when my brother and me was trimmin' houses", he said.

Then he showed us how it works. He drew one pencil mark on the face of the door at the lock height. After matching that mark with the centerline machined into the jig, he twirled the wing knob to lightly hold the self-centering tool body to the door. Cinching the star-shaped knob transformed this friendly handshake into an iron-fisted grip, driving a sharpened circle into the rear face of the door. The ring sliced the wood to prevent tearout.

His experienced hands fitted the threaded shaft of the drill bit between the split feeder bushings and snugged a wing nut. The long handle gave him enough leverage to bore a 2 1/8"-diameter hole through the pine door in under 30 seconds without breaking a sweat.

The electricity was back on when we returned the tool to its owner and related our amazement that we were ahead of schedule. The veteran carpenter winked and said, "Not every powerful tool has an electrical cord."