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COUNTRY SKILLS SERIES

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TRACTOR PLANS
P. 56

GUIDE TO HOMESTEAD DIY PROJECTS

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GRIT

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Create your outdoor cooking feature, and make it the focal point of all your backyard gatherings.

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FEATURED COMMENT

“That’s a mighty fine looking pioneer gate you made. It’s always good to use what you have to make what you need. Sometimes I wish I had a bigger place to be able to find trees and saplings to make arches and fences as well as a ready source for rocks to use for things around the yard. It just isn’t going to happen. I’ll just have to continue to get rocks and things from folks taking out retaining walls and branches from those who have me trim their trees. Thanks for keeping that pioneer spirit alive.”

– Nebraska Dave on “Homemade Pasture Gate: Woodlot to Fenceline Project”

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SEND US YOUR PHOTOS

Are you the handy man or woman at home? Do you often have home and garden improvement projects in the works? Send us your photos and a few details about your DIY projects, either current or completed. Send them to ktrimble@grit.com, and the photo may be featured on our social media or in a future issue of the magazine.

RURAL COURIER

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92 percent of GRIT readers consider themselves do-it-yourselfers

46 percent of readers have built a storage shed or barn

JOIN THE CONVERSATION

On “How to Make Hugelkultur Raised Beds” by James White

“Has anyone built a hugel-berm up against a house’s crawl-space wall? In a cold, wet climate like Ohio? It would seem to have not only a temperature-moderating effect but also wind damage abatement potential, with a gravel path at the edge to keep storm water controlled.” – *MJR, via Grit.com*

“I would think something against the house may create an issue with drainage under the house or even into a basement area without proper drainage under the mass. I could be wrong. I went on a farm tour here and the man was doing the same thing but called it permaculture. This is definitely a great way to do things, yet it’s also long term and takes a lot of planning where to do this – since once it’s in place, it can never be moved.” – *Jim, via Grit.com*

“I read about hugelkultur a couple years ago when clearing out a vacant lot with trees that had to be cut down. I haven’t really given it a try yet, but it’s on the list to do in the future. The articles that I read were a little more labor intensive. They suggested digging a trench first, filling it with wood branches, paper and cardboard, then covering up the pile with the soil from the trench. They suggested letting it lay dominant for one year for the nitrogen reason that you indicated, then plant away for the next 25 years. I like your method better. No digging a trench.” – *Nebraska Dave, via Grit.com*



READER BLOGS

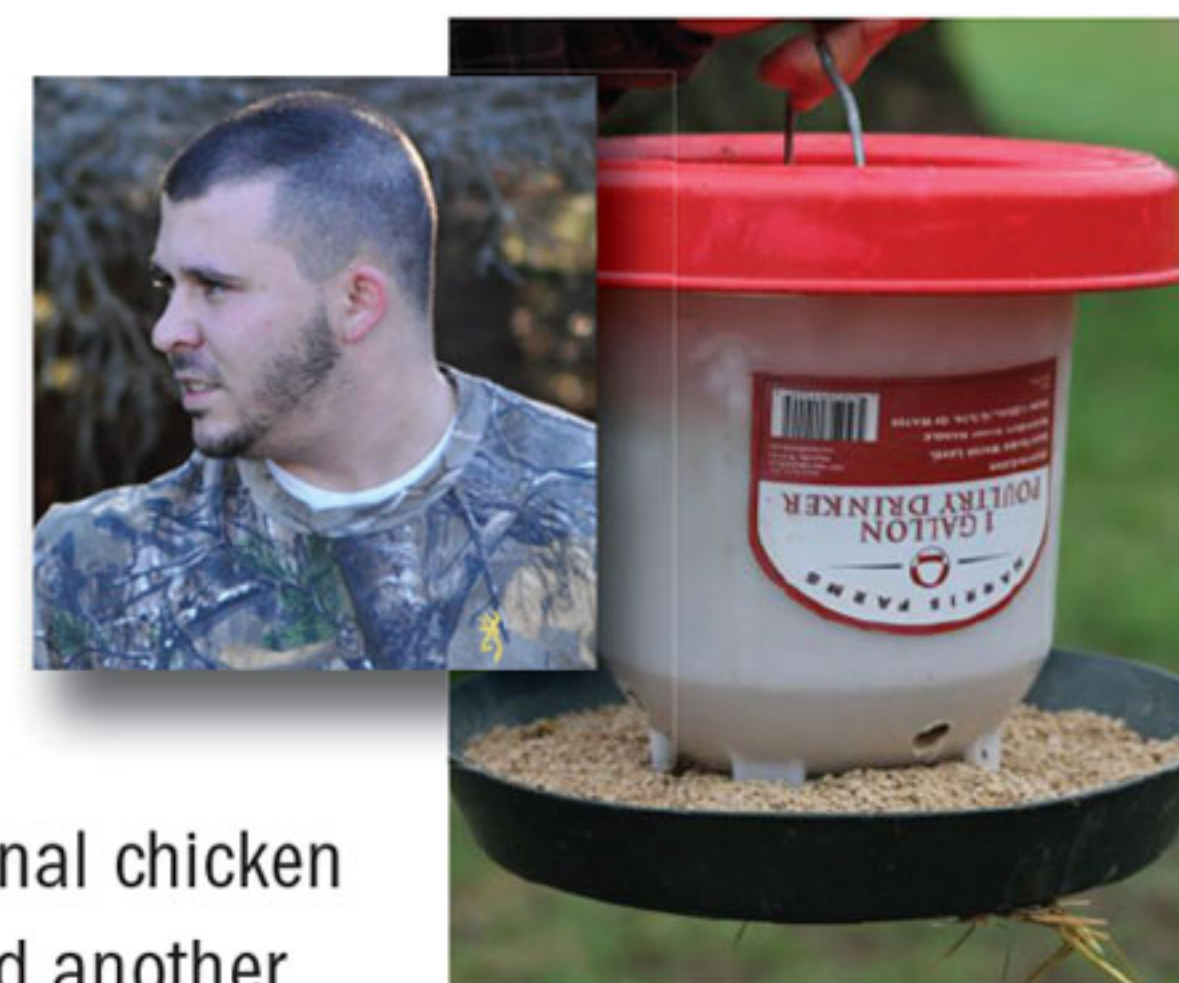
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How to Turn a Busted Chicken Drinker Into a Busy Chicken Feeder

by Backwoods Brandon

“A few days ago, I was looking for an excuse to take a short break from our fence-building project. My hands were full of blisters and pin holes from stretching welded wire, and I needed a little change of pace. So, I decided to redeem myself by turning the busted chicken drinker into a fully functional chicken feeder with supplies I had laying around the barn. We’ve needed another feeder in the coop since we introduced our 10 young hens, anyway. So, we got to it.” – from “Heavy Hardwood Corner”

Brandon lives in northern Michigan with his wife, Becky, and 3-year-old daughter, Bella. Together, they seek self-sufficiency on their 10-acre homestead by growing, hunting and preserving much of their own food.



A Quick and Easy Fruit Picker

by Allan Douglas

“If you’re looking for a quick and easy-to-make tool for picking fruit in the fall, try this. Mine took only about 20 minutes to make. (I’ll put in some more time later being fussy about it, but you wouldn’t have to do that.) By using a screw to hold the picker on the end of the handle you can easily make and install a new one each season if you’re rough on it and it cracks, and it costs next to nothing to make – 3 cents for the screw, and the rest was scrap that was lying around.” – from “Of Mice and Mountain Men”

Allan lives among the Smoky Mountains of eastern Tennessee. He enjoys the simple life along with the challenges of slope-side gardening.



Of GRIT Readers Surveyed

- 52%** consider themselves somewhat skilled at repairs and projects
- 12%** consider themselves extremely skilled
- 65%** have reused wooden pallets for a DIY project
- 45%** have built a storage shed or barn
- 45%** have made a chicken coop or chicken tractor
- 81%** have completed garden devices like cold frames and trellises



How to Stack Firewood for Seasoning and Storage

To ensure your firewood is seasoned correctly and protected from the elements, it must be properly stacked and stored. Well-seasoned firewood is the key to a clean-burning fire, as wet or unseasoned wood will create a lot of smoke and cause creosote buildup in your chimney. Watch as Managing Editor Caleb Regan demonstrates how to stack a woodpile for efficient seasoning.



Using a Garden Cultivator

Weeding and cleaning up garden beds can be a back-breaking chore. A rotary cultivator saves time and makes a great addition to any gardener's arsenal of tools. They also act as a great alternative to heavy, gas-powered machines. Watch Contributing Editor S. Jason Cole demonstrate how to knock out weeds between garden rows with his cultivator.



How Long to Keep a Brooder Lamp on Baby Chicks

Are you new to raising chickens? Have your first batch of chicks in the brooder? Editor-in-Chief Hank Will sits down to discuss brooder dos and don'ts. Get expert advice on keeping chicks healthy in the brooder and when they are ready to be introduced to the coop.



How to Churn Butter

Butter is a key ingredient for biscuits, pies and pastries, and adds rich flavor to meat and vegetable dishes. Home cooking simply would not be the same without it. Learn how to turn fresh cream into the best you've ever tasted. Assistant Editor Kellsey Trimble takes you through the steps of making homemade butter in this cooking tutorial.



Backyard Blacksmithing

Getting started with blacksmithing can be easier than you think. A little creativity goes a long way when it comes to finding materials that will work for your forge, anvil and blower, as well as finding a few hammers and other hand tools. Meet David, a long-time backyard blacksmith, and discover how he manages to forge knives, tools and more with just a small set up.



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GRIT

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Tips for Saving on DIY PROJECTS

With so many ideas and so little money, we offer nine ways to save money on that endless list of do-it-yourself projects.

By ANDREA WOROCH

As the leaves start to fall and the temperatures drop, we start to think about the holidays and entertaining our family and friends. And, we realize there's some serious work to be done around the house. Fall is a great time to work on home-improvement projects, so if you're thinking about stocking up

on supplies for your most pressing project, consider the ways you can save when you do-it-yourself:

1. Big box vs. small stores

For the frugal consumer, shopping smart is always a logical first step. When you're shopping at the big-box home improvement stores like Home Depot and Lowe's, there are always deals going down.

The two heavyweight retailers are highly competitive, and both stores offer price matching with an additional 10-percent discount on identical products advertised at a lower price at any competing store. Both stores also post weekly sales, discounts and rebates on their websites so you can be prepared before you hit the store. Not to mention, you can always find coupons for these home and garden giants.

On the other hand, locally owned home-supply stores, like Ace Hardware, often provide email sign-ups that allow you to receive special deals on the same or similar items you would find at the big-box stores. While you may not be able to purchase Sheetrock, the smaller places may carry everything from plumbing supplies to finishing notes for your home. There is also the added appeal of supporting locally owned family operations.

2. Tester cans and used paint

Next to buying a nice area rug, painting is probably the easiest way to change the look of a room. Unfortunately, home improvement stores are aware of this and they like to make you pay for it. There are definitely ways to get around the high prices though.

If you only have a small space to paint, there's no need to invest in a whole gallon of paint that'll inevitably take up space in the garage or closet. Ask about small tester cans that can often be found for \$5 or less in a variety of colors.

The word is starting to get out on used paint, too. When people order large amounts of custom paint, they often order too much. This paint gets returned to the stores, but the merchant can't put such cans back on the shelf with the rest of the paint. If you're in the right place at the right time, you might be able to get gallons of paint for around \$5. Not all stores will have used paint, but it doesn't hurt to ask.

3. Buy lumber in bulk

Working with lumber can be intimidating. It requires precise measurements and cuts, or you'll end up wasting money and materials. Prices vary by lumber grade and wood type, so be aware of what materials are required to get the job done.

4. Generic vs. name brand

There's an incredible variety of nails and screws available, but how much of a difference is there, really? Generic brand nails and screws are often up to par with the name brands but cost significantly

less. In some cases, the only difference between a generic and the name brand is the box!

The same can be said for pipes and plumbing fixtures. Unpackaged fixtures in a bulk bin can have the same quality as their packaged counterparts on the shelf, but cost much less. Longevity is also something to consider when working on a plumbing project. Copper pipes and PVC pipes typically give you the most bang for your buck, lasting up to 60 years.

5. Caulk singles

Caulk certainly won't be the most expensive item on your home improvement list, but it's useful for patching up holes and sealing cracks. Often when people buy a tube of caulk for a small project, they end up making a mess of it and throwing half the tube away.

If you want to keep some caulk around for projects that spring up, try out some caulk singles from General Electric. Much like the fast-food ketchup packet, they're enough for one project and cut back on waste and mess.

Watch for coupons to home centers like Home Depot that offer General Electric's caulk singles.

6. Government rebates

When cold weather is on the way, you can replace your old windows and doors with more energy-efficient ones. While it's a big project, it may be worth it when you save on heating costs next winter.

7. Buy reconditioned or rent power tools

It's hard to justify buying an expensive power tool, especially when you know you'll never use it again. If you live the DIY credo, Home Depot rents such power tools as power washers, paint sprayers, chainsaws and buff sanders. By renting, you'll get the professional finish you want with-

out having to cut corners on expensive equipment.

Many power-tool manufacturers have online outlets where they sell reconditioned tools at a discount. These tools are certified by the manufacturer, so you have a guarantee that they'll work. Also check company websites and other online sites for possible coupons.

8. Used hand tools

The garage sale may still be king for finding good deals on hand tools. Many people don't enjoy inherited tools and are willing to part with them for next to nothing, compared to new tools. Wrench sets, hammers and screwdrivers made by quality toolmakers like Craftsman and Stanley can stand the test of time and are as good today as they were 30 years ago.

9. Working together

No one escapes a little home maintenance from time to time. If you and a neighbor are working on similar projects, sharing the cost of renting a wood chipper or cement mixer can save both of you time and money.

While skilled friends and family don't necessarily enjoy manual labor, they can be coaxed into it with the promise of good food, drink or a labor exchange to be named later. Working with friends gets the job done faster and is usually much more fun. 🛠️



How to Build a CHICKEN FEEDER



Feed your flock securely without encouraging mold or supporting the local mouse and starling populations.

By JEFF NICKOLS

Whether you have a large laying flock or just a few backyard hens, keeping them fed is a regular chore (never mind the expense), especially if the feeder isn't weatherproof and allows rodents and wild birds access. One way to keep the feed safe from spoilage and pilferage is to keep it covered – but how will the chickens gain access? Through a bit of physics, it's possible to employ some carefully designed levers and fulcrums that will cause the feeder to open when a chicken (or an object of similar weight) steps on a perchlike treadle. The best part is that you can build a treadle-opened feeder yourself – in fact, it makes a fun weekend project that can be completed with common tools and basic carpentry skills. You

will be pleased with the result because the feed is kept dry; songbirds, mice and other rodents can't get in the feed; and less feed is wasted by the chickens scattering it, and the feeder will hold several days' worth of food.

Using the feeder

This was our first time raising chickens, and when I first put the feeder out, the chicks were too small and frightened to raise the lid by themselves. I put a brick on the treadle and left the lid up for a few weeks. After the chickens got used to standing on the platform to eat, I removed the brick. They had no problem adapting to the treadle after that.

Several people have been concerned that the feeder will become some type of decapitation device, clamping down on a chicken's head, leaving the chicken running around like a ... well, you

CONSTRUCTION

TOOLS:

- Table Saw
- Drill with countersink drill bit
- Hand saw (I recommend the finer-cut Japanese pull saw)
- Electric sander or sandpaper
- Miter saw (optional)
- Air nail gun (optional)

MATERIALS LIST:

- 2½" x 16" x 72" paint-grade, edge-glued pine panel (1)
- ⅝" x 6" x 72" cedar fence board for lid, trim and treadle (2)
- #6 1½" wood screws (40)
- #6 1" wood screws (4)
- Exterior wood glue
- Primer and paint of choice

FEEDER BOX

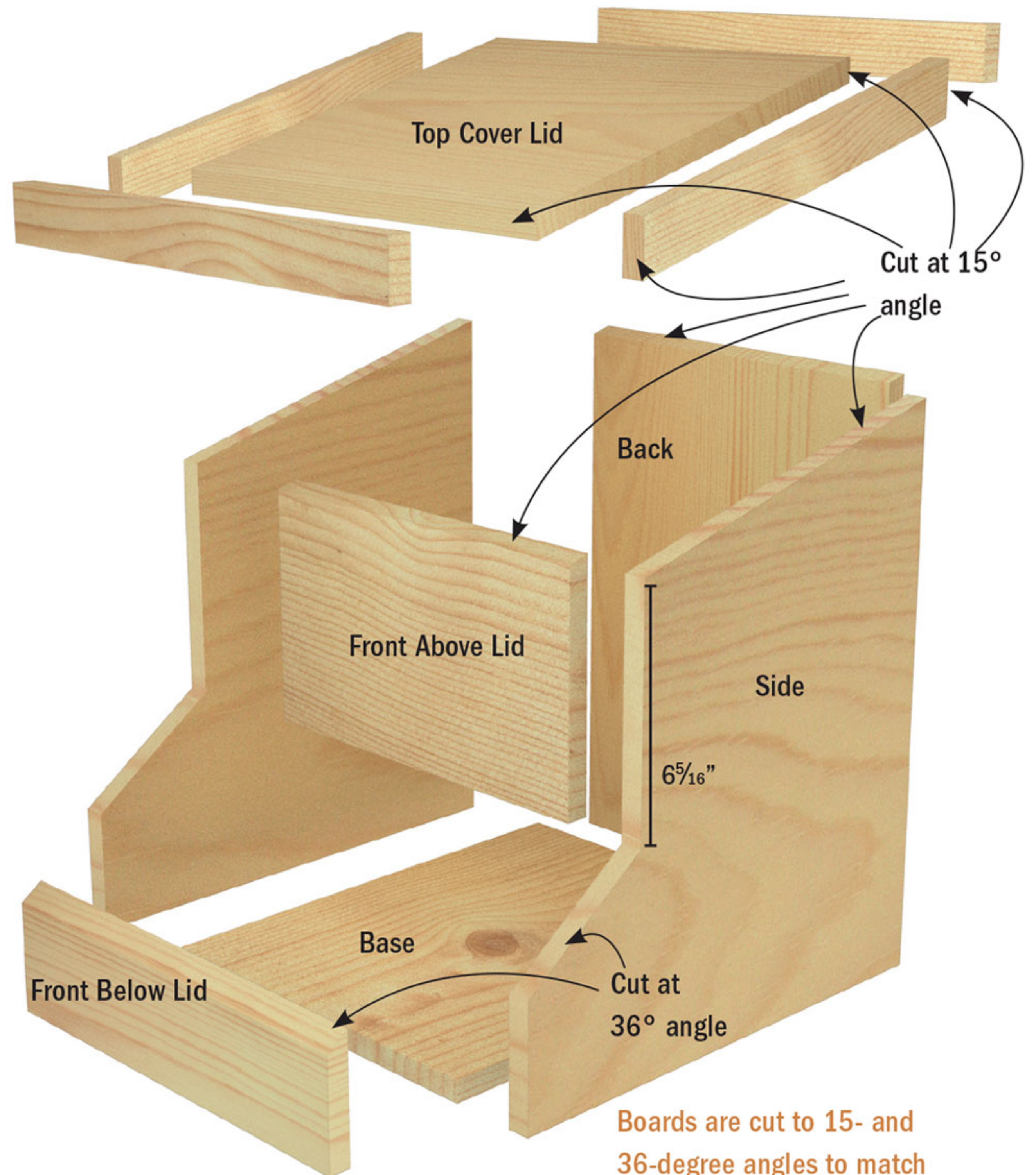
1. Attach sides 1 and 2 to the base using 1½-inch wood screws and glue.
2. Attach back of feeder to the sides and base with 1½-inch wood screws and glue. The 15-degree angle along the top should be flush with the angle of sides 1 and 2.
3. Attach the 2 front pieces to front of feeder with 1½-inch wood screws.
4. Attach the 1½-inch cedar trim pieces to the top of the lid board so that the lid will nest over the top of the feeder box.

HINGED TROUGH COVER

5. Attach the 6-inch-wide cedar board to the 1½-inch cedar arms using 1-inch wood screws. The cedar splits easily, so predrill carefully.
6. To attach the cover to the feeder, I put the cover in place in the closed position, and then marked my attachment point on the feeder box. I experimented with using wooden dowels, machine screws, and various nuts and bolts. All of them worked fine, but not any better than using 1½-inch wood screws.
7. Remember not to screw the arms tight to the side of the feeder, leave some wiggle room for the cover to swing freely.

FEEDER BODY AND COVER

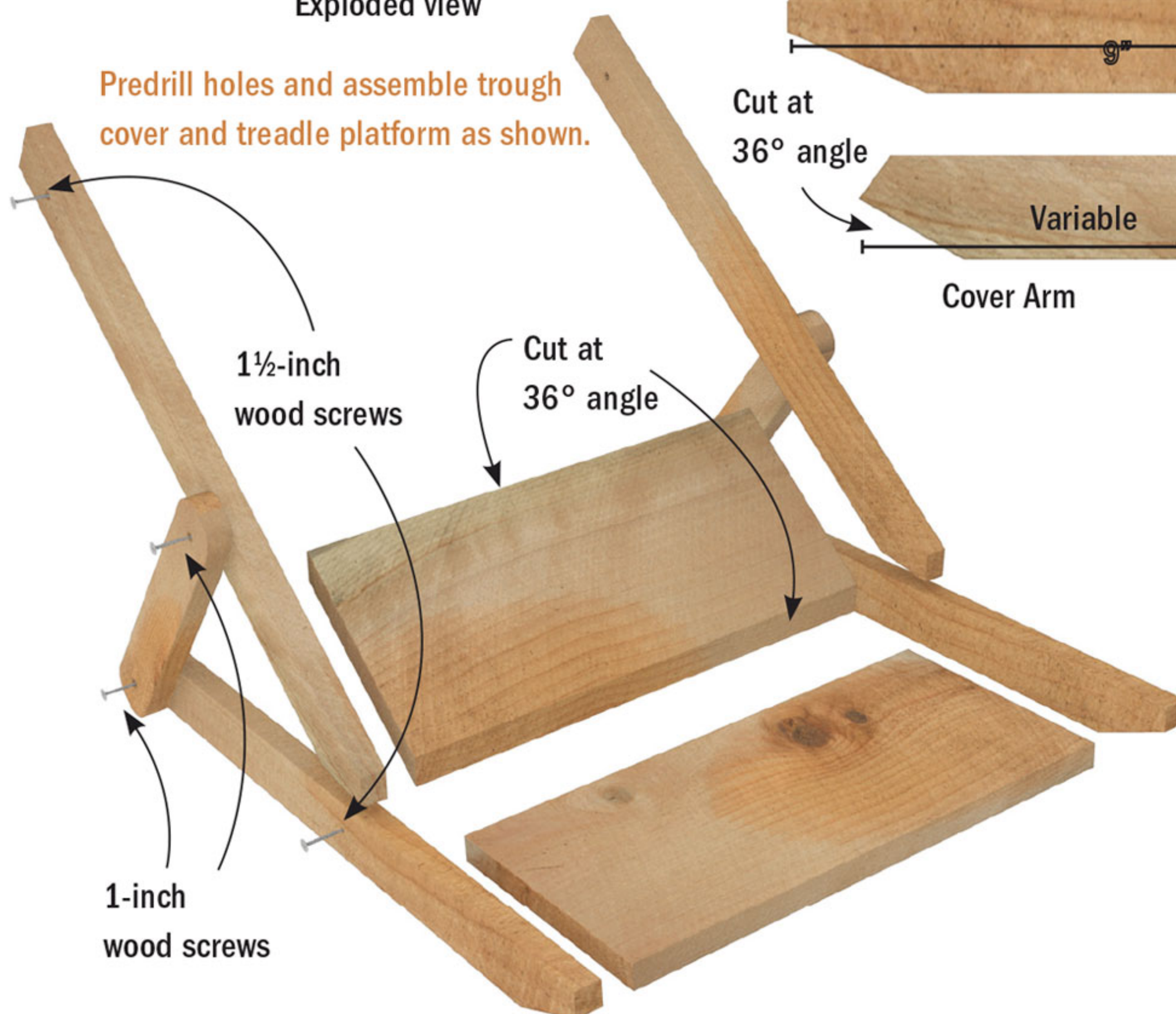
Exploded view



Boards are cut to 15- and 36-degree angles to match the lid and the top cover, then screwed together.

TROUGH COVER AND TREADLE

Exploded view

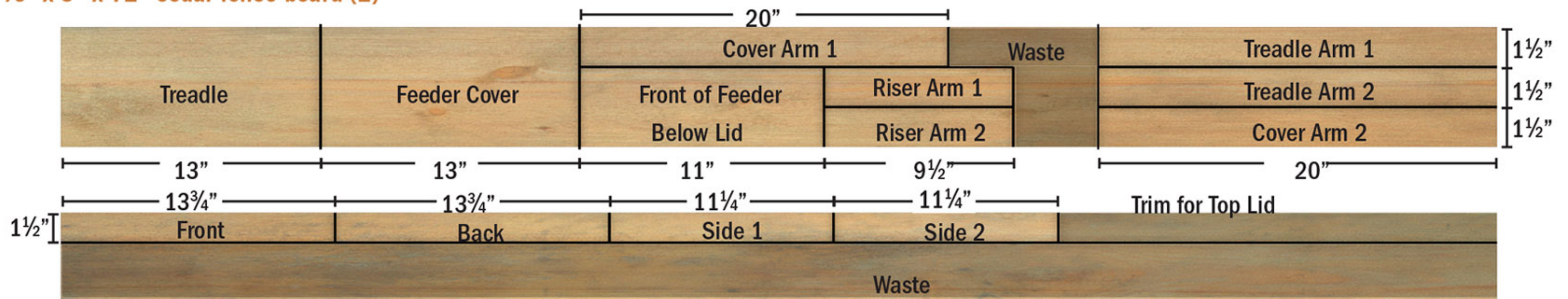


TREADLE PLATFORM

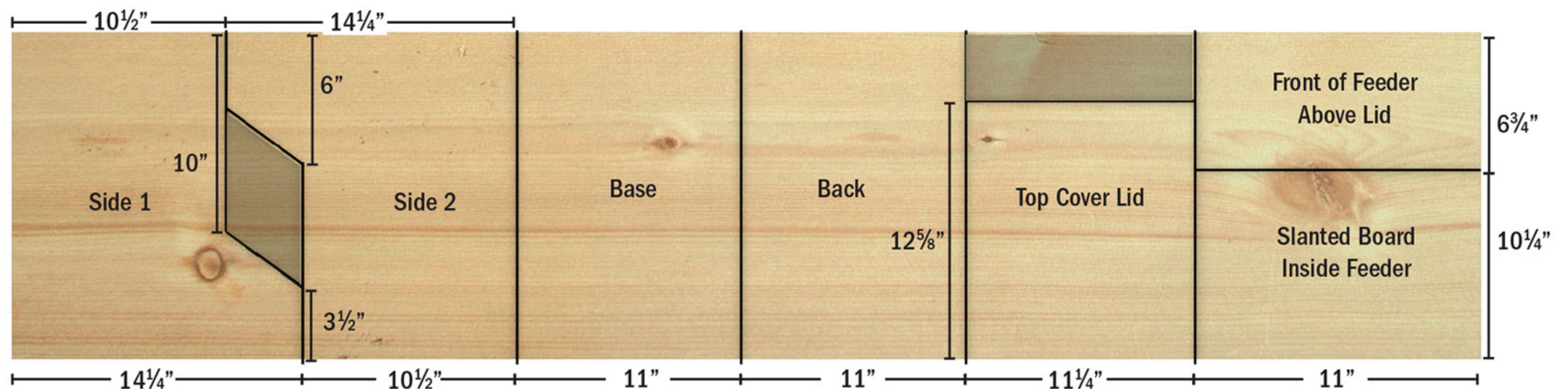
8. The treadle is constructed in the same fashion as the trough cover. Attach to the feeder box with 1½-inch wood screws 9 inches from the front end of the platform.

CUTTING DIAGRAMS

$\frac{5}{8}$ " x 6" x 72" cedar fence board (2)



$2\frac{1}{32}$ " x 16" x 72" paint-grade, edge-glued pine panel (some waste not shown)

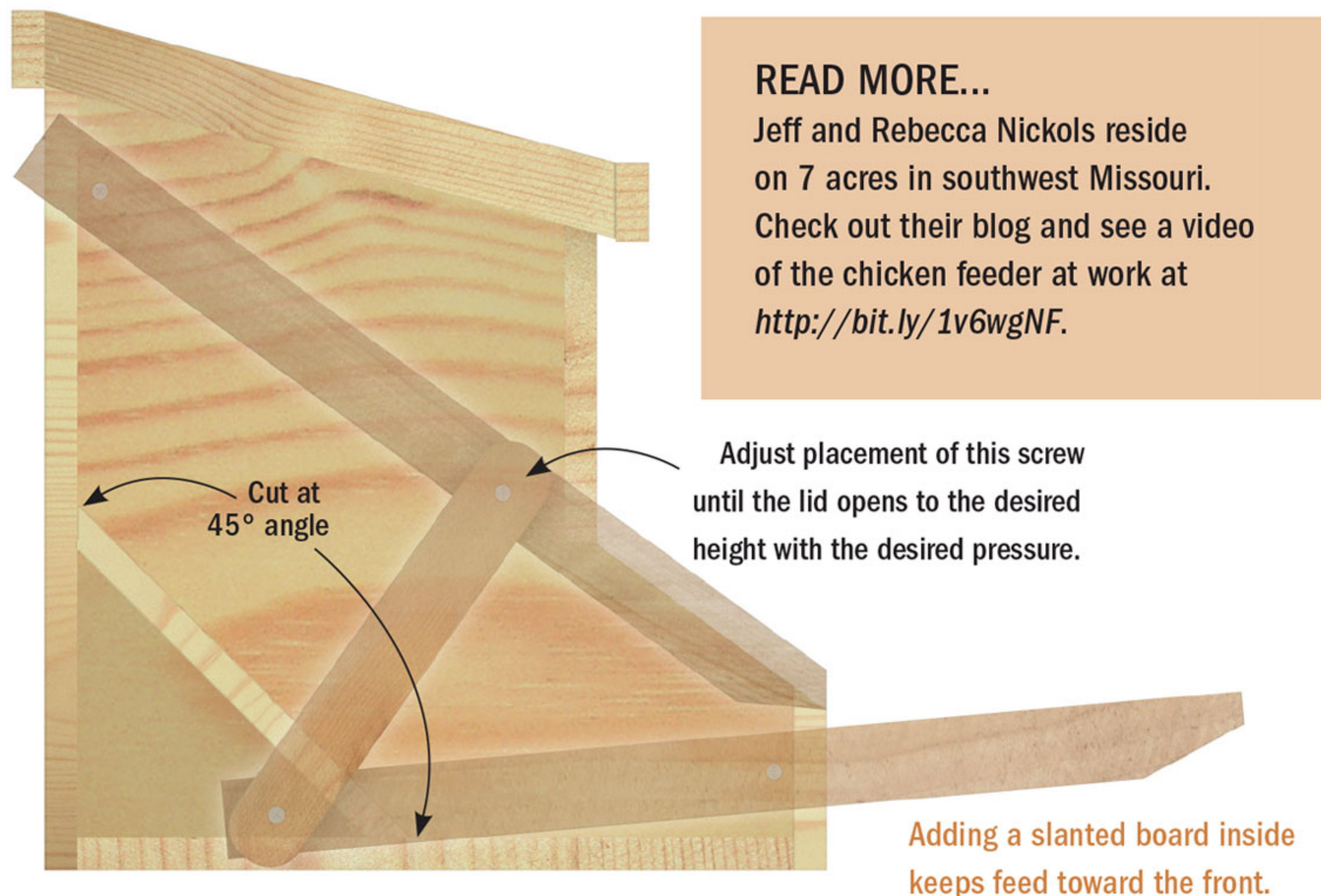


know. First, cedar is a fairly light wood, so the lid does not crash shut with a lot of force. Second, chickens learn quickly; they only have to get whacked on the head a couple of times before they figure it out.

The first few days after removing the brick from the treadle, I did notice a process I called “eating from the side.” One chicken would stand on the treadle eating, while a second chicken would come in from the side and start eating without being on the treadle. When the first chicken finished eating and stepped off the treadle, the second chicken would get whacked on the head. Our chickens are growing just fine, and they don’t seem to have suffered any harm; they’re every bit as entertaining as they’ve always been.

I constructed my feeder using one $2\frac{1}{32}$ -inch-by-16-inch-by-72-inch edge-glued pine panel for the body of the feeder and two $\frac{5}{8}$ -inch-by-6-inch-by-72-inch cedar fence boards for the trim and arm pieces. You may substitute plywood for the pine and cedar boards.

I used scraps from my chicken coop construction for the first feeder I constructed. Even purchasing all of the lumber, the cost was less than \$20: \$15.79 for the pine panel and about \$2 each for the cedar fence boards. Add a few wood screws and wood glue, and you have all the supplies you need to get started. 🐔



READ MORE...

Jeff and Rebecca Nickols reside on 7 acres in southwest Missouri. Check out their blog and see a video of the chicken feeder at work at <http://bit.ly/1v6wgNF>.

RISER ARMS

9. The riser arms are screwed to the treadle arms 1 inch from each end using 1-inch wood screws. With the riser arms attached to the treadle, depress the treadle all the way down, as if a chicken were standing on it, and then raise the trough lid as wide open as you would like it to be when in use. Put a board or brick on the treadle so you don’t have to hold it. Now you can attach the riser arms to the trough lid using 1-inch wood screws. Mine is 7 1/2 inches from the front of the trough lid. The farther away from the hinge point you attach the riser arm, the less force it takes to raise the lid, but the lid will not open as wide. The farther back you attach the riser arms, the more weight required to open the lid, but the lid opens wider. If you are starting off with small chicks, adjust the riser arms further from the hinge point — it is easy to adjust this mechanism as the chicks grow.

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PROJECTS

For the Homestead

Ingenuity abounds in rural settings, as these inventors provide details on projects to help you make the most of your homeplace.

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Small Square Bale Feeder

“My grandchildren take care of bottle calves as 4-H projects, and feed small square bales when the calves start eating hay and grain. When hay was fed to them on the ground or in a regular bunk, the calves wasted a lot of hay. So I built this single bale feeder that greatly reduces waste,” says Donald Scholz, of Grand Island, Nebraska.

The feeder is built out of 2-by-4, 2-by-6 and 2-by-12 lumber, and has a 12-inch-wide trough all the way around that catches alfalfa leaves as well as stems. The trough is also used to feed grain and pellet feed.

The bale cage at the center is built with 1-inch-diameter 14-gauge tubing and 1-inch angle iron. It measures 18 inches wide by 46 inches long by 15 inches high.

A 1-by-6-by-36-inch board bolted to a chain is used to hold the bale down in the cage. The chain is welded to the

top bar at one end of the cage, and snap hooks connect to a ring welded to the top bar at the other end.

“I don’t have a drawing of my feeder, but I’d be glad to help anyone interested in building one,” says Scholz.

For more information, contact Donald Scholz at 308-687-6430.

Wind-Powered Scarecrow Helps Deter Critters

By Linda Greer

To keep crows, squirrels and rabbits from raiding his wife’s vegetable garden, Darren Holliday, of Myrtle, Missouri, knew there had to be a simple “no-kill” solution. Lots of fancy garden gadgets are on the market, but he finally decided to go with an idea that’s centuries old: a homemade scarecrow.

The unusual part of this case is that Holliday wanted a scarecrow that would be lifelike, with motion and noise. He came up with a man-sized mannequin that turns with the wind and is fitted with wind chimes.

Holliday used scrap PVC pipe, woven wire, plywood and metal pipe.

The plywood warning sign attached to the scarecrow’s upraised arm works as a sail, pointing the scarecrow in the direction of the wind. There is a comical warning to critters on the front of the sign, and a set of owl eyes painted on back.

Wind chimes, made from pieces of electrical conduit, dangle from the scarecrow’s lower arm, jingling in the



Donald’s invention has a bale cage at the center and a 12-inch-wide trough all the way around.

breeze. Holliday's wife made the head out of panty hose, using pillow stuffing, buttons and yarn.

He says it's a fun addition to the garden and is easy to move around to keep pest animals guessing. For questions, email Darren Holliday at darren@wellwaterboy.com.

Low-Tech Watering System

Clark Kadis, Longmeadow, Massachusetts, wanted to try his hand at vegetable farming without spending a lot of money. He needed a cheap way to water his plants, so he used a 55-gallon plastic barrel to build an inexpensive gravity-fed waterer that he pulls behind his four-wheeler.

It's equipped with a 3-foot-long boom on one side of a two-wheeled trailer that the barrel sits on.

"It's simple and easy to operate," says Kadis, whose vegetable garden measures 400 feet long by 250 feet wide. "I worked for seven years for a commercial vegetable grower who uses raised beds with drip irrigation and plastic mulch for weed control. I wanted to try it without a lot of expense, but to do that I needed a way to water right after planting. I grow pumpkins, green and wax beans, turnips and carrots."

He leaves a 5-foot-wide unplanted area between each set of rows, where he drives the ATV and waterer. "I go back and forth down the field. I use the same gaps at harvest with the ATV and a wagon to collect buckets of vegetables," Kadis says.

The watering pipe is made from 1/2-inch-diameter PVC and attaches with connectors to the bungee hole at one end of the barrel. It has a series of holes spaced about 1 inch apart and is equipped with a shut-off valve and an end cap.

"It works well. I use the shut-off valve to adjust how much water comes out of the holes," he says.

"The end of the pipe is braced by a rope that runs up to the top of the barrel. I cut a hole on top of the barrel to fill it. I run a rope over the top to keep it from bouncing around."



PVC pipe makes the frame for Darren Holliday's wind-powered scarecrow; a sign warns off the critters, though it's true purpose to provide the sail for the wind to push.

Make a Sturdy Workbench Base

When Scott Bruce of Ozark, Missouri, found an old straight-six engine block at a dump, he used it to build a heavy-duty workbench.

He says the workbench works great for just about any project. "It can hold an anvil and tolerate any amount of hammering, welding, cutting or grinding, and there's a metal rib running down the middle that's useful for clamping projects of any shape in place. Also, the solid weight of the engine block base ensures the workbench isn't going anywhere," Scott says.

He inserted lengths of sewer pipe into cylinder holes at each end of the engine block to serve as legs. The pipes fit into the holes with very little play, adding stability.

To further secure the legs to the block, he made a locking collar out of horseshoes. He heated the horseshoes with a torch and then beat them to the engine block around the circumference of each pipe. Then he welded the



Clark Kadis' do-it-yourself ingenuity makes for cheap and easy watering.



Lengths of pipe inserted in engine block support the tabletop.

horseshoes to the pipe and the block. A similar collar was created at the bottom of the block.



Jordan and Ann Qualm cut the heavy plastic cores from field tile into 20-inch lengths to create tomato cages.



Using the wooden wheelbarrow his dad used for some 50 years, Jack McGee updated it by carving new handles and building a slatted bed, leaving the sides open for hauling long lengths of firewood for his outdoor stove.

The next step was to create a tabletop using sections of a junked trailer ramp. He welded two ramp sections together to make a rib that runs down the middle of the tabletop. Then the tabletop to the pipe legs, first notching the pipes where they meet the tabletop. The final step was to bolt a vice to the tabletop.

For more information, contact Scott Bruce at scottb4kfarms@gmail.com.

New Life for an Old Wheelbarrow

On his Michigan farm, Jack McGee makes a special connection with his deceased father every time he hauls a load of firewood. McGee uses the same wheelbarrow frame his dad used for 50 years. “We’re going to get another 50 years of use out of it,” McGee says.

The Lake City, Michigan, building

contractor sanded and repainted the legs and hardware that held the wheelbarrow’s original tub and steel wheel, and he purchased a new wheel and tire.

He carved handles out of 2-by-2 ash and used ash boards to build a slatted bed. He left the sides open in order to haul long lengths of firewood for his outdoor stove, but he uses the wheelbarrow to haul other stuff, too.

“Ash works well because it’s strong but lightweight,” he says.

For more, send a letter to Jack McGee, 4330 W. Houghton Lake Road, Lake City, MI 49651.

Tile Cores Make Great Tomato Cages

If you or your neighbors are having field tile work done this fall, you may want to save the plastic cores that the tile comes on.

Jordan and Ann Qualm of Sherman, South Dakota, cut the heavy plastic into 20-inch lengths to create cages for some of their tomato plants.

“The plants with the tubes have grown more upright and don’t have a mess of vines like the plants without,” Jordan Qualm said.

“With these tubes there’s no need for wire cages, in my opinion.”

In the spring, the black color warmed the ground and plants to give them a good start, and despite a hot summer, the dark color didn’t seem to add heat stress. Instead, the cores helped shade the plants and hold water. The plants in the core tubes were the first to have ripe tomatoes, which are easier to pick as they cascade over the side of the tubes.

Instead of setting plants 2 feet apart, the Qualms planted them farther apart, about 3 feet.

Qualm used a reciprocating saw to cut the 18-inch-diameter cores and plans to make more for next year’s garden. For more information, send a letter to Jordan Qualm at 48782 252nd St., Sherman, SD 57030, or call 605-594-2290.

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A Homemade RECYCLED Tomato Cage

Use PVC pipe for an easy-to-build, storable and easy-watering tomato cage that will last season after season.

By DOUG THALACKER

It was the best of times ... it was the worst of times. My success fed my failure. My tomato plants were wonderful, huge with lots of fruit – yes, botanically tomatoes are fruit – slowly ripening in the warm summer sun. I was failing because those tiny wire tomato cages I was using kept falling over, stressing and sometimes breaking the stems.

This was the situation by the end of the summer: My tomato patch looked like a modern art sculpture – string, wire, wooden stakes – all intertwined with tomatoes. Anything to hold up those plants until harvest. I had to find something better by next summer, something inexpensive, lasting, easy to store and strong enough to hold my plants. As I thought about it, the scrounger in me took over.

Materials

Three 3-foot-3-inch (or longer) pieces of white PVC pipe, or cut a 10-foot piece into three equal pieces.

A total of 15 feet of electrical conduit, cut into six 20-inch pieces. **NOTE:** The dimensions can vary. If you're scrounging, any size will work.

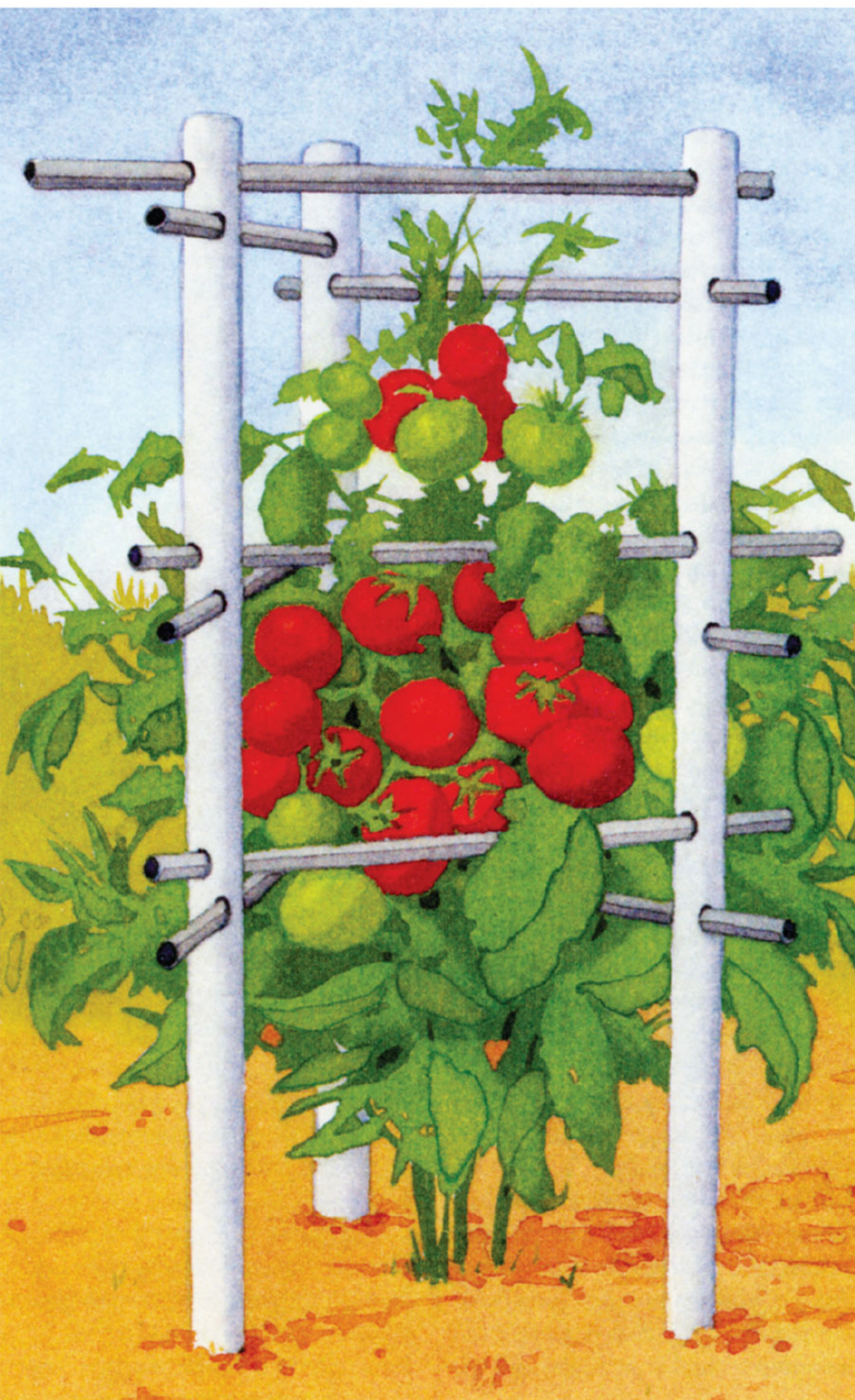
Tools: hack saw, electric drill or brace, half-inch drill bit.

Tomato cage construction

Step 1: Cut the PVC and electrical conduit to length.

Step 2: Hold or tape the three pieces of PVC together as shown in the illustration (opposite page). Use a straight edge to mark the ends as shown. This ensures that the holes will be at the correct angle to each other for the cross pipes.

Step 3: Tape together the two pipes marked "A" so that all the "A" marks are lined up. By drilling the two pipes together, it guarantees that all holes will line up even when you drill the holes less than perfectly perpendicular, which is easily done if you are using a hand drill. Drill one set of holes about 2 inches from the top and the second set of holes about in the middle. If you want



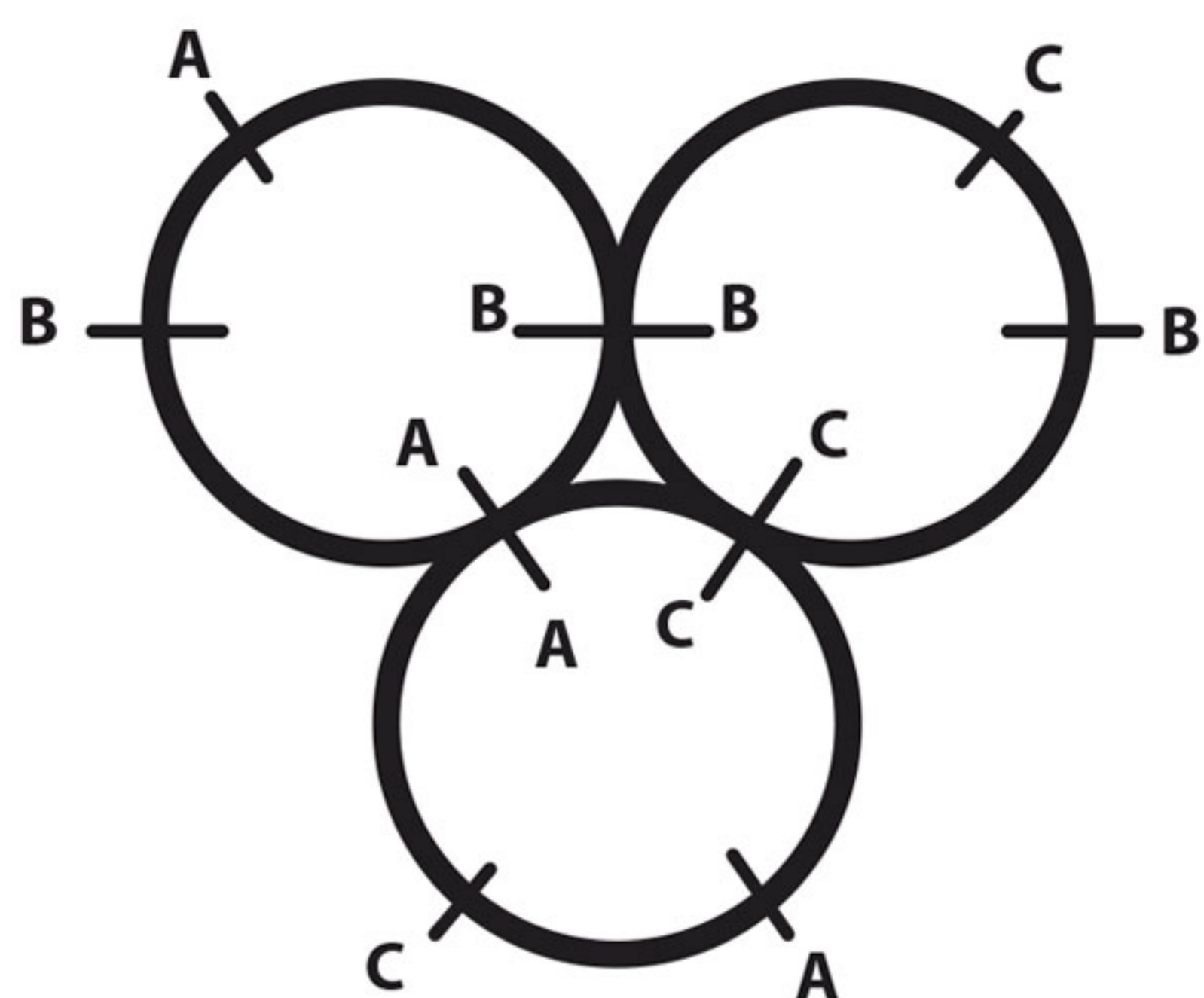


Diagram: Figure A. Hold the three lengths of PVC together and mark the ends, as shown. Opposite: PVC pipe and electrical conduit make for one heavy-duty tomato cage that couldn't be simpler to make.

to add a third set of cross pieces, adjust the placement of the holes accordingly. Drill a single hole in one or all of the pipes just below the bottom most set. This is the watering hole that I will explain further on.

Step 4: Repeat Step 3, lining up all the Bs and then all the Cs. Make sure you stagger each set of holes a little so that the cross pipes do not hit each other.

You're all set to put your cages together. Insert the cross pipes so that about ½ to 1 inch sticks out on each side. You may have to use a round file to enlarge the holes a little, but you want the cross pipes to fit tightly.

Press the pipes into the soil about 8 inches. The watering hole allows me to apply water and fertilizer almost directly to the roots instead of wasting both with normal sprinkling.

Weeds are better controlled by keeping the surface of the soil dry and with fewer readily available nutrients. The low surface moisture also helps with fungal infections of the stems. I have a 5-gallon bucket with a small diameter plastic hose inserted at the bottom. This hose goes into the watering hole of the PVC support and my manure tea is delivered 8 inches below the surface. It's slow but effective.

At the end of the season you merely take the cages apart, and they easily store in a corner. No more pointed ends of wire cages to catch you unawares. 🕒



HOW TO CONTROL TOMATO PESTS

CUTWORMS: Stiff, 3-inch piece of cardboard — such as a frozen orange juice container — placed 1 inch in the soil and up around the stem.

SLUGS: Night handpicking, wood ashes, saucers of beer or trap boards.

SPIDER MITES, APHIDS, FLEA BEETLES: Hard hose sprays, diatomaceous earth, ladybugs, onion sprays or pyrethrum.

HORNWORM: Homemade spray of red pepper juice, *Bacillus thuringiensis* (Bt) or diatomaceous earth. Leave any hornworms covered with small, white egg cases alone, however.

They are parasite-burdened and will soon die and spread the problem to other hornworms.

NEMATODES: These invisible killers attack the plant's root system, stunting growth and lowering disease-resistance. Once you suspect trouble, check the roots of the plant and look for little knots. African and French marigolds have been shown to exude a substance that repels nematodes, so plant a few among the tomato plants or, better yet, plant this year's tomatoes where last year's marigolds were. Increasing the amount of organic matter in your soil will also help by increasing the number of nematode predators. Nematode-resistant varieties are also available and are typically labeled VFN.



Make Your Own No-Space POTATO BARREL

Enjoy homegrown potatoes no matter how much space you have with these step-by-step instructions.

By SCOTT MEYER

The difference between a homegrown potato and a store-bought one can literally be measured in the moisture lost as the spud makes its way across the country. Freshly dug potatoes are juicy – almost as much as an apple – and have a meltingly soft texture. You don't need a potato farm in Idaho to discover this for yourself. You can grow a crop of potatoes in any sunny spot that's big enough for an ordinary trash can.

Start in spring. Potatoes take all season to mature, so begin this project around the average last frost date (ask your county extension agent or look it up at <http://bit.ly/1opq3P1>).

Select the spuds. They grow from chunks of last year's crop – chunks with an “eye,” or rootlet, are referred to as “seed potatoes.” Each “eye” produces a cluster of new tubers. You can find countless potato varieties in nurseries and online, and you can use any one you want, but small to medium-size ones work best in a barrel. Be sure to get certified disease-free seed potatoes, because they can suffer from nasty problems like scab.

Pick a barrel. Plain or fancy, it's your call. Gardening catalogs and websites offer barrels specifically designed for growing potatoes. But they are mostly about being more attractive – not functionally better – than one you make at home out of a whiskey barrel or a common trash can. If your container has been used before, be sure to scrub it out well to get rid of fungi that might cause your potatoes to rot before you harvest them.



Putting the barrel up off the ground is a great way to maximize effective draining. Make sure the base of your barrel is wide enough to prevent tipping in windier parts of the country.

Drill for drainage. If the barrel doesn't already have holes in it where excess water can drain out quickly, drill a few in the bottom and in the sides close to the bottom. Quarter- to ½-inch holes are big enough.

Give it a lift. Set the barrel in a sunny spot and get it up on blocks or bricks so it sits a few inches above the ground and air can circulate around it.

Add the soil mix. Make up a soil mix by blending three parts compost with two parts peat moss. Fill the bottom of your barrel 6 inches deep with the mix. Dampen the mix.

Plant your spuds. Place seed potatoes a couple inches apart in the soil mix. Keep it moist but never soggy (which can cause the potatoes to rot).

Cover after sprouting. In a week or so, the seed potatoes will have sprouts about 6 to 8 inches tall. Add more soil mix to cover them up to their bottom leaves. Again, keep the mix moist, but not soggy. Repeat the process of allowing the sprouts to grow, adding more soil to cover the sprouts and moist-

ening the soil until the barrel is filled completely to the top.

Keep the moisture constant. Remember to keep the soil damp but not wet. Feed the plants weekly or bi-weekly with liquid fish and seaweed fertilizer – available at nurseries and home centers – until you see little white or yellow flowers on the vines, which indicate that the new potatoes have begun forming.

Dig for buried treasure. At the end of the growing season, the vines turn yellow and die back. The potatoes are fully grown. Carefully tip over the barrel, and sift through the soil for potatoes. Brush the dirt off them – don't wash them until you're ready to cook them – and store them in a cool, dry place away from direct sunlight. 🍷

Excerpted with permission from The City Homesteader by Scott Meyer (Running Press, 2011), a guide to greener living filled with easy-to-follow instructions and step-by-step tips for creating a sustainable lifestyle in any home.



Flavor Sun-Dried

Preserve your harvest with a solar food dehydrator and free energy from the sun.

Article and photographs by
EBEN FODOR

More and more people are recognizing the importance of food quality in their daily lives. The freshest, ripest, tastiest and most nutritious food comes from our own gardens or local farmers. But because these high-quality fruits and vegetables are seasonal, you have access to them for only a few weeks or months each year.

What do you plan to eat the rest of the year? Will you rely on industrial foods grown by strangers from all over the world and shipped thousands of miles? With increasing interest in healthy eating, sustainable local food supplies, and self-reliance, many people

are discovering the benefits of a solar food dehydrator.

Solar food drying is more than a curiosity or hobby, it's an ideal application for solar energy. Solar radiation passes through the clear glass top of a wooden dehydrator box, then the heat trapped by the box dries the food. The dehydrator may also have an absorber plate inside, which indirectly heats your food and creates a convection current of air that enters a vent at the bottom of the dryer. The cool, fresh air that enters the vent heats up, circulates through the dryer, and then exits through a vent at the top. As your food dries, moisture is carried away with the hot air. But do solar food dryers work well? Are they practical? Yes, but first let me put this topic in the context of creating a healthy and sustainable food supply.

Eat in-season year-round

Food preservation is the key to extending the summer's precious bounty of locally grown produce throughout the year. If you're like me, you would prefer a method that's easier and requires less energy than canning.

Freezing is commonly viewed as the most convenient preservation method, but freezers require a constant source of electricity. Your food will be vulnerable to power outages and mechanical failures, and the inevitable freezer burn will limit the storage life of most foods to about six months.

Drying is an excellent method of food preservation that maintains a high level of flavor and nutrients, while providing a convenient, compact, easy-to-store supply of your favorite produce. Electric food dryers work fine, but I don't care for the constant noise, heat and odors they add to my house. Electric dryers also take away valuable counter space for

OPPOSITE: Most vegetables, once dried, can quickly and easily be rehydrated in soups or by adding a bit more water to a recipe, such as zucchini bread.

weeks on end, can attract ants and other pests, and cost money every time you run them. The convenience of electricity does not compare to the satisfaction of drying food with free solar energy.

Disenchanted with electric drying, I began experimenting with solar drying. With a background in engineering and solar energy, I soon designed and built my first solar dehydrator. I was delighted to watch the sun quickly dehydrate my organic fruits and veggies. It worked even better than I had hoped, drying large batches of food in one to two days. I dried my entire surplus of garden and orchard produce, leaving nothing to waste. The following year, I grew a larger garden so I could dry even more food.

Got sun?

If you're wondering whether solar drying could be right for your location, consider that I live in Eugene, Oregon, at a latitude equivalent to Bangor, Maine. We receive lots of rain, but fortunately we also receive enough sunshine during the summer and fall harvest seasons to successfully dry all of our crops with solar energy. If you can get two days of sunshine in a row with some regularity, solar food drying will work for you.

However, for those times when the sun is hiding, a backup heating system can help. I added 200-watt light bulbs as heating elements so I could finish drying my produce any time the weather turned cloudy.

Good designs

A solar food dehydrator can be made in many designs, ranging from simple to complex, and from small to large. For the home gardener, a good solar food dehydrator has these qualities:

- It dries food quickly – on par with a

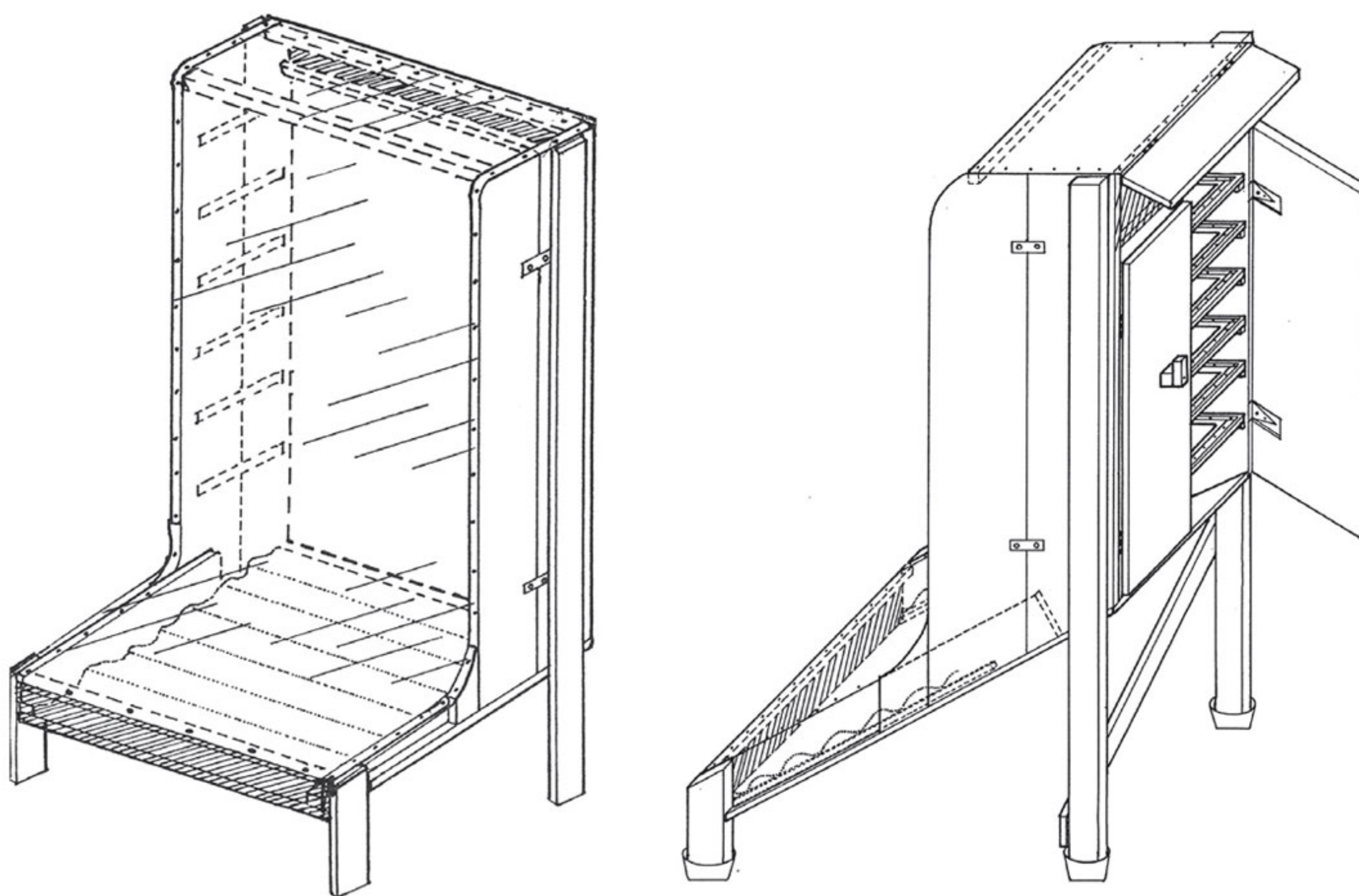


FOOD DRYING FAVORITES

Fruits: apples, apricots, bananas, blueberries, seedless grapes, peaches, pears, plums and strawberries.

Vegetables: broccoli, carrots, cauliflower, corn, green beans, onions, sweet peas (in pod), peppers, potatoes, summer tomatoes, zucchini and other squash.

Mushrooms and herbs are excellent, too!



The New Mexico solar food dryer combines direct and indirect solar heating. Direct sunlight heats the racks of food in the upper part of the dryer, while the corrugated metal absorber plate at the bottom of the dryer promotes indirect heating by creating a convection current of hot air that travels upward through the racks of food.

good electric food dryer.

- It has venting controls that allow for easy adjustment of drying temperature and airflow.
- It's easy to load, unload and clean.
- It's easy to set up and put away, with little or no assembly.
- It's relatively compact and lightweight for portability.

- It's weather resistant and keeps your food dry in the event of rain.
 - It has sturdy and durable construction for a long life of outdoor operation.
 - It's pest proof, and all vent openings are screened.
 - The food trays are made from durable, nonstick and food-safe materials.
- Now that you know the basics about



LEFT: Mix dried fruits, such as apples, with hot cereal, muesli or granola for added sweetness and nutrients. **RIGHT:** Many dried foods, such as plums, are excellent when eaten plain as a snack.

solar food dryers, where do you go for designs? Surprisingly, you won't find much useful information on the Internet. If you search, you will find plans for solar dryers made from cardboard and duct tape. Skip these and stick with the handful of high-quality dehydrators that meet my criteria. My book *The Solar Food Dryer* provides information on some of the better designs, and includes complete plans for building the SunWorks dehydrator I designed.

The easiest solar food dryer to build is a "hot box," a design in which the food is enclosed and protected in a box with a clear covering on top. Screened holes should be in the bottom and sides, so warm, moist air can exit the dryer.

To increase airflow and efficiency, you'll have to modify the simple hot-box design. Many high-performance designs are based on the strategy of separating the two functions of a solar food dryer – gathering heat and drying the food.

The New Mexico dehydrator (shown on Page 23) illustrates this approach.

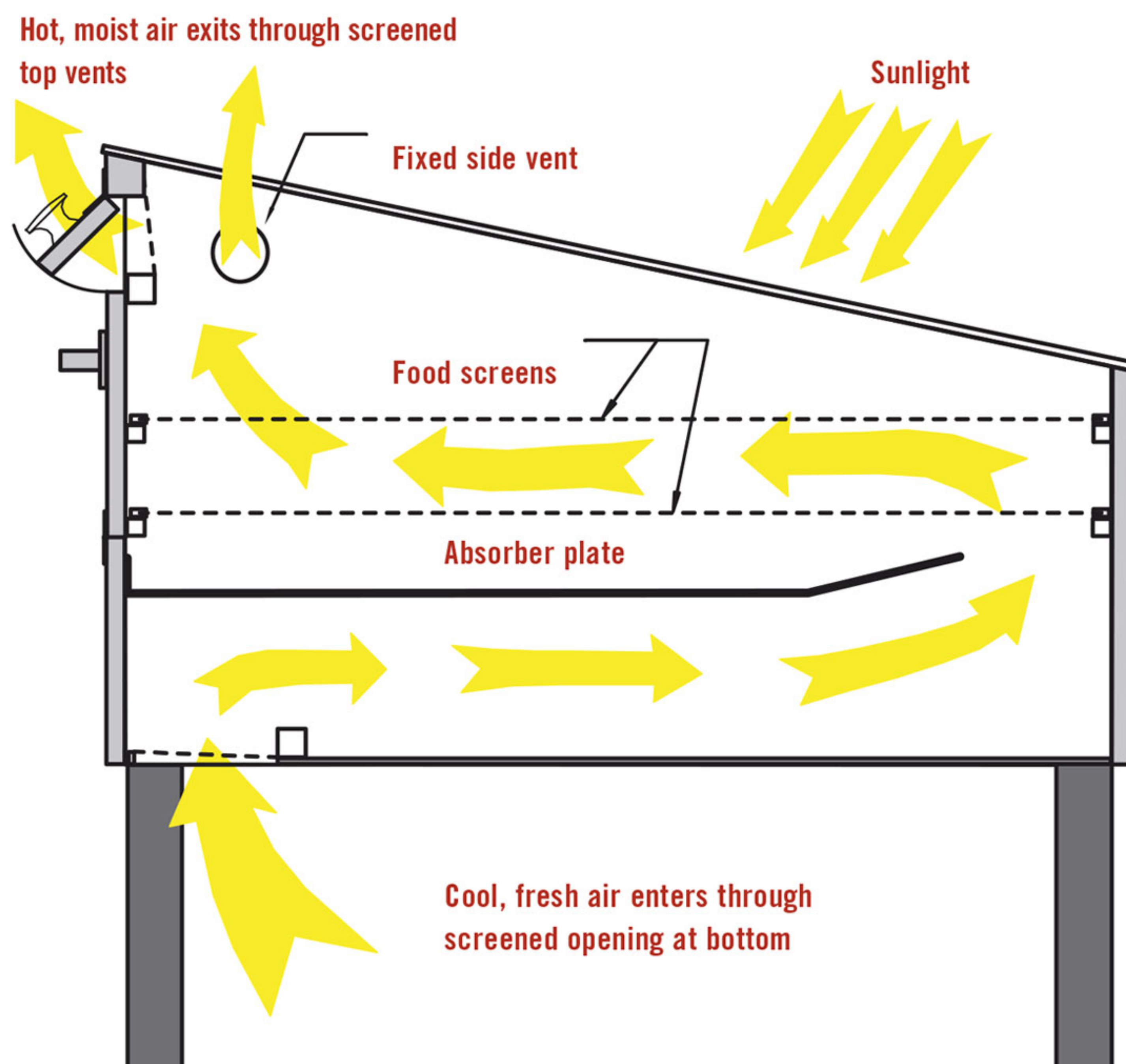
My design, the SunWorks, integrates the solar collector and food drying cabinet into a compact configuration, which uses both direct heating, like the solar hot-box dryer, and indirect heating from the absorber plate. The airflow is optimized for even drying, and ventilation is achieved by natural convection.

How to use a solar dryer

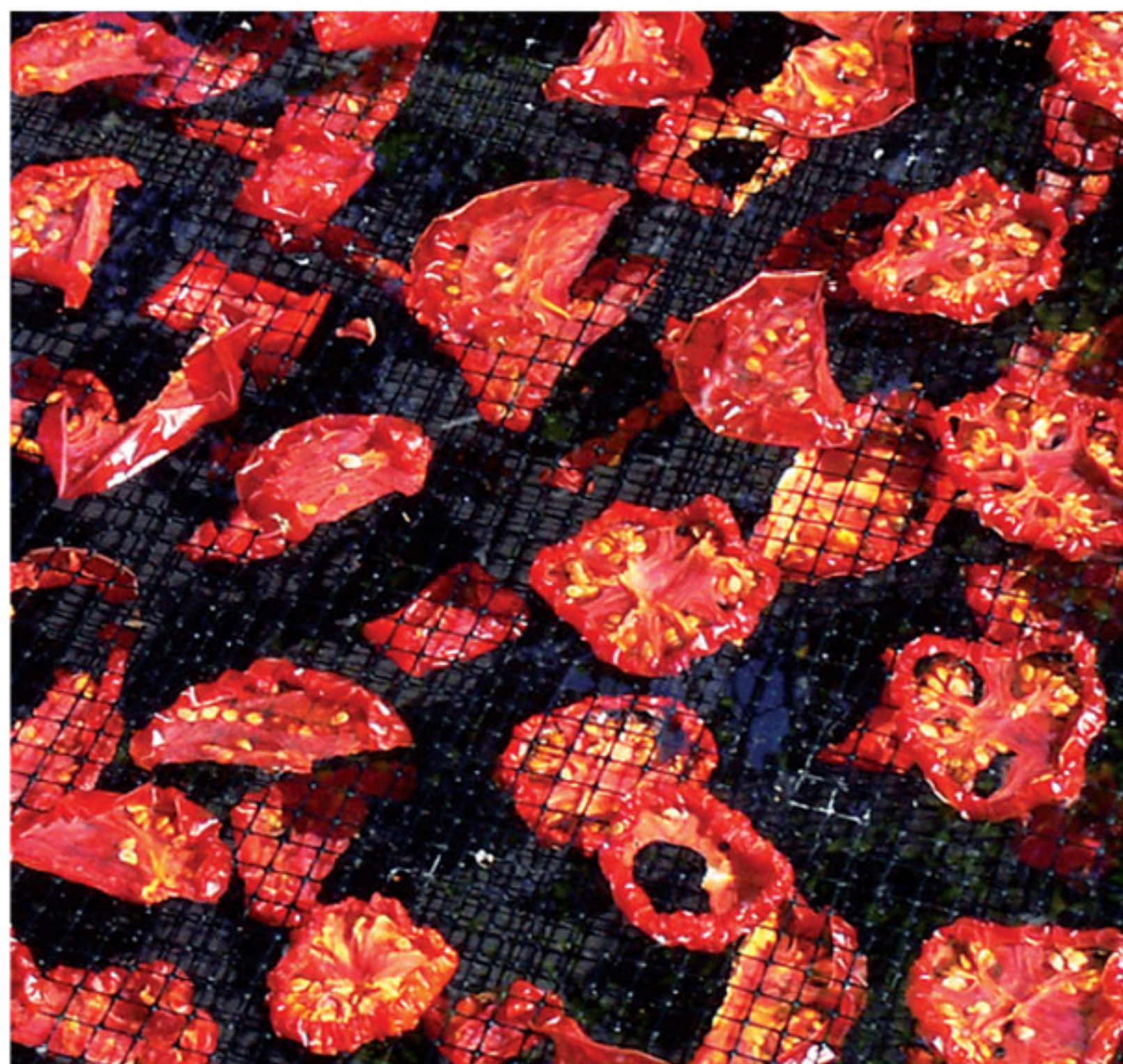
You don't need to be a solar whiz to operate a solar dehydrator; just place it in a sunny spot oriented to the south, and load it with food. If you'll be around during the day, you can speed drying by occasionally repositioning the dryer to track the sun as it moves across the sky. Many foods will dry in one day of sunshine. Wet foods like tomatoes or pears will require a second day. They should be dry enough after the first day to stay in the dehydrator overnight.

Always start with food that is at its peak freshness and ripeness. Simply wash, slice to your desired thickness, and place in your solar dryer. I get great results without any blanching or pretreatments. The dried food consistently looks and tastes great. The flavor is better than anything I find in supermarkets, and it's free of sulfites – a sulfur-based preservative – and other additives found in commercial dried foods.

Most people think about drying food in August, when they can't keep up with the supply from their gardens, but there's abundant solar energy in the spring for drying as well. In May or June, you can start capturing early season crops like



Warm temperatures inside Eben Fodor's SunWorks food dryer create a convection current that circulates air through the dryer.



LEFT: Drying is an excellent method of food preservation that maintains a high level of flavor and nutrients in vegetables and fruits, such as tomatoes. **RIGHT:** Dried foods store well in airtight containers and will keep for up to one year.

peas, blueberries and strawberries. Then you'll be ready for your summer and fall bumper crops of beans, plums, peaches, apples and squash.

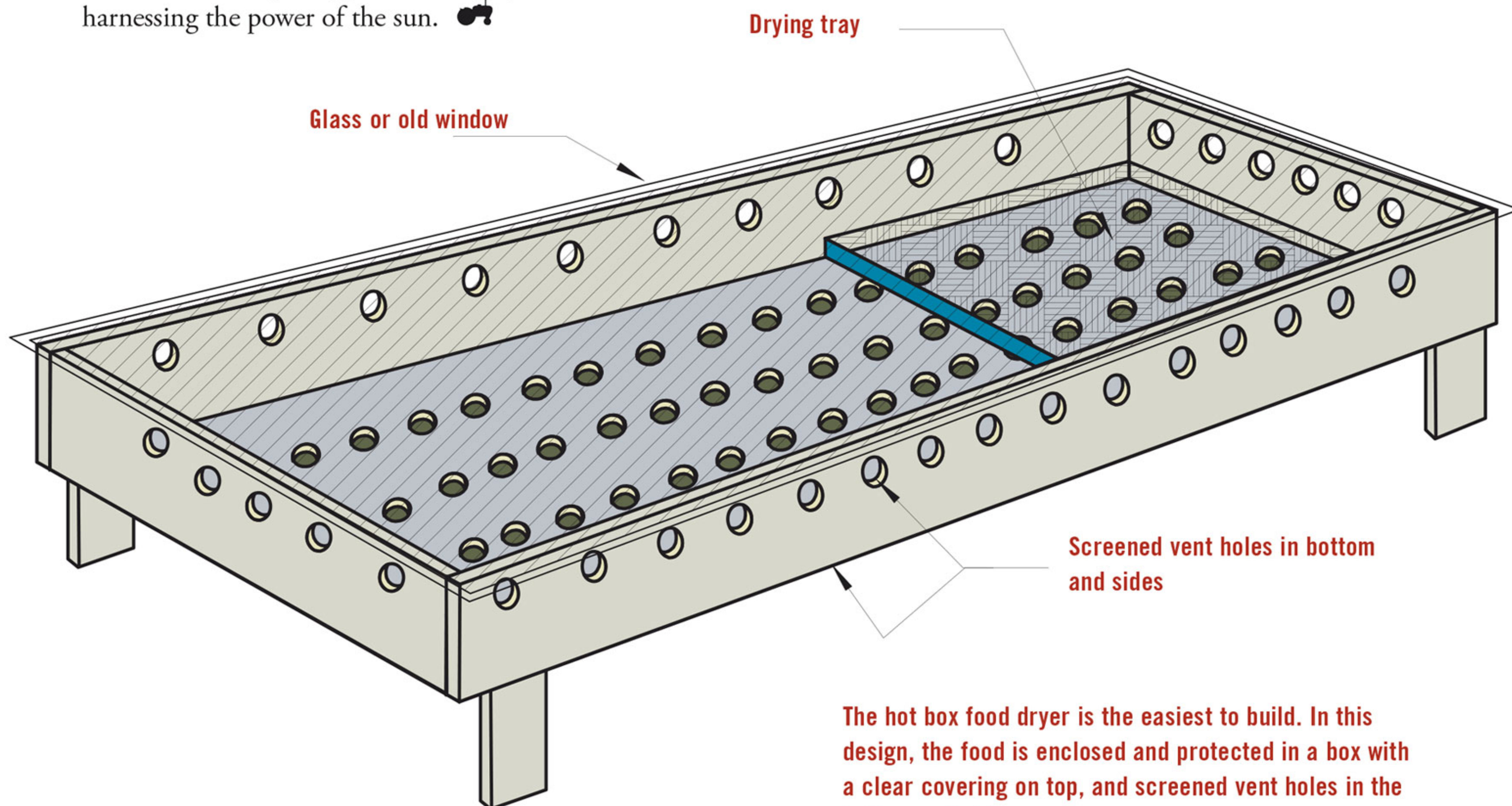
As you think about how much fun you'll have with a solar food dryer, consider that by preserving and storing produce, you can expand your garden and grow more of the things you'd like to enjoy year-round, such as tomatoes. A solar food dehydrator is a great way to maintain a nutritious and tasty supply of high-quality, locally grown foods all year long. A good dehydrator will produce outstanding results, along with the satisfaction of saving energy and money by harnessing the power of the sun. 🕒

COOKING WITH DRIED FOODS

Most dried vegetables can be quickly and easily rehydrated in soups or by including a bit more water in recipes like zucchini bread. For great additions to stir-fry and pasta dishes, you can also rehydrate vegetables by soaking them in water for 10 minutes to an hour.

You can mix dried fruits with things like hot cereal, muesli or granola to add sweetness and nutrients. They can also be blended with seeds, nuts and grains to make wholesome energy bars. Solar-dried tomatoes taste sweet and are delicious when eaten plain, marinated in olive oil and garlic, or made into a tomato pesto.

Many dried foods are excellent when eaten as they are. In fact, drying can improve the flavor of some foods. Bananas are fantastic fruits, but dried bananas are heavenly. A Roma tomato is almost too bland to eat fresh, but when dried, it's a treat your taste buds will savor. Watery Asian pears are sometimes a little disappointing, but when dried, they're among the finest treats on Earth.



The hot box food dryer is the easiest to build. In this design, the food is enclosed and protected in a box with a clear covering on top, and screened vent holes in the bottom and sides.

DIY Garden Trug

Make a handmade harvest basket for collecting your garden's bounty.



CUT LIST

- Curved sides: 2 pieces – 17 ½ inches long, 3 inches wide, ¾ inch thick
- Ends: 2 pieces – 10½ inches long, 1¾ inches wide, ¾ inch thick
- Wide center slats: 3 pieces – 10½ inches long, 1½ inches wide, ½ inch thick (can use ¾-inch)
- Narrow slats: 8 pieces – 10½ inches long, 1 inch wide, ½ inch thick (can use ¾-inch)
- Rope handles: 2 pieces – ½ inch thick, 30 inches long

Article, photographs and illustrations by BRIAN TOKARCHUK

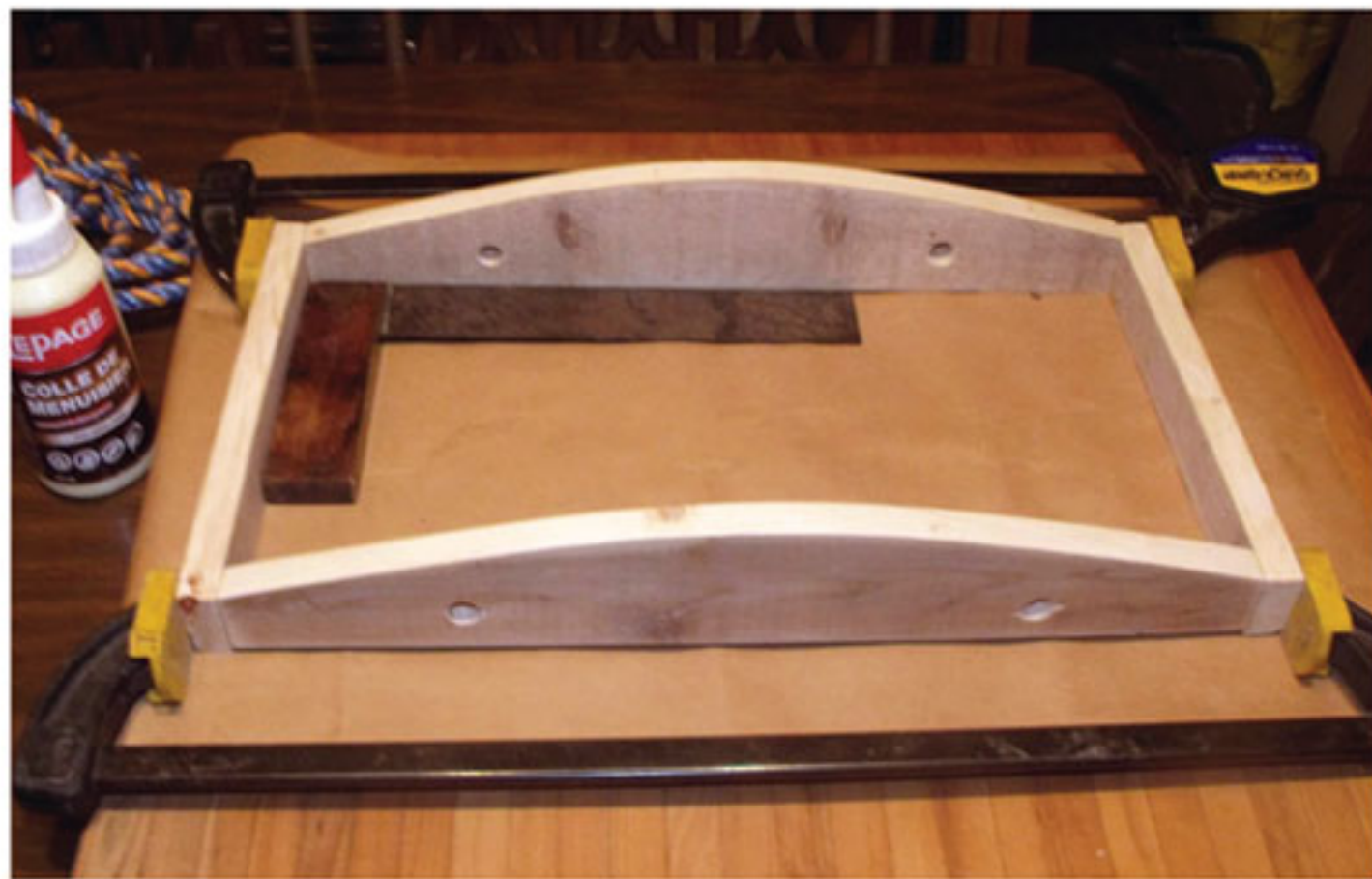
A trug can be valuable around your home and garden. It can hold your tools while you're working in the garden and serve as a collection basket for your harvested produce. This already simple design is made even easier with a rope handle, and the type of wood you use is entirely up to you. I used ½-inch-thick pallet wood for the wide center slats, but if you can't find any or don't have a wood planer to cut your wood to this dimension, you can substitute ¾-inch material. Likewise, feel free to use your favorite type of wood, reclaimed lumber pine or any hardwood you'd like for this project. This is my version of the classic English "garden trug."



For faster assembly, have all of your wood cut before you begin.

MATERIALS LIST

- | | | |
|---|---|---|
| ■ 3-foot length 3-inch-wide-by-¾-inch stock | ■ 3-foot length 1½-by-½ to ¾-inch stock | ■ 5-foot length ½-inch rope (cotton or nylon) |
| ■ 2-foot length 1¾-by-¾-inch stock | ■ 8-foot length 1-by-½ or ¾-inch stock | ■ ¼ pound 1½-inch finishing nails |



Long C-clamps hold the frame in place while the glue dries.



Scrap wood that is $\frac{1}{2}$ -inch thick spaces the bottom slats perfectly without needing to measure each time.



Use either pallet wood or your favorite stock that you have on hand.



The almost-finished trug can be sanded and stained if desired.



Thread your rope handles from the outside and tie a simple knot.

Assembly

- Make a full-size pattern of the curved sides by drawing on light cardboard. (The apex of the curve will be the width of the stock.) Sketch the outline of the half pattern, and flip it to trace the remaining half. Mark with a pencil where each of the holes for the handles will be located.

- Place pattern on the 3-by- $\frac{3}{4}$ -inch stock and trace the outline of your pattern. Mark handle locations on the stock and cut to shape. I used a handheld jigsaw for the curved cut. Drill the $\frac{1}{2}$ -inch holes for the handles. Sand lightly. Repeat for the other side piece.

- Cut the two 10 $\frac{1}{2}$ -by-1 $\frac{3}{8}$ -inch pieces to size and lightly sand. With glue and finishing nails, fasten in place so that they're flush with the top edge of the ends of the curved side pieces.

- Cut the three 10 $\frac{1}{2}$ -by-1 $\frac{1}{2}$ -by- $\frac{1}{2}$ -inch center slats. Find and mark the center on the bottom edge of both curved sides. Center the middle slat on marks and fasten in place. Leave a $\frac{1}{2}$ -inch gap on either side of the middle slat, and fasten the remaining two wide slats in place.

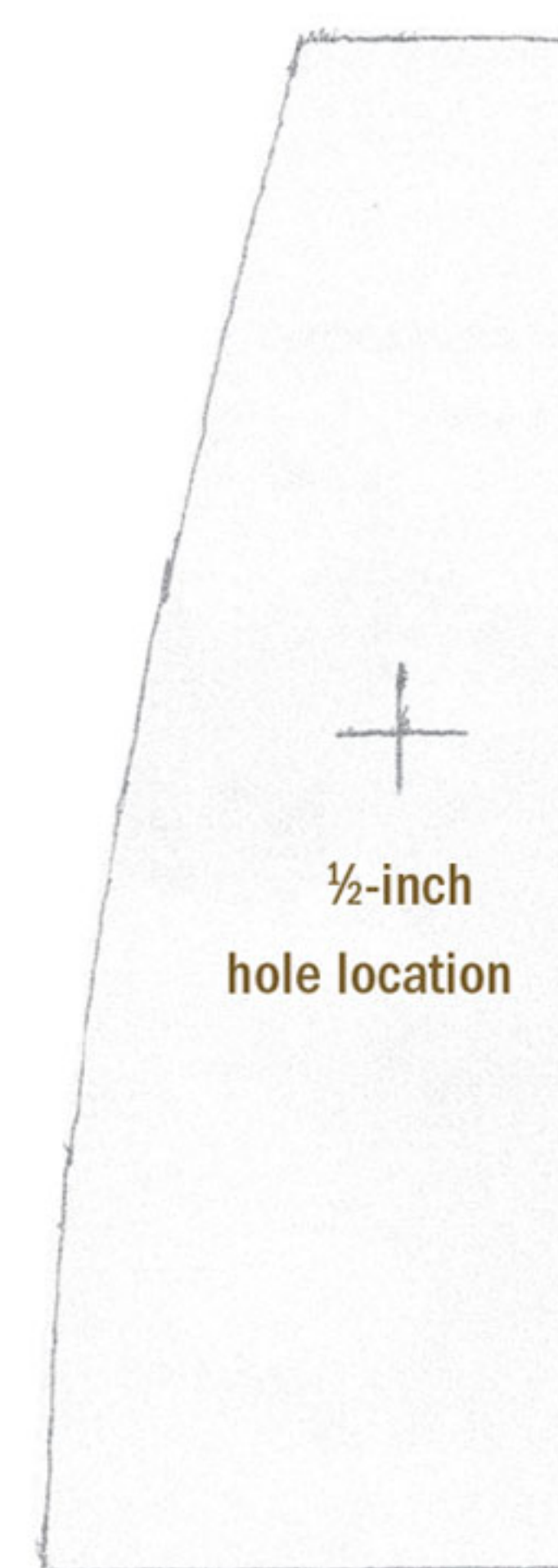
- Cut the eight 10 $\frac{1}{2}$ -by-1-by- $\frac{1}{2}$ -inch narrow slats to size. Install by beginning at the ends of the curved sides. Keep flush with the edges of the curved sides, not the end pieces. Space the remaining slats equally with $\frac{1}{2}$ -inch gaps between

slats. Use glue and finishing nails to fasten in place.

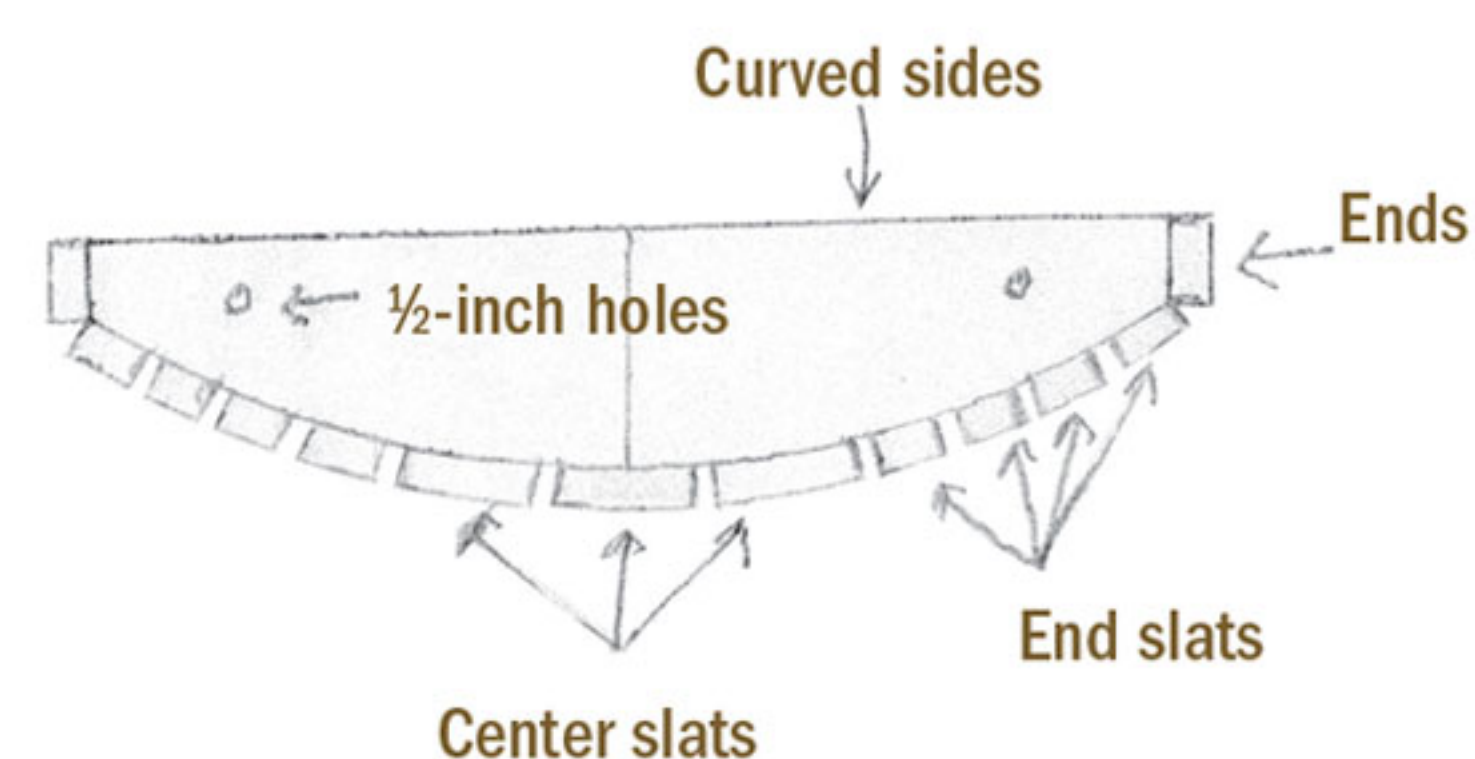
- Lightly sand entire piece and apply finish as desired. Paint, stain, oil or varnish are all acceptable. I chose non-toxic cutting board oil for mine to let the natural beauty of the wood show.

- Cut the rope into two 30-inch lengths. Thread into holes from the outside in, and tie a simple overhand knot on the ends.

You're now the proud owner of a handy little basket that is equally as functional as it is beautiful. Enjoy! 🛠️



Full size half pattern



Add BEAUTY & FUNCTION to BACKYARD GARDEN



Two easy-to-make projects transform a backyard into a productive farm.

By CHRIS GLEASON

Transform an ordinary backyard into a productive farm with two easy projects from *Building Projects for Backyard Farmers and Home Gardeners* (Fox Chapel, 2012). The book includes 21 gardening and animal projects.

DIY Moveable Bean Trellis

Trellises, at least in my mind, come in two forms: those that are free-standing, and those that require some other

kind of support. This particular trellis belongs to the latter group, in that I designed it to be leaned up against whatever else is around. Originally, I had placed it against a fence, but it turned out I didn't need it there, because the beans I had planted in that spot were bush beans instead of pole beans. I guess I did a pretty bad job of reading the seed package!

In any event, it was no problem to move the trellis to a different bed where I was getting ready to plant more beans. The second time around, I was much more careful about checking the label. And leaning trellises



aren't just useful when you need to correct a silly mistake: they are really handy because they can be moved around from year to year. Since they have no moving parts, they're easy to set up, take down, and store during the off-season.

1. Cut the posts. Since this trellis is basically a large rectangle that gets most of its strength from its two vertical posts, that's where I started. I ripped a 2-by-4 in half on my table saw to produce the posts (A), and then I set them next to each other on a pair of sawhorses to lay out a series of marks where the horizontal rods would be placed. The easiest way to do this is to start in the middle and keep dividing each length about in half until you have as many marks as you want rods – an even number is easiest. I picked eight.

2. Drill holes. To ensure that the holes for the rods (B) were drilled exactly perpendicular to the surface of the posts (A), I used my drill press. You could definitely use a hand drill in a pinch, but the drill press does help to make certain that the rods will line up neatly later on. Make sure the holes you drill are the same size as the diameter of the dowels you're using.

3. Insert the dowels into one post.



DIY BEAN TRELLIS MATERIALS LIST

ITEM	MATERIAL	DIMENSIONS	QUANTITY
(A) Posts	2x2	66"	2
(B) Horizontal Supports	7/16" dowel rods	30"	8
(C) Top Rail	1/4" plywood	32" x 9"	1
(D) Star Decoration	Scrap wood	Size as desire	1
(E) Vertical Supports	Nylon string		

BEAN VARIETIES

Since you're already hard at work building a support structure for your bean plants, here's a list of the different varieties you can grow when you're finished:

NAME	VINE SIZE	DAYS TO MATURITY	NOTES
Blue Lake Pole	6'-7'	70 days	Use in soups or freeze and can
Genuine Cornfield	5'-6'	70-90 days	Often grown in cornfields
King of the Garden Pole Lima	8'	90 days	Large beans with a sweet flavor
Old Homestead Pole Bean (Kentucky Wonder)	More than 6'	70 days	Variety from the 1860s
Romano Pole Bean	6'	70 days	Harvest pods often
Scarlet Runner Pole Bean	10'	70 days	Vines have bright red flowers

Since I planned to use this trellis for beans and peas, which are pretty lightweight, I didn't have to worry too much about making the rods (B) extra-strong: I just used a bunch of dowels from an old clothes drying rack that my neighbor was throwing away. Using a rubber mallet, I pounded the rods into one of the posts (A). It was easiest to just lay the post down for this step. I didn't find it necessary, but if you wish, add glue to the holes.

4. Insert the dowels into the second post. Getting the second post (A) to fit onto the exposed end of the dowels (B) is a little tricky – you'll wish you had three hands – but once the dowels have gotten started, you can use a pair of clamps to squeeze

the posts and tighten up the fits.

5. Shape the top rail. The trellis is capped off by a wide horizontal rail (C) that I made from 1/4-inch plywood. Its main purpose is to add rigidity to the structure and keep it from getting wobbly over time. I shaped the top of the rail with my jigsaw. Once I cut off one corner, I saved the scrap as a pattern for the opposing one. A band saw is also a fine way to cut out the curved portions. Attach the rail (C) to the posts (A) with a few screws. I also cut a small star (D) out of scrap stock and fastened it to the top rail as a nifty decorative touch.

6. Add vertical supports. To add more places for the pole beans to climb, I tied a row of strings (E) to the

top and bottom dowels and wove the nylon in and out of the other horizontal supports (B).

Build a Versatile PVC Cloche

This style of cloche is common in our area, and for good reason: they're simple, inexpensive and versatile. You can adapt them to fit just about any size area you'd like, and with a little imagination, you can even scale it up and build a large walk-in hoop house. I do recommend doing this with a partner if you can, because the long lengths of PVC tubing can be frustrating to try and handle on your own.

I used 1/2-inch (13mm)-diameter PVC tubing and standard T connec-

PVC CLOCHE MATERIALS LIST

ITEM	MATERIAL	DIMENSIONS	QUANTITY
(A) Base	½"-diameter PVC tubing	30"	4
(B) Ribs	½"-diameter PVC tubing	10'	3
(C) Connectors	½"-diameter T fittings		6 (or you could use 4 right-angles for the ends)
(D) Nylon string		8'	3
(E) Plastic covering	Greenhouse film	11' x 11'	1
(F) PVC clips	¾"-diameter tubing	3" (Cut in half)	10 total, so 5 lengths of tubing that are then cut in half
(G) End clips	Office supply binder clips	Any size will work	4



tors from the plumbing section of our local home center, and that aspect of the construction is pretty self-explanatory. The 10-foot-long (3,050mm) tubes easily bend to create a cloche that is 8 feet (2,440mm) wide and about 3 feet (915mm) high, but you could bend them to a tighter radius, which would produce an arch that is narrower and taller.

You could also cut the tubes down – when in doubt, I suggest buying one or two extra lengths and experimenting to figure out the size that will work best for you.

1. Prepare the ribs and base. I cut up the base tubing (A) into 30-inch lengths, so you can see this project will be 60 inches long (well, slightly longer, since each connector adds an inch or so). Lay out the base pieces (A), rib pieces (B), and T connectors (C) as shown. The T connectors (C) make it easy to join the sections of tubing (A, B). I didn't use any glue, since it is nice to be able to break down a cloche and store the parts when it isn't needed, but you might want to use glue if you plan on building a more permanent structure. You could join as many sections together as you'd like.

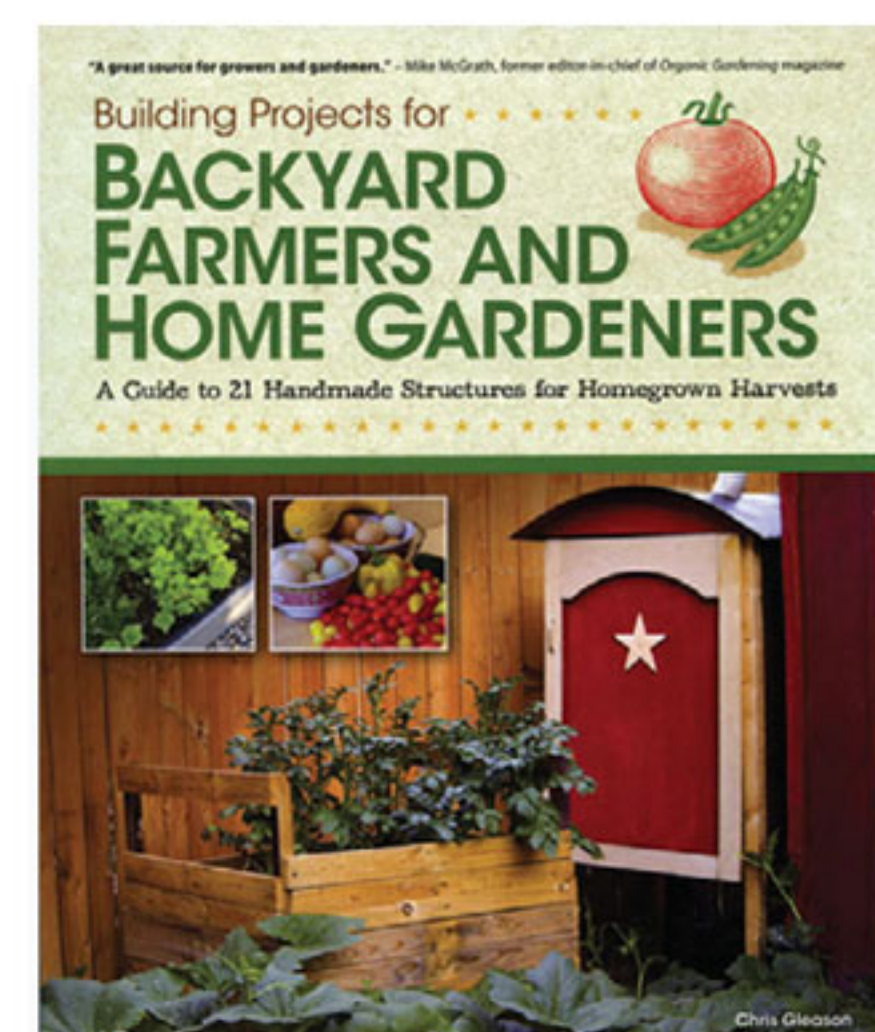
2. Bend the cloche. To spring the flat assembly into shape, I tied some nylon twine (D) on one side and then pulled it taut and tied it off on the opposing side.

I placed a length of string below each PVC rib (B), and this worked great. The finished skeleton is extremely lightweight and easy to move around. Having an assistant would've made this step a lot easier, though.

3. Create clips. To hold the plastic to the frame, I made a set of clips (F) using ¾-inch PVC. I used my table saw to make two parallel rip cuts, thus removing a portion of the center of the tubing. Viewed from the end, the tubing was shaped like a C instead of an O. I then cut the tubing into 3-inch chunks on my chop saw. I suggest making a pile of the clips, since it is better to have too many than too few. You can also buy these clips from most garden supply centers for around 50 cents a piece. If you have a table saw, this method will save you a few bucks – the homemade version will cost about 10 cents each.

4. Attach plastic. The finished clips (F) just click onto the skeleton base (A) and hold the plastic (E) in place. Put two or three on each base piece (A). To attach the plastic (E) to the nylon twine (D) on the ends, simply fold the plastic under the twine and secure with a binder clip (G). 🛠️

These excerpts have been reprinted with permission from *Building Projects for Backyard Farmers and Home Gardeners: A Guide to 21 Handmade Structures for Homegrown Harvests* by Chris Gleason and published by Fox Chapel, 2012. Order the book from GRIT's Bookstore, www.Grit.com/Shopping, or call 866-803-7096.





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Porch Swing Plans

Make this porch swing using recycled wood pallets.

By JEFF HOARD

Living out where the pavement ends offers the simple pleasures of country life. Unadulterated stargazing, the sound of a rooster's crow each morning, and weathered farm struc-

tures are just a few to mention. Rural folks use the front porch as a place to gather the family and take in their surroundings, and nothing encourages a relaxing get-together more than a classic porch swing.

Most porches have sturdy beams and rafters from which to hang a swing. For those looking to forgo the expense

of purchasing a brand-new wooden swing and hiring someone to hang it, there are several economical options that will yield the same laid-back results. Using recycled pallets and my simple porch swing plans is one way to make your front-porch-swingin' dreams a reality.

Porch swing plans

Living on an "off-grid" ranch, we save just about everything, so I built our swing for zero dollars. But even

if a person can find a pallet, the cost of the hardware needed would be minimal. The size we built (4 feet long) required only one large pallet, and because of the ranch setting, we occasionally place orders that require a pallet for delivery, which we save. I picked one out that was in decent shape and dismantled it.

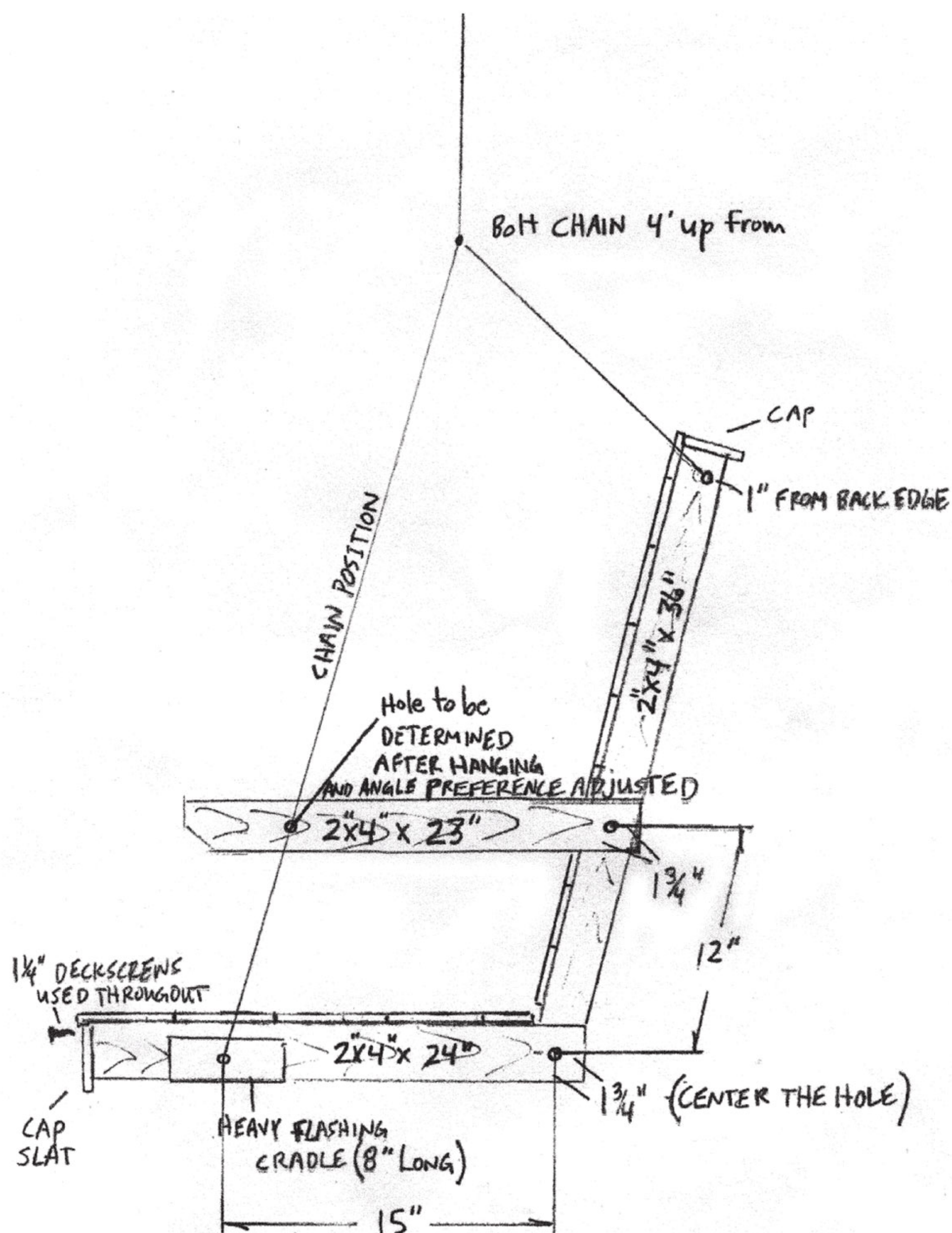
Sometimes pulling nails can be tough, so to make it easier, soak the pallet with a hose or work on it a couple days after a rainstorm. You just need to separate the 2-by-4s from the 1-inch-by-6-inch slats to make the simple swing shown on this page and on Page 34.

One large pallet was all the wood I needed to build ours. Basic tools required to construct the swing include a hammer and nail bar to dismantle the pallet. If the slat ends are split or the nails are just too hard to pull, use a saw to cut 1½ inches off each end and shorten the swing's width accordingly. On ours I was able to keep the full 4-foot width of the pallet.

After the pieces are cut to size, it's time to drill the holes. Start with the 2-by-4 pieces. I used ⅝-inch all-thread that I found in my scrap pile to fasten the support pieces together. If you use bolts, choose carriage bolts the lengths shown on Page 34. The hardware listed is just what I used and will hold the weight of two average-sized adults. Use your best judgment, but do not use smaller diameter hardware than that listed.

Attach the shorter 2-by-4s to the larger ones as shown in the illustration to create the supports. "Snug up" the nuts, but not too tight. Now it's time to smooth up the 1-inch-by-6-inch slats with a plane or sandpaper.

Arrange the outer 2-by-4 supports upright on a smooth, flat surface and cross-tape to make sure they are square. Attach the seat's front slat flush with the edges and overhanging one inch past the ends of the 2-by-4s using 1¼-inch screws (predrill and counter-sink the holes to avoid splitting) and a generous bead of construction adhesive. Find the center point in the slat



CLARIFIER DRAWING

Be sure to hang your swing on sturdy beams.

and position the center seat support beneath it, square it to the end supports, and screw and glue the slat to it. Make sure the whole project remains square as you glue and screw additional slats to the seat and back supports.

Note that the back slats will overlap their support ends by about 1½ inches. I created a space between each slat with a nail. When you get close to the bolted joint, lift the back up to the approximate finished angle and snug up the bolts to hold them in place.

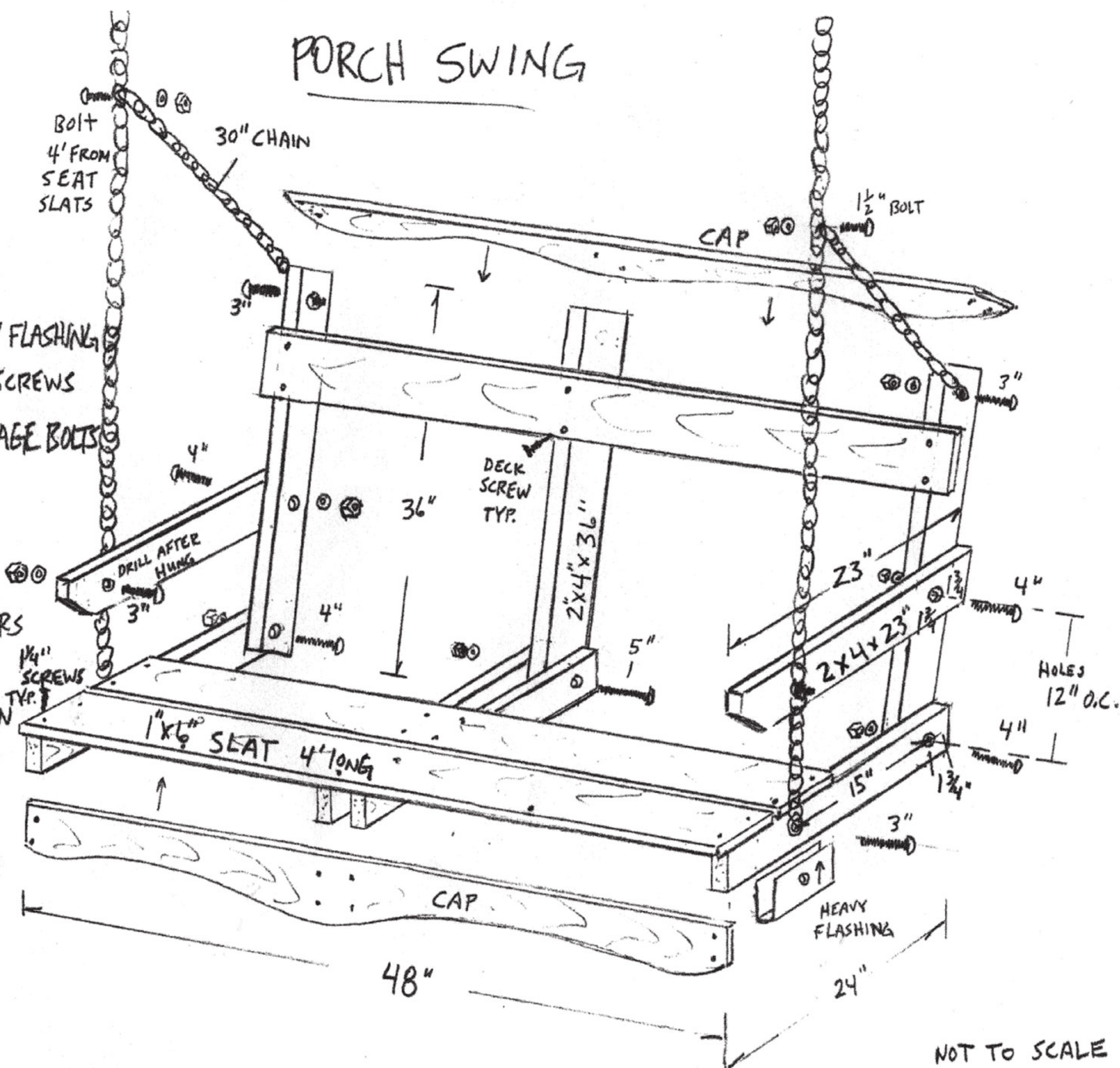
If needed, rip the last two slats to the proper width and install them.

Now cap the end of the seat and the top of the seat back with the two remaining slats. I took a jigsaw and made ours curvy to class it up a little, but it's not necessary.

Next install the arm rests. Remove two 3½-by-1½-inch pieces from the ends of one back slat at a height that makes sense for the 2-by-4 armrests. Install the armrests using bolts. Now it is ready to be painted. Being built

PORCH SWING

- MATERIAL LIST**
- 3- 2"x4"x 36"
 - 4- 2"x4"x 24"
 - 12- 1"x6"x 48"
 - 2- 2"x4"x 23"
 - 2- 8"x8" HEAVY FLASHING
 - 88- 1/4" DECK SCREWS
 - 13- 5/16" CARRIAGE BOLTS
 - 2- 1 1/2"
 - 6- 3"
 - 4- 4"
 - 1- 5"
 - 13- 5/16" WASHERS
 - 13- 5/16" NUTS
 - 2- 30" 3/16" CHAIN
 - 2- 3/16" CHAIN LENGTH TO FIT YOUR INSTALLATION
 - GLUE
 - PAINT



NOT TO SCALE

These plans include plenty of flexibility; take advantage of that to make a delightful porch swing that suits you, your family, your porch size and the materials you have on hand.

from a pallet, it obviously has some rough areas. Two good, thick coats of paint covered a lot of the rough stuff. Remember, this is an old-fashioned swing here, not a piano!

I used 3/16-inch galvanized chain for hanging. I had only a limited amount of chain leftover from another project, so I used 5-foot-long pieces of pipe from my scrap pile on the sides, but it can all be done with chain.

The length of the longer main chains will be determined by the height of your hanging point, but the short chains that attach from the main chain to the swing's back should be 30 inches long, and I attached these

chains to the main chain with a 5/16-inch bolt 48 inches up from the top of the seat.

As you can see by this design, the back-to-seat angle can be adjusted. To attach the main chain to the seat bottom, first fashion a set of brackets using heavy-gauge flashing. Cut a strip of flashing, hammer it around the 2-by-4 so it will cradle the weight, drill a hole for attaching the chain, and repeat for the other side.

Now the swing needs to be hung at the desired height, keeping in mind the height of the cushion. With the swing hanging, push the back out to take the slack out of the smaller top

chain and tighten the three bolts connecting the back to the seat.

Make sure the arm rests are parallel with the seat, line up the chain, and drill a hole through a link and the arm rest; bolt those. Choose a sturdy beam or rafter to hang your swing. We circled pieces of chain around our beam. I would use parachute clips instead of s-hooks to secure the chain as they are safer. Just make sure you have a good solid mount so you can swing away your troubles like our grandparents used to do! 🍷

For more wood pallet projects, turn to Page 36.

Quick, Easy and Cheap COLD FRAME

With recycled material, it didn't take long
to put this project to use.

By JACQUELINE WILT

We decided to try using a cold frame to get an early start on our vegetable gardening. My father-in-law had some old sliding glass doors sitting in his shed, so we retrieved those and brought them home. Then we scored a great deal on straw from a neighbor (\$2 per bale). Using these materials, we were able to quickly assemble a temporary cold frame in order to try our hand at early garden planting.

The site we used was not level, but since the ground was still frozen we were unable to level it out. We let the cold frame warm the ground and then worked on leveling out the area. The straw bales were arranged in a square, making sure they would accommodate the glass doors we had to place on top.

The glass was pretty dirty, so those were washed with vinegar and water. I made an exception to my "I don't do windows" rule. Doug made sure there were photographs to prove it.

Even the chickens had to inspect the whole process. After we got it all put together, they all climbed on top of the straw bales and gleefully tossed straw all over the glass! We were busy cleaning the barn at the time, so I missed getting photographs.

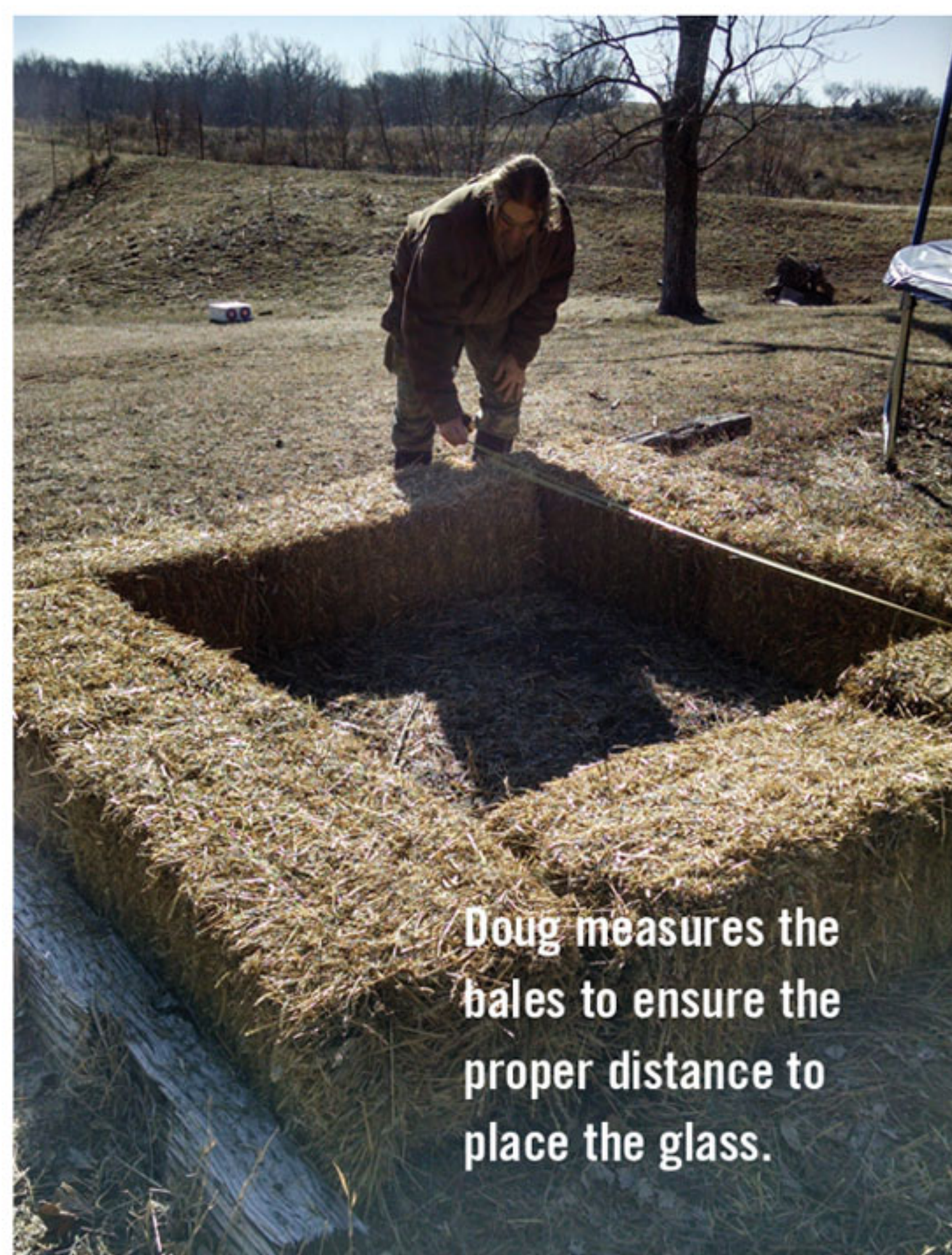
We put this whole thing together in about 30 minutes (including window-washing time!) and the only cost was \$16 for eight straw bales.

The site really needed to be leveled out, as you can tell the glass panels

were not level. An important aspect of a cold frame is to seal the cold out. We placed a thermometer inside the bales to watch the temperature. Our plan was to break the ground under the cold frame once the ground warmed a bit. Then we added composted soil from our barn and planted seeds once everything was in place. 🛠️



I don't usually do windows, so Lizzie made sure I did it correctly.



Doug measures the bales to ensure the proper distance to place the glass.



This curious hen had to find out what was going on!



Finished cold frame. Area still needs to be leveled out.

WOOD

Build With

Use upcycled free materials to create one-of-a-kind projects.

By CHRIS GLEASON

Author and craftsman Chris Gleason uses sound woodworking techniques and trendy designs in his crafts. In this excerpt from his *Wood Pallet Projects*, learn how to scavenge for wood pallets and make things that you can incorporate inside and outside your home.

How to be an effective scavenger

Pallets offer a great opportunity to obtain free materials for little or no money, and this fact alone makes them worth considering as a resource. However, not all pallets are created equal or are suitable for your project. Here are my tricks of the pallet-scavenging trade.

1. PERMISSION: ALWAYS GET IT

It's the golden rule of scavenging pallets: Always ask permission first. Many businesses that use pallets actually recycle them. They may use the pallets repeatedly, or the supplier might pick up the pallets and reimburse the business for returning them. So before you help yourself to what you think may be free, remember that if you don't



JOANN BILLIGMEIER

PALLETS

have permission, it could be viewed as theft. Just ask. Some businesses will be delighted to have you take extra pallets off their hands.

2. SAFETY: KNOW WHICH PALLETS TO USE AND WHICH TO AVOID

Most pallets are perfectly fine to work with, but some aren't. Chances are that the pallet you're working with is safe, but what if it was treated with some kind of chemical earlier in its life? I've also been emailed a story in which someone got a nasty sliver from a pallet that introduced infection, requiring hospitalization.

So, just be picky. Always wear gloves and choose wisely. When in doubt, leave it out. But how can you tell?

Fortunately, it is straightforward. Common sense is your best starting point. Skip any that:

- Are unusually heavy
- Are wet
- Appear greasy
- Have stains
- Smell
- Display too many twisted nails
- Otherwise look unsavory

Beyond that, what else can you look for? Many pallets are stamped "HT" for heat-treated, a good sign that the pallet is newer and was kiln-dried to remove moisture, which could otherwise turn into a problem.

Remember, if a pallet isn't dry, it'll be a pain to work with, and it could harbor bacteria, so give it a pass.

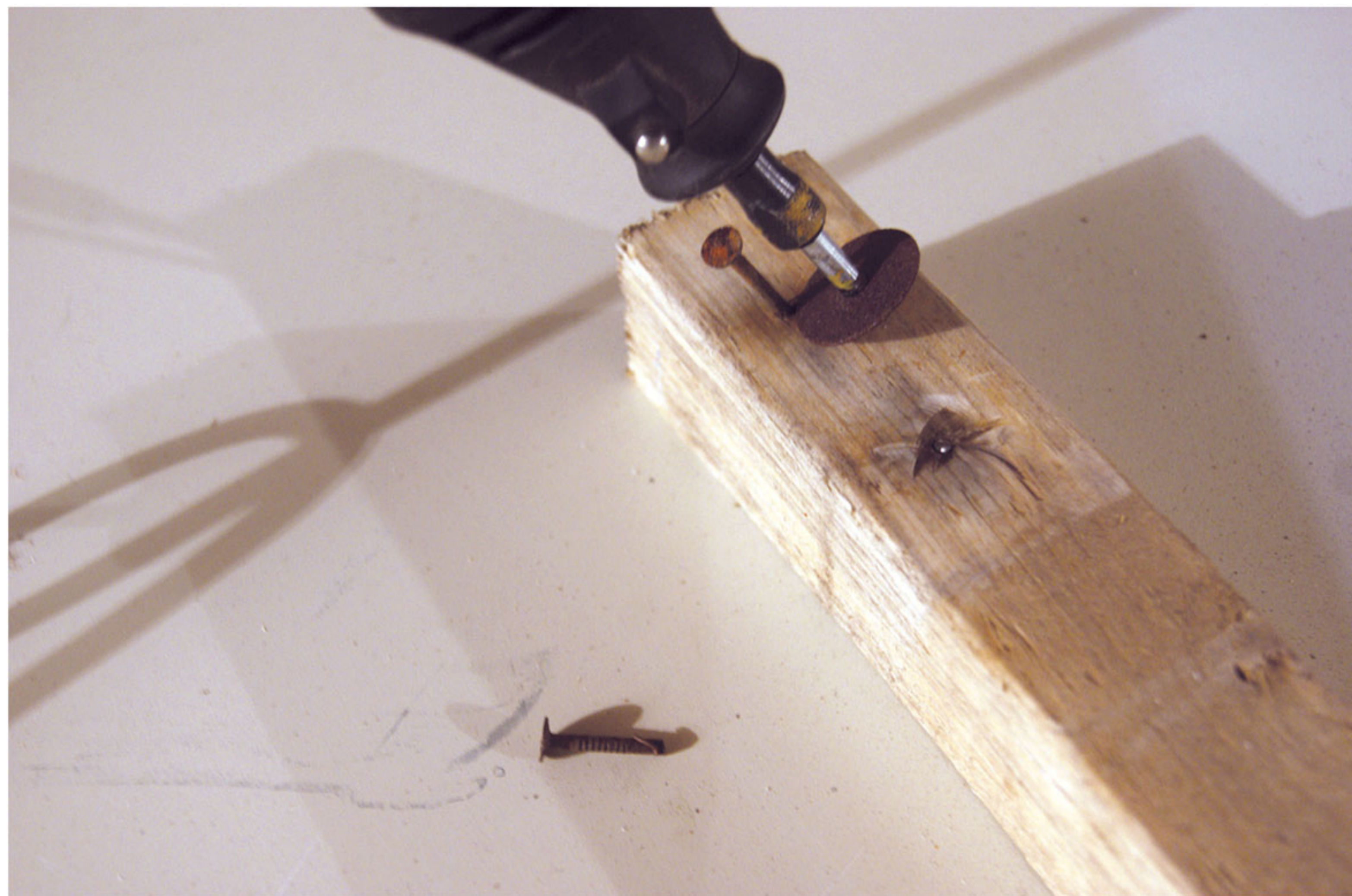
Some pallets are even stamped with a website or a toll-free phone number that lets you know about the pallet's origins. You probably don't need to get on the phone or fire up a web browser: The mere presence of an indicator



Unruly stacks may hold treasures to create great projects. Always ask permission first before you delve into a stack. The business may recycle, reuse or be reimbursed for the pallets.



Pedigree stamps are a good sign, often indicating that a responsible company has produced the pallet to be as safe as possible.



Manufacturers like spiral-cut nails, but pallet scavengers could do without them. A rotary tool equipped with a metal-cutting disc is a fast and easy way to cut the nails flush.

like this is a good sign that the pallet was produced as carefully as possible. These pallets are probably good candidates for your projects, provided they meet your other basic criteria (i.e., clean, dry, good condition, etc.).

3. BEWARE BACTERIA

Even if a pallet was clean, dry and safe on the day it was manufactured, it could have been exposed to undesirable bacteria sometime during its lifetime. To play it safe, scrub the wood with bleach and soapy water. Rinse well, and allow to completely dry. Remember, wood is porous, so there's a chance the bacteria is embedded. Don't use pallet wood for food-related items, children's toys, or children's play furniture. It just isn't worth the risk.

4. SUITABILITY: IS IT A GOOD MATCH FOR YOUR PROJECT?

The key to working with pallets is strategy. Having wood pallet project ideas will guide your assessment. The first question is, does this pallet merit a second glance or should I move on? If it looks promising, you'll want to ascertain the following.

- Is it safe?
- Are there any especially appealing boards (due to species, interesting character, or useful dimensions)?
- How much usable material does it contain?

- How easy will it be to disassemble? For example, softwood runners are easier to get nails out of than hardwood ones. With a little practice, you'll be able to see the difference at a glance.

The answers to these questions, in aggregate, will determine which pallets are worth your time and effort. Sometimes I will only take one board from a pallet, as I don't have infinite time and energy to spend on tasks that only offer a marginal yield. Is this the optimal level of upcycling? Maybe not, but I don't try to take on the responsibility of reusing every piece of material in all of the world's pallets; once you view the situation through this lens, it is easy to see that even partial reuse is certainly better than none at all. In other cases, I can use the whole thing.

When it comes to pallet disassembly, a methodical approach pays off. Take a minute to decide which parts of the pallet are the most important to you. You may not have a premium use for all of the wood, due to damaged pieces, odd sizes, or the presence of way too many nails in a given spot.

Pallet sizing

Wood pallets come in all shapes and sizes, and depending on where you live, you will encounter pallets of many different dimensions. In North America, for example, some common

CHECK A PALLET FOR SYMBOLS:

LABEL	MEANING
HT	Heat-treated
KD	Kiln Dried
MB	Methyl bromide treated
DB	Debarked
S-P-F	Contains spruce, pine, or fir components

pallet sizes include 48-by-48 inches, 48-by-20 inches, and 36-by-36 inches. The great thing about pallets, however, is it doesn't matter what shape or size they come in, as long as you can harvest wood of the dimensions you need from them. All the others can be made from wood harvested from pallets and cut to size.

Dealing with nails

Pallets are usually built with nails, because it is a low-tech but strong approach. If you take a close look, you'll see that many of the nails are spiral-shaped; this is because their unique shape helps them resist backing out and allowing the boards to loosen over time. Spiral nails are good for constructing pallets, but can create a challenge for someone who is actually trying to remove the nails to get at usable lumber. My standard approach is to pull the nails using a crowbar or similar tool if it isn't too time-consuming, and to leave them in when removal isn't feasible. This latter approach usually means cutting around the nail-infested areas and harvesting shorter, but still useful, lengths.

Occasionally, I'll have nails that refuse to budge from a piece of wood that I still really want to use: In cases like this, I cut the nails back as far as possible using a hand-held rotary grinder, angle grinder or pliers. I then use a belt sander to ensure the nail heads are flush to the surface. This approach is neat because the polished nail heads gleam nicely and recall the wood's origins as a humble pallet.

Learn to recognize the inherent limits of some pallets. Occasionally, I'll come across a pallet that features

really pretty wood, but the nails are just torture to remove. In this case, cutting out the largest nail-free sections of wood possible is the best decision. It may mean settling for shorter lengths of wood than you'd ideally like, but it will allow you to work safely with the material.

If you need larger pieces, find a pallet that will allow you to harvest them more easily, and save the short pieces for another day. You'll eventually find a project that they're better suited for. It is also worth noting that changing your design and/or construction techniques might allow you to use the shorter pieces right away, too.

Sometimes the nails themselves aren't the only problem: Boards are sometimes prone to splitting in the areas where nails have been inserted, especially if the nails are close to the end of the board. In this case, I usually just cut off the cracked portion so I have a clean end to start with. If cutting off the end isn't an option – i.e., you really need the extra length for a given project – you might be able to force glue into the crack and clamp it shut.

While this method isn't guaranteed to work, it can be worth a try, and it doesn't take very long, so you're not out a lot of time and energy if the crack reopens.

The good thing about nails in pallets is that they are placed fairly predictably: You won't generally find random nails occurring in random places. Manufacturers have no incentive to place nails at irregular intervals. So, if you got all of the nails out of the obvious places, you can generally feel fine about sending a board through a planer, jointer or table saw.

Don't be afraid to move things around when you're working with pallets; use the floor, a workbench, or whatever else works. Finer tasks like pulling nails are often most easily accomplished on a bench, whereas larger-scale tasks like tearing apart pallets will probably occur with the pallet on the ground. Jump right in, and you'll get a feel for it in about five minutes.

EREN (SEA+PRAIRIE)



A simple yet charming project, this movable table can fit anywhere you need it – even outdoors.



For an accent wall like this one, you may need up to 25 pallets. Construction adhesive and a nail gun attached the pallets, and the TV is anchored to a wall stud.

Wood pallet project ideas

▪ EASILY MOVABLE TABLE

It doesn't get much simpler than this, but the result is still utterly charming. Bolt a set of large casters (they look to be about 4 inches in diameter to me) to the bottom of a pallet, and you've got an instant, low-to-the ground, easily movable table. The rough, weathered quality of the wood on this pallet makes it ideally suited for outdoor use. It could be a perfect way to transport garden or

yard tools around the backyard as you do some mulching or pruning.

▪ WOOD PALLET WALL

An enterprising mom took some pallets home from work and used them to create an accent wall in her living room. It took about 25 pallets to cover the wall. She used construction adhesive and a nail gun to attach the pallets, and then anchored the TV to a stud. The wood pallet wall is completely unfinished, without stain or polyurethane.



Change up this design for an outdoor loveseat by making the design of the back your own and adding cushions and pillows in different colors. **BELOW:** A simple design adds charm to a pallet porch swing. Hang the swing outdoors, indoors or from a tree.

▪ OUTDOOR LOVESEAT

This outdoor loveseat is the perfect mix of fun and fashion, with a funky back pattern and cushions and pillows in refined colors.

▪ PALLET PORCH SWING

A simple pallet design adds charm to this porch. You could also suspend the pallet porch swing from a tree, or even an indoor ceiling.

▪ WOOD PALLET COFFEE TABLE

Paint and stack a few pallets, and you have a new wood pallet coffee table for your family room. Use a paint or a finish that will match the décor and style of your home. If you redecorate, simply sand the pallet down and start again. 🛠️

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TOP TO BOTTOM: LAURA DUSTIN; SHERYL SALISBURY

Build This → Easy SLIDING HOOP HOUSE

Make plans to keep your raised beds full of greens for the winter.

From our friends at FARM SHOW®

Vern Harris likes setting up hoop houses over his vegetable beds, but he doesn't like the hassle of working under them. Most designs require lifting the plastic sides to get at the produce. So, Harris came up with hoops that glide on rails, making access as easy as pulling on two ropes.

"Anybody who is even slightly mechanical can build one," Harris says. "If they run into trouble, I'd be glad to help. My hoop houses let me grow greens in the snow."

Harris lives in northwestern Washington state where winter temperatures are commonly in the 30s and 40s. Hoop houses make year-round gardening possible. He builds garden beds from 8-foot-long, 2-by-6-inch untreated fir. The hoop house is framed with schedule 40 PVC pipe. The rails the house slides on are 3/4-inch-diameter, and the hoops are 1/2 inch in diameter. They fit into 1-inch-diameter tees that glide over the rails.

"I needed to raise the rails slightly above the bed sides so the tees can glide down the rail," Harris says. "To get the height, I predrilled holes through the pipes and set 1/2-inch-long pieces of 1/2-inch aluminum tubing under the holes. Screws driven through the holes and through the tubing secure the rails in place."

Harris then sliced away the bottoms of each hoop tee. This allows them to slide past the aluminum supports. He also extended the rails about 18 inches past one end of the bed so all the hoops could be pulled to that end, exposing the entire bed. The rails are braced with a crosspiece.

After placing five tees in place on each rail, Harris inserted a 9-foot, 1/2-inch PVC pipe in a tee on one side and then bent it



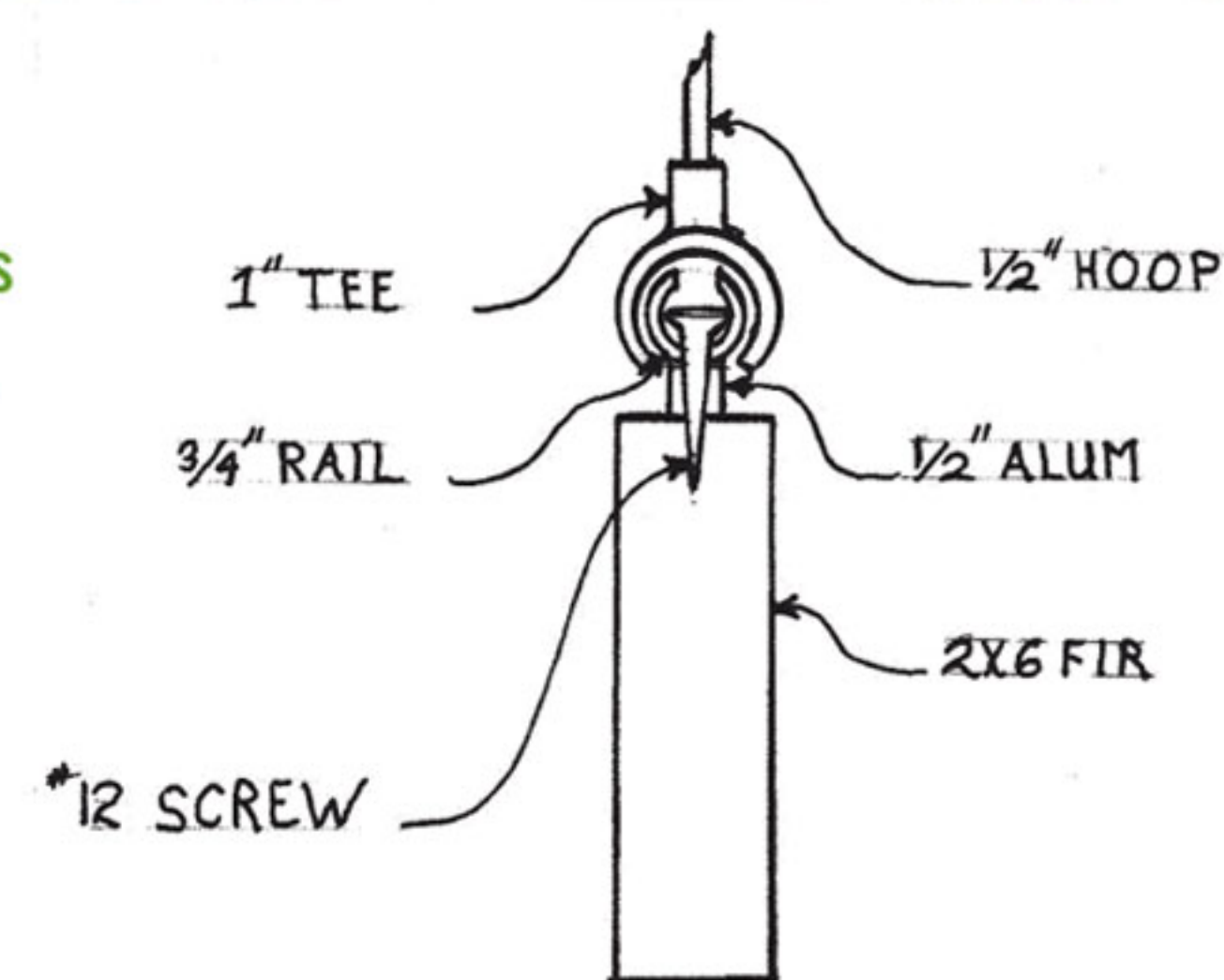
All the hoops can be pulled to one end of the bed, exposing the entire growing area to sunlight. **RIGHT:** Multiple hoops glide on rails, making access to the garden bed as easy as pulling on two ropes.

to fit the other end into the opposing tee. He predrilled holes for attaching the plastic. Harris suggests using high-quality film.

"I cut a plastic sheet to 9 feet by 10 feet and attached it to the hoops with the 9-foot side running the length of the 8-foot bed and hanging over each end by 6 inches," Harris says. "The 10-foot dimension was fastened so edges overlapped hoop ends by 6 inches. I used 1/2-inch lath screws with washer heads to help prevent tears and leaks."

To enclose the ends, Harris cut two 4-by-5-foot pieces of plastic. He attached one to the hoop at the extended end of the bed. The other is temporarily clamped to the end hoop when the house is closed.

To make opening easy, he installed 3/16-inch eye screws at the bottoms of each side of the front rail. To these he attached lengths of 3/16-inch clothesline cord. To



open or close, he simply pulls on the cords.

"In my climate, a single layer of plastic is enough to keep my hoop houses from freezing on our coldest days," says Harris. "In a colder climate, you could attach a second layer of plastic to the hoops. It's well worth it either way. Those fresh garden greens taste great in January."

Harris is willing to help with information, a complete parts list, or even parts ordering. If desired, he will even prepare a hoop house kit to order.

If you're interested in more information, you can contact Vern Harris at gardenhoop@gmail.com. 🛠️



Build a Compost Tumbler

Rapidly rot your way to rich and healthy garden soil.

By KRIS WETHERBEE

Truth be told, our compost pile very rarely, if ever, gets turned. When it comes to the compost heap, my preferred method is to pile it up and let nature take its course, which it effectively does. Compost cures whether you turn the pile or not; it just happens at a slower pace when you leave it to nature alone. While this method of composting is easy on the back and

takes little effort to maintain, it does take time for the process to complete—sometimes up to a year or more.

We still keep a compost pile, but for producing compost on the fast track, I prefer a compost tumbler. It's an easy-to-use option for the busy gardener, the closed environment of this barrel-style tumbler makes it rodent-resistant, and when used correctly, you can create compost in eight to 10 weeks from start to finish. Besides, I'd rather turn a tumbler than toss and turn the compost with a manure fork any day.



Add your kitchen waste as the green portion of your compost pile.



Adding compost to your garden helps the plants and the soil. **OPPOSITE:** Keep your compost tumbler near the back door or near your garden plots for easier access.

Build a compost tumbler

Building this compost tumbler is surprisingly easy and can be done in an afternoon. Here's what you need to get started.

Start with the materials list at right, and gather your tools (a tools list is also at right).

1. Start by assembling the four pieces of 2-by-4 and sawhorse brackets to make two sawhorse halves.

If needed, you can strengthen each side by attaching a cross member board or a triangle-shaped piece of plywood placed 6 inches below the top of the A-frame and 6 inches above the A-frame's bottom.

2. Measure and mark your container along its length halfway between the top and bottom. Make a similar mark on the opposite side. Through each mark, drill a hole that is large enough in diameter to accommodate the gal-

vanized pipe you are going to use for the axle.

3. Use a $\frac{3}{8}$ -inch or $\frac{1}{2}$ -inch bit to drill holes, spaced 4 to 6 inches apart, all around the container to provide for aeration and drainage.

Drill 12 to 15 holes in the container's bottom, and a total of 6 to 10 rings of holes around the barrel. The goal is to create enough holes to allow excess moisture to seep out and keep air flowing freely through any materials that you add to the compost tumbler.

4. Attach one handle about 6 inches below the top of your container. Attach the second handle on the opposite side about 6 inches above the bottom of your container.

5. To assemble your compost tumbler, choose a level area where you want your composter to live and put the sawhorse halves in place.

Insert the galvanized metal pipe through the two opposing center holes

MATERIALS LIST

- Sturdy plastic drum or barrel with tight-fitting lid, or galvanized steel trash can with tight-fitting lid, between 30 and 55 gallons (for particulars, see "Tips to Tumbler Success" on Page 44)
- Galvanized pipe (threaded both ends), 1 to 1½ inches in diameter and 36 to 48 inches long (diameter and length will depend on the size of your container)
- 1- to 2-inch-diameter galvanized pipe caps (to match the diameter of your galvanized pipe)
- 2-by-4 lumber, 4 pieces with each piece cut to a length that is one-half the container's height plus 2 feet. For example, a 55-gallon drum at 36 inches in height requires 4 pieces of 2-by-4, with each piece cut 42 inches long (36 divided by 2, plus 24 equals 42 inches).
- 2 sawhorse brackets and galvanized screws
- 2 bungee cords (needed only to secure a nonlocking lid)
- 2 handles with bolts and washers, for turning your composter

TOOLS NEEDED

- Drill with $\frac{3}{8}$ -inch or $\frac{1}{2}$ -inch bit for drainage/aeration holes; and one bit large enough in diameter to accommodate galvanized pipe
- Screwdriver, or drill with screwdriver bits
- Adjustable wrench

that you previously drilled in your container. Screw on the pipe caps. Place the container between the two sawhorse halves, top end up, and set in place so one end of each pipe sits on a sawhorse half.

6. Fill the container with kitchen scraps, grass clippings, leaves, straw, garden trimmings and other organic materials. Moisten the compost materials, if needed, and toss in a few scoops of fresh topsoil every time you add more materials.

7. Always make sure the lid is secure before turning your composter. If needed, you can use elastic bungee cords to secure a loose-fitting lid by stretching the cords across the top of the lid in a crisscross fashion and securing the hooks to the garbage handles. If your container lacks handles, secure each hook to one of the small aeration holes. 🛠️



Colorful cages surround spring tomato plants taking root in the compost-enriched soil.

TIPS TO TUMBLER SUCCESS

▪ Choosing a container.

Look for galvanized steel trash cans or plastic drums or barrels at your local home improvement store, or check out eBay or other online sources for new or used containers. Large restaurant or food distributors are another source for food barrels.

You may already have a new or used plastic drum or rain barrel on hand. Just make sure that the container was used only for food or other nontoxic substances. You don't want any hazardous materials or toxic residue to end up in your compost, and ultimately, your garden.

▪ Keep materials in balance.

The closed environment of your compost tumbler is different than an open pile; think potted plant versus a plant in a terrarium. As such, it's important to add at least 40 percent of high-carbon organic waste – brown materials – to ensure friable compost instead of a slimy and smelly mess. I prefer a 50/50 ratio – an equal mix of high-nitrogen organic waste (green materials) and high-carbon organic wastes (brown materials) every time you add materials to your compost tumbler.

Make it easy to maintain the proper green-to-brown ratio by keeping a bag of leaves, shredded newspaper or bale of straw near your composter. And a large bucket filled with topsoil gives easy access for when you add more materials to the compost tumbler.

▪ Size matters.

It helps to break up, cut up, chop up, or shred anything that's large or easily mats, such as tree branches, corn stalks, watermelon rinds, leaves, etc. You can leave them whole if you would like – everything eventually decomposes – but you'll speed up the process if the pieces are smaller.

▪ Maintain adequate moisture.

Your compost tumbler will maintain moisture more efficiently than compost in an open pile or compost bin. As such, the goal is to keep your materials slightly damp, like a well-wrung sponge.

You may not need to add any additional water depending on the weather, temperature and location of your compost tumbler.

If the materials feel somewhat dry, add just enough water (a light misting is best) to keep materials moistened, but not wet. If the contents are wetter than a damp sponge, leave the lid open for a day or so to allow them to dry out. This will help accelerate the composting process without adding excess weight to the container.

▪ Turn up the action.

Turning the pile is easy with this compost tumbler – just keep grabbing the handles and pulling downward. By turning the tumbler you will introduce air and redistribute the composting material each time you spin.

The spinning action, on occasion, can force some of the organic material into some of the air holes.

Since this composter is designed with either $\frac{3}{8}$ - or $\frac{1}{2}$ -inch airholes rather than 1-inch airholes, this shouldn't be an issue. Even so, it's a good idea to check the airholes every now and then to make sure that none have become clogged by organic material inside the container.

Give the tumbler a spin every time you add organic matter. For faster compost, give it a few good turns from once a day to once a week. The frequency will depend on the outdoor temperature and size of materials being composted. Keep spinning the drum and your compost should be ready to use in 10 weeks or less.



How to Build a Small Garden GREENHOUSE

Treat your plants to a safe transition and extend the growing season.

By TOM LARSON

When I decided to build my first greenhouse, I wanted a place for my vegetable plants to continue growing after they had become too large for the lighted shelves where I started them. I wasn't sure I wanted a greenhouse at all and didn't, therefore, want to put much money into one to use for a trial. Buying a kit or a complete

structure involved more than I wanted to spend, so I decided to build my own.

Since I wasn't sure where I might locate the greenhouse, I made it light and sturdy enough to move around, and covered it with an elaborate array of laminated arc-shaped beams supporting two layers of hardware store plastic. These plastic-covered laminations have survived winter storms, thunderstorms and some small hail, but creating the beams was tedious and time consuming so I designed a more conventional structure for

this project. I also chased pieces of the cheap plastic I used as a cover (the first time) all over the neighborhood one winter, so I recommend using film made for greenhouses – it will last for several years.

When I leave my plants in the greenhouse at night, a small thermostatically controlled electric heater keeps the temperature above 50 degrees Fahrenheit. During the day, heat is always a hazard so ventilation is essential. On a cold but sunny day, the temperature in the greenhouse tops out at 140 degrees Fahrenheit

MATERIALS LIST

- 1 4-foot-by-8-foot sheet of $\frac{3}{4}$ -inch lattice (plant shelf)
 - 1 30-inch wooden screen door
 - 2 4-foot-by-8-foot sheets of $\frac{3}{8}$ -inch plywood (top and bottom of base)
 - 3 8-foot 2-by-4s (perimeter of base)
 - 7 8-foot 1-by-4s (interior of base frame)
 - 5 8-foot 1-by-3s (support frame for plant shelf)
 - 40 8-foot 1-by-2s (sort carefully at the lumberyard or buy several extras)
 - 12 8-foot 1-by-2s (back wall)
 - 8 8-foot 1-by-2s (end walls)
 - 11 8-foot 1-by-2s (rafters)
 - 6 8-foot 1-by-2s (plates)
 - 3 8-foot 1-by-2s (window frame)
 - 1 10-foot 1-by-2 (ridge pole)
 - 2 10-foot treated 2-by-4s (skids)
 - 2 3-inch eye bolts with nuts and washers
 - 2 tubes construction glue
 - 1 heat-activated opener
 - 120 linear feet of batten tape
 - 10-foot-by-30-foot greenhouse plastic
- Approximate numbers of screws:
- 100 $1\frac{1}{2}$ -inch exterior screws
 - 50 2-inch exterior screws
 - 100 3-inch exterior screws
 - 20 $3\frac{1}{2}$ -inch exterior screws

with the door closed. I try to keep the temperature below 80 degrees by propping the door open, but during my first house's second spring, I accidentally left the door shut at noon. After lunch and a brief nap, I returned to plants that looked as if they had been sprayed with brush killer the day before. Opening the door and watering didn't revive them. To help prevent that happening again, I've included a window and a heat-activated opener in this design. Commonly available radio-transmitter systems have alarms to alert you if the temperature inside the greenhouse gets too hot or cold. I'm going to set mine up this spring.

The wall and roof framing used in this greenhouse is appearance-grade 1-by-2 pine. The base is untreated construction grade plywood and pine 1-by-4s and 2-by-4s. The skids are 10-foot treated,

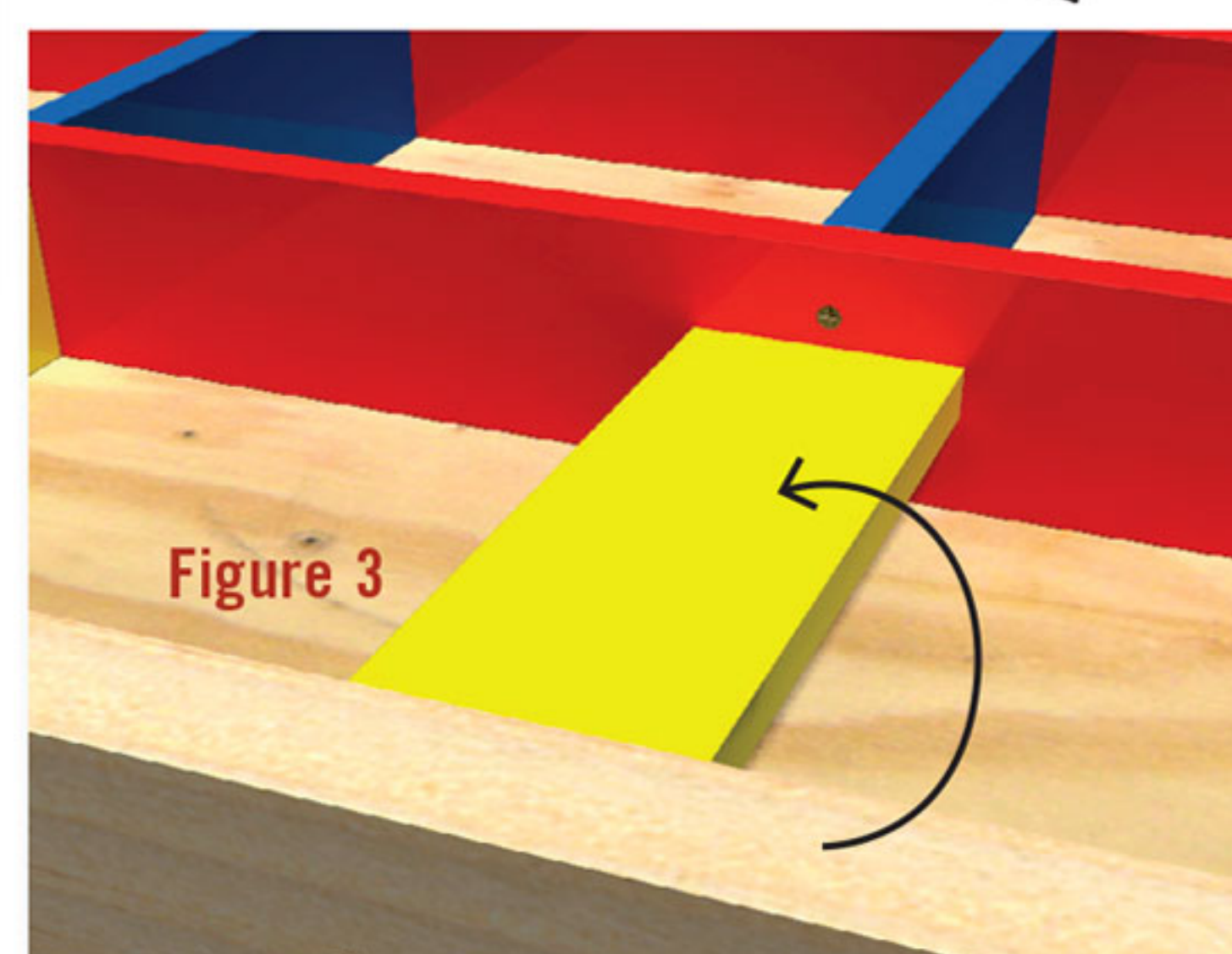
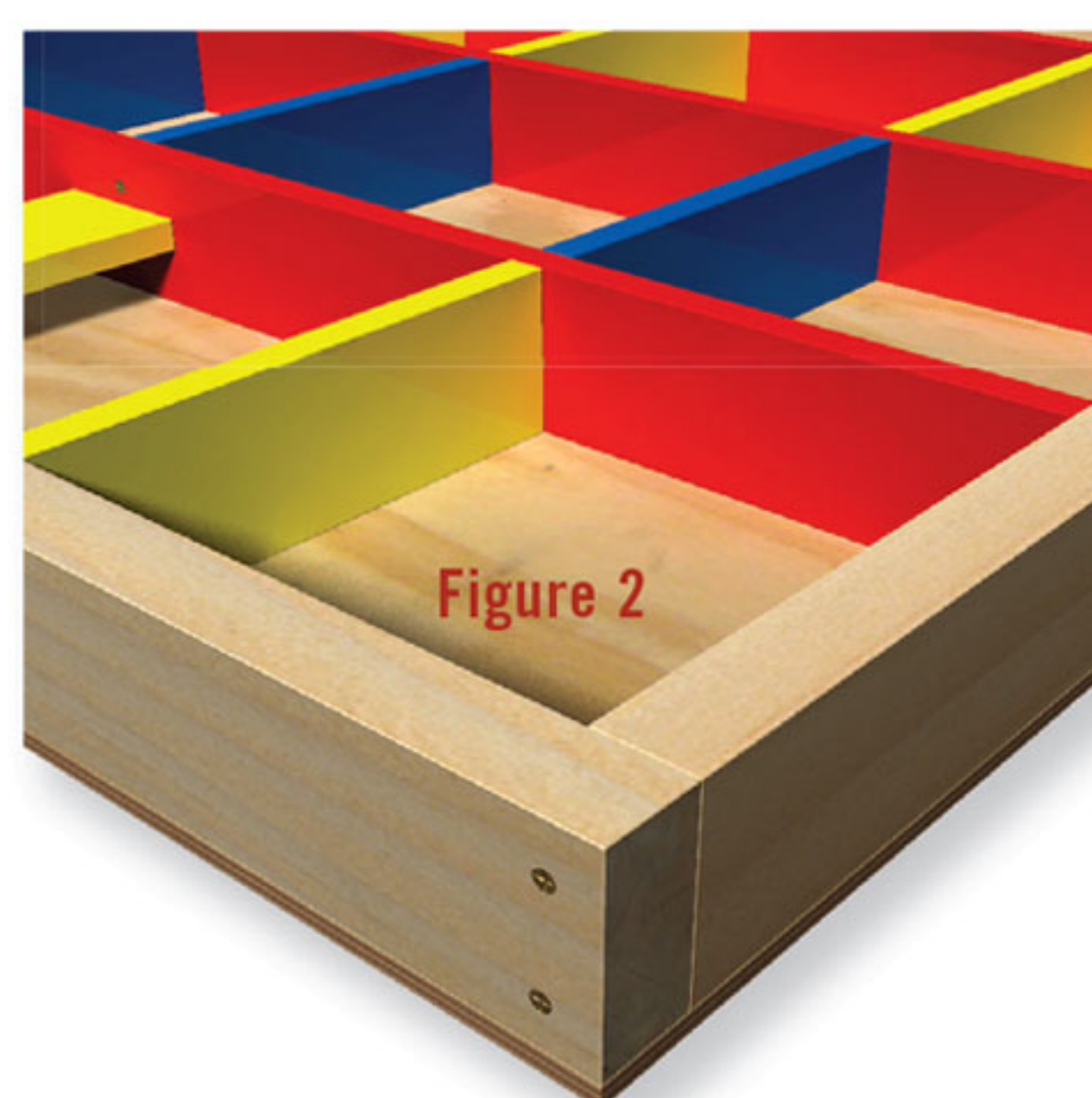
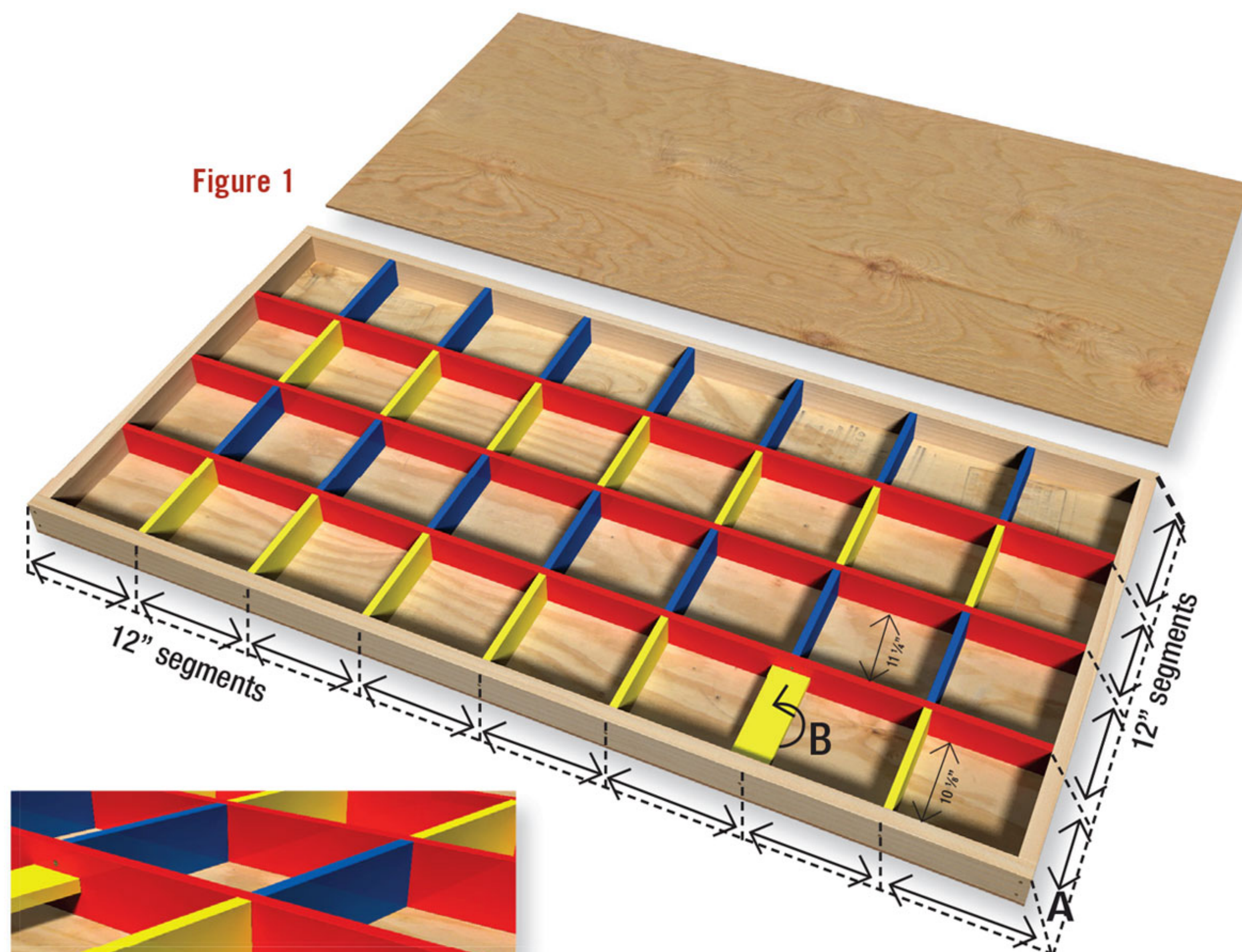


Figure 1: The key to the torsion box's strength is the honeycomblike internal framework that's glued to both external surfaces. The yellow and blue pieces need only be fastened to the red and outer pieces sufficiently to hold them for gluing. Getting screws into the internal cross members is facilitated by rotating the outer cross members (Box B). Locating the internal frameworks is as easy as marking the outer frame at 12-inch intervals and centering the pieces. Once the two plywood skins are glued to the frame, you have a rigid, durable and relatively lightweight foundation. Box A detail in Figure 2: The 45-inch-long 2-by-4 is to the right; the full 8-foot-long piece is to the left. The 2-by-4 frame should be squared up with one piece of plywood before installing the internal frameworks. Box B detail in Figure 3: Rotate loosely fastened cross members for gluing.

construction-grade 2-by-4s. If you intend to water by general spraying, you should consider using treated or naturally rot-resistant lumber, such as cedar, redwood or walnut heartwood. Other possibilities are Osage orange, mulberry and black locust. I'm not concerned about rot because I moisten flats by pouring water into a corner I have lifted, and pots I water just enough to keep the soil damp.

I used a 4-foot-by-8-foot piece of wood lattice as the shelf in my first greenhouse; I replaced it a year later with plastic lattice. Both proved too flimsy. In this design I used $\frac{3}{4}$ -inch thick cedar lattice. I like lattice because it allows some

light to shine through, and spilled water doesn't puddle on its surface.

Construction notes

The strength and rigidity of the torsion box that forms the base of the greenhouse require only that the frame pieces fit snugly together and provide a level base for the plywood until the glue sets. The completed base weighs about 140 pounds, so you might want help moving or tipping it to attach the plastic and skids to the underside. The upper frame is amply strong for its intended purpose, but it is best not to use it as a lever to tip the base.

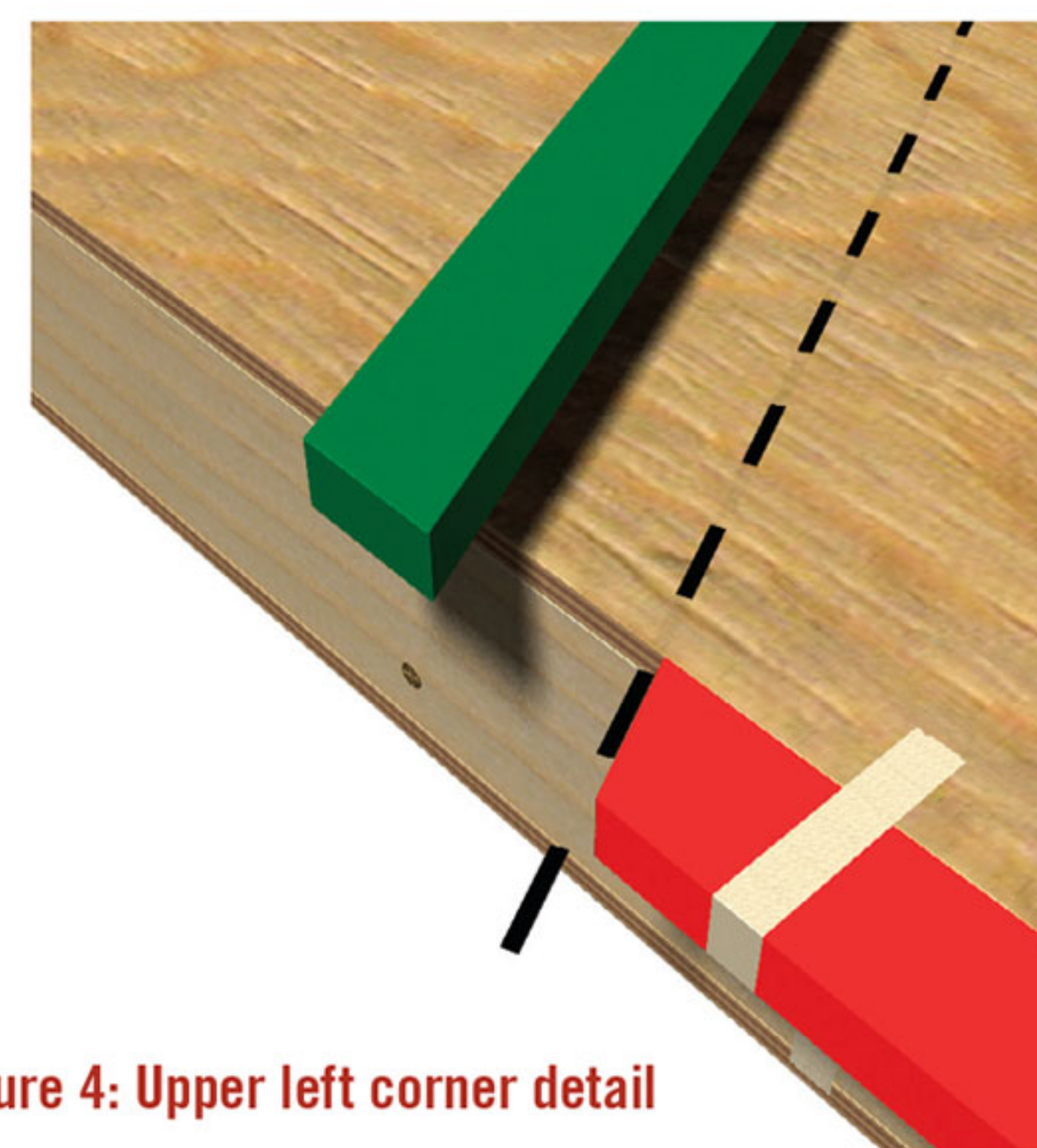
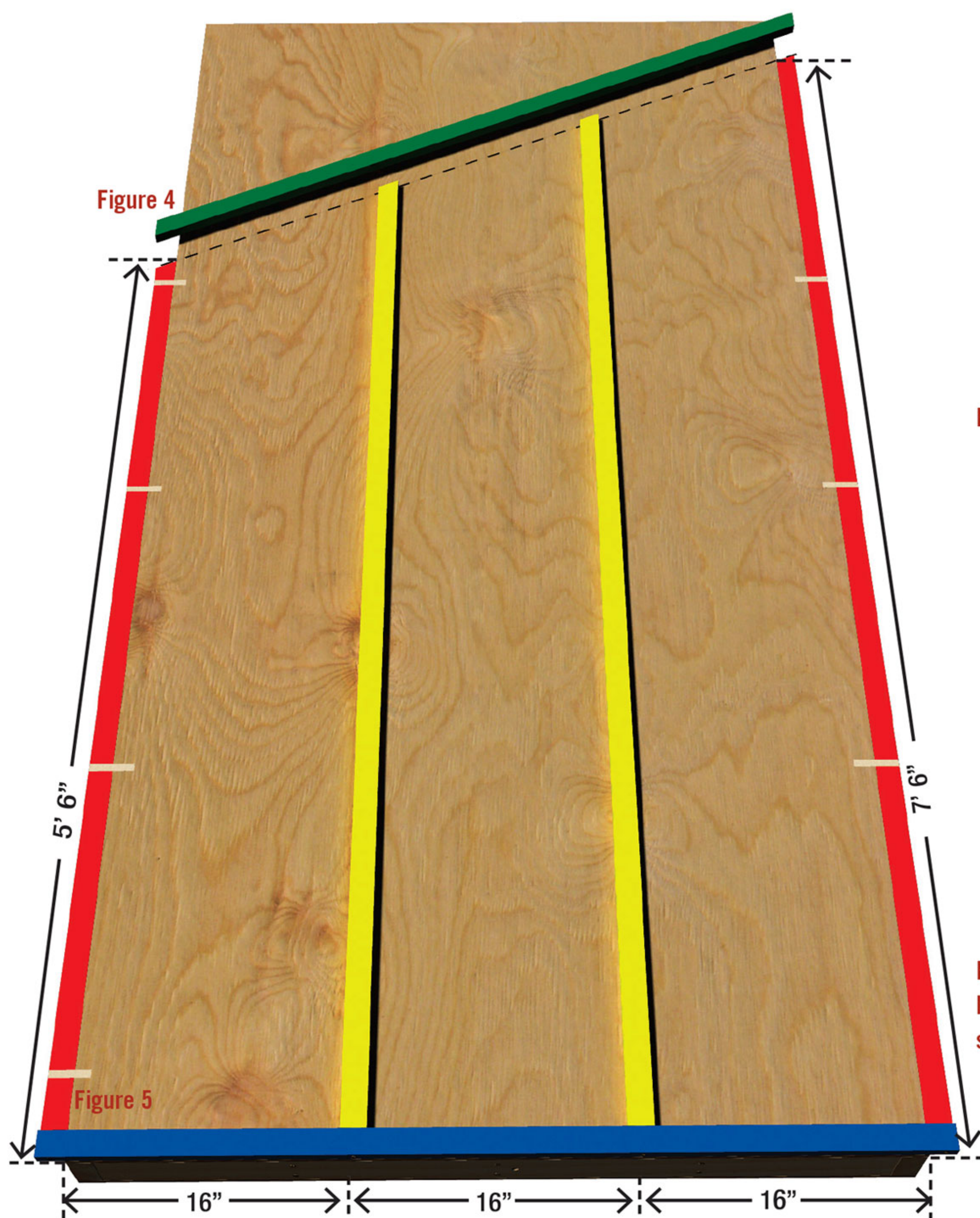


Figure 4: Upper left corner detail

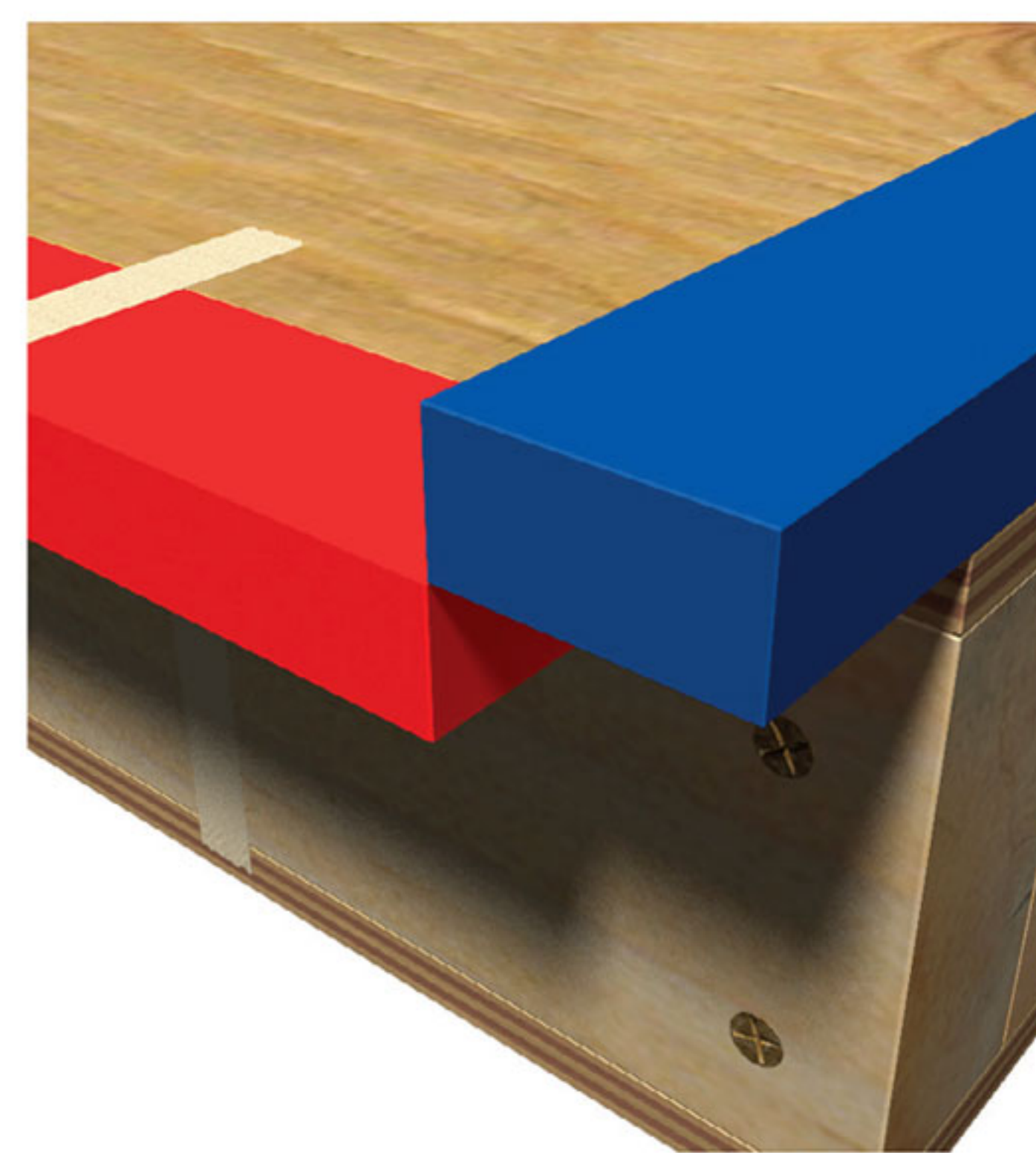


Figure 5: Lower left corner detail of sidewall layout. The red stud is taped to the base's side flush with the top, while the blue bottom

Figure 6: The completed base makes a perfect surface for laying out the greenhouse's sidewalls, and makes it easy to mark angled pieces for cutting.

The upper frame's joints are "crowded" with screws. If you hit a screw while drilling a pilot hole, adjust the angle of the bit until it clears.

Greenhouse plastic is damaged by oil-based paint; use latex coatings only.

Base construction

First, make a frame by cutting two 45-inch 2-by-4s and fastening them to two 8-foot 2-by-4s (shorter ends between the longer sides) using two 3½-inch deck screws at each corner (Figure 1). Next, mark three 93-inch-long 1-by-4 stringers shown in red and fasten them inside the frame at points marked on the ends using two 3-inch deck screws at each joint.

Measure the distance from the inside of one side to adjacent red stringer (10⅞ inches in our box). (Because of minor deviations in the thickness of lumber, a direct measurement is best.) Cut 14 1-by-4 blocks to that length. Measure the distance between two of the red stringers (11¼ inches in our box) and cut 14 1-by-4 blocks to this second length.

Fasten seven of the shorter blocks to the first of the red stringers using one screw at the marks. For now, leave the other end of these blocks unfastened (the end that would connect to the outside 8-foot frame). Next fasten seven of the longer blocks between the second and third stringer using one screw at the

center of the stringer. Rotate these two rows of blocks (in yellow) 90 degrees as shown in Figure 3. Fasten the remaining blocks (in blue) in place using two screws at each joint. Then rotate the other two rows of blocks back into position and fasten the first row to the frame. Drill a hole in each end 2-by-4 for a ⅝-inch eye bolt 2 inches long. Locate these holes just far enough off center to miss the red stringer centered on the inside. Put the eye bolts in the holes and put washers and nuts on the inside.

Next, fasten ⅜-inch thick plywood sheets to both sides of the frame using 1½-inch screws in each corner and at the center of each side. Remove the screws on one piece of plywood and set it aside as shown. Run beads of construction glue on the top edge of all the frame pieces. Lower the plywood onto the frame; be careful that the plywood drops directly down onto the frame. Replace the screws. Place weight on the plywood.

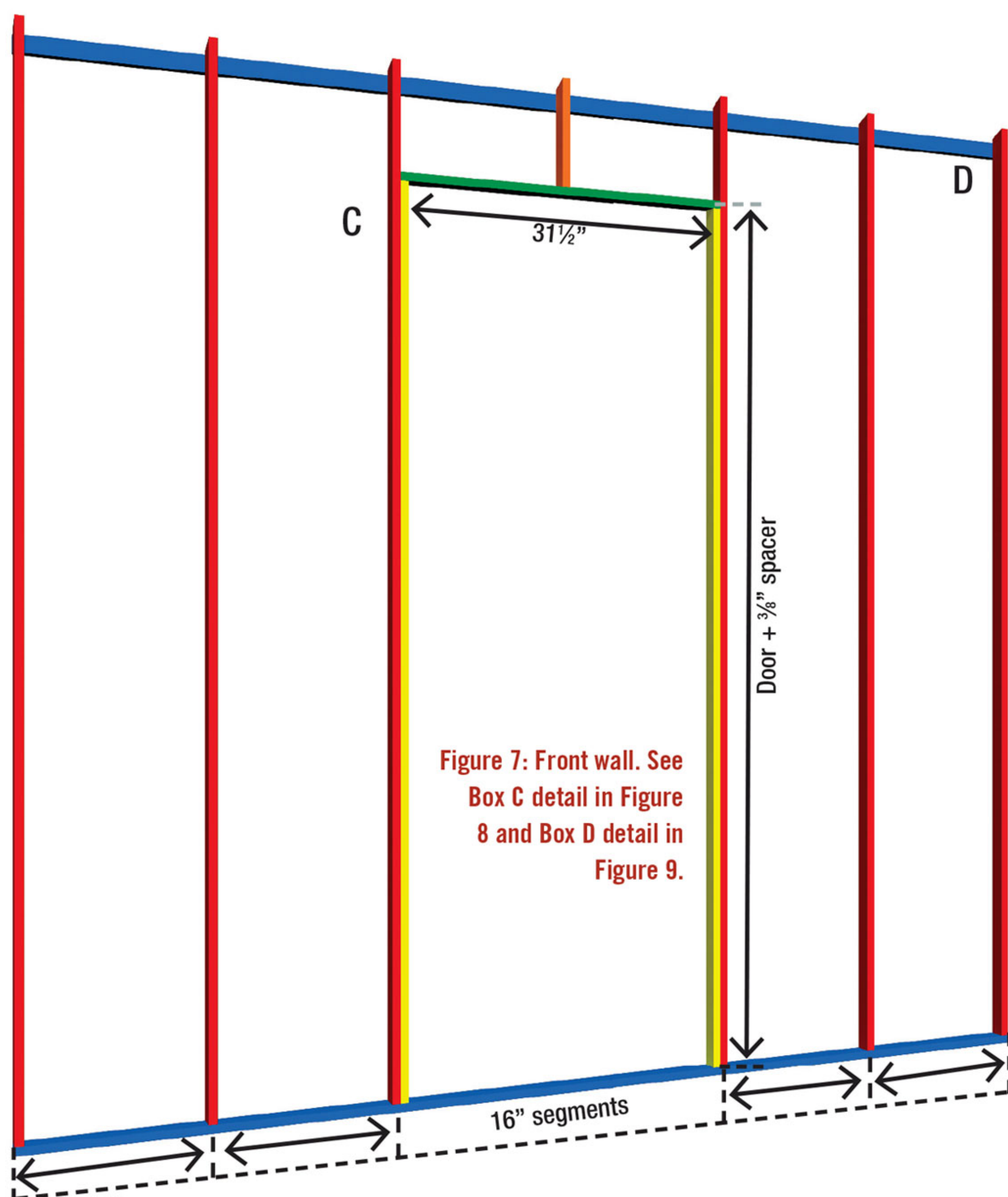


Figure 7: Front wall. See Box C detail in Figure 8 and Box D detail in Figure 9.

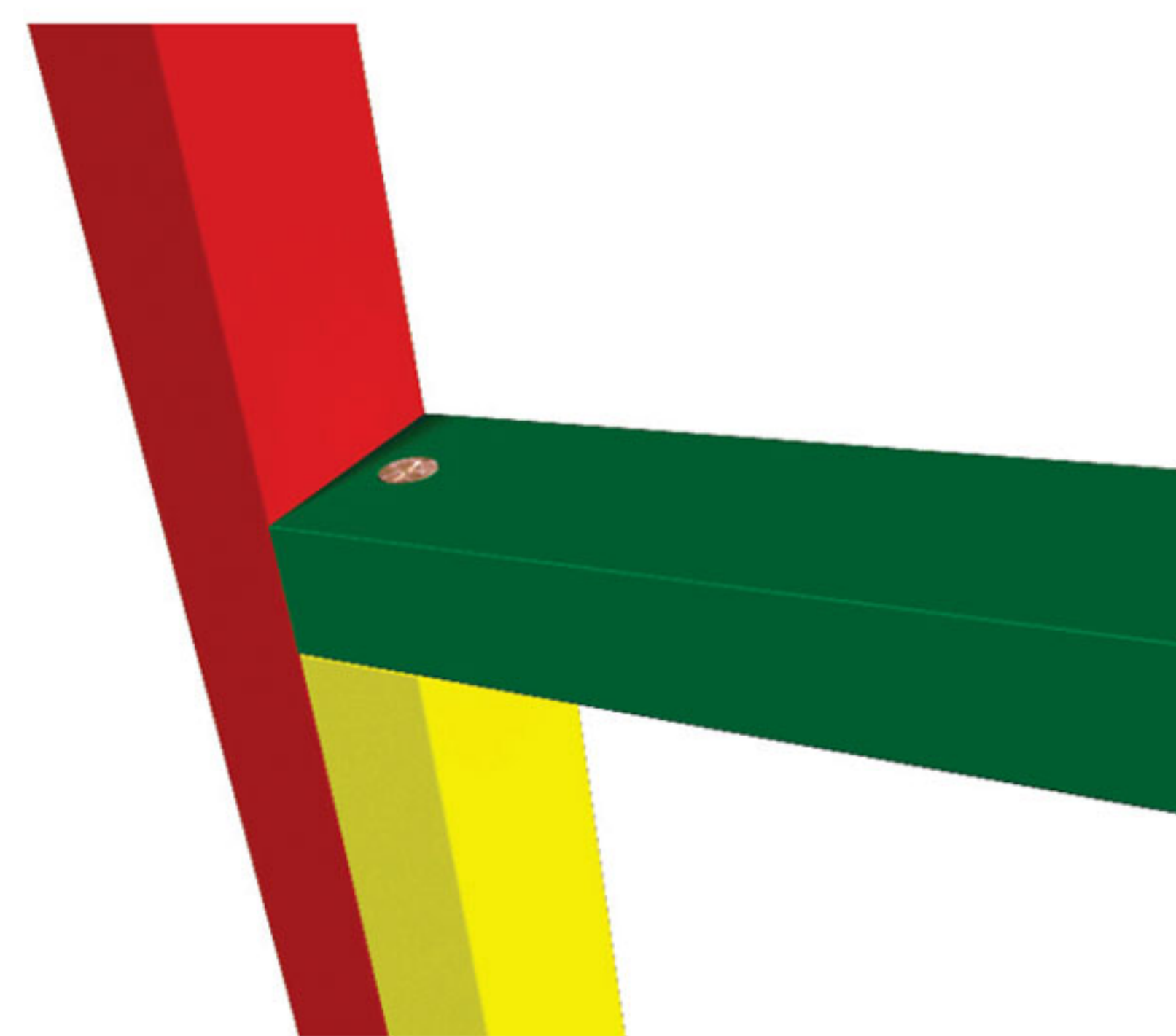


Figure 8: Attaching the door header.

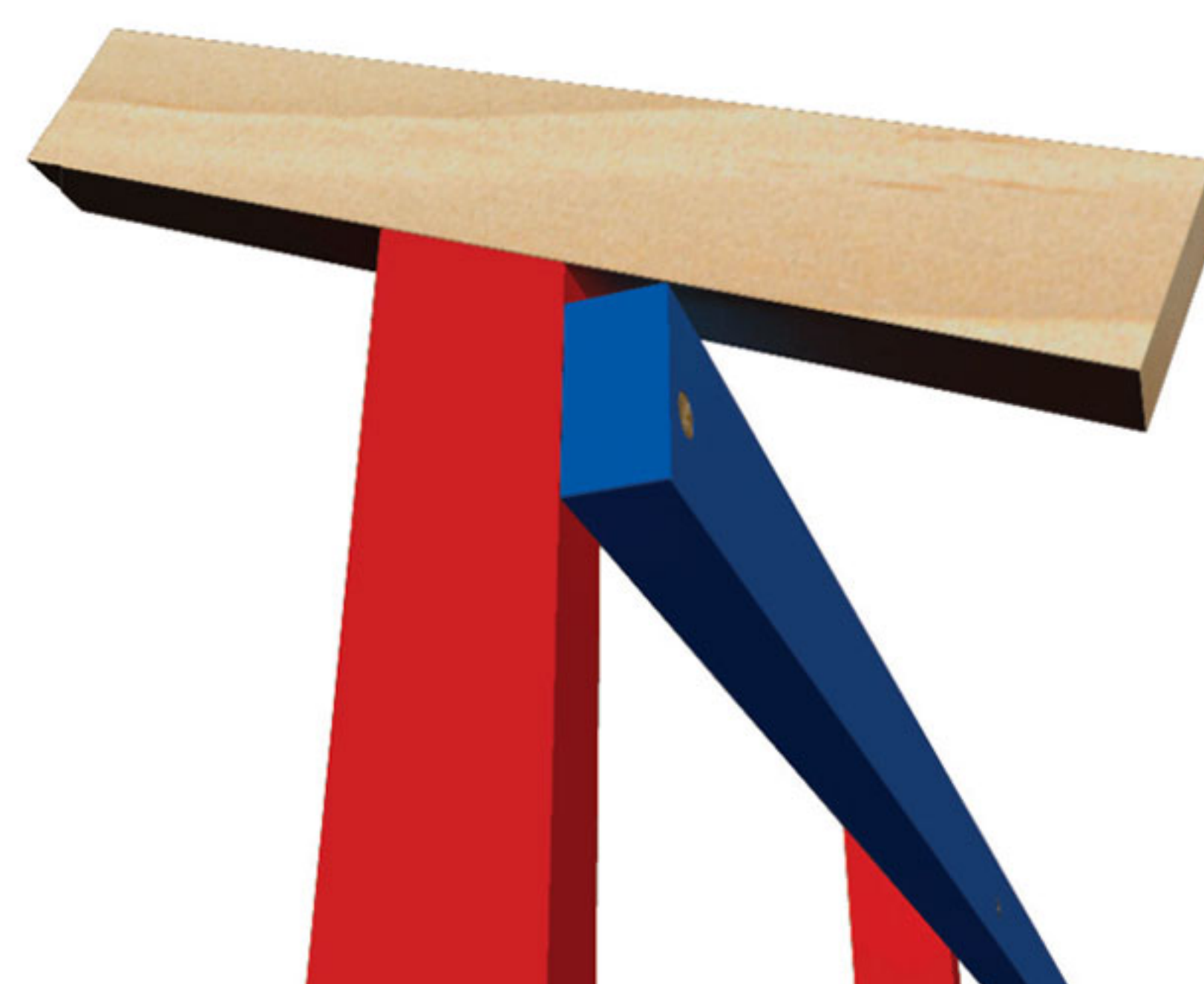


Figure 9: Fine tuning the position of the front wall's top plate.

Remove the weights after the glue has cured. Turn the box over and repeat the process with the other piece of plywood.

End wall framing

The completed base will now become a place to lay out the wall frames. Set it on a couple of sturdy sawhorses. See Figure 6 for details on the following. Make a mark on the base's edge 7 feet 6 inches from one corner. From the adjacent corner make a mark at 5 feet 6 inches. Temporarily fasten (with tape) two 8-foot 1-by-2s (future end wall studs shown in red) with lower ends $1\frac{3}{8}$ (long dimension in 1-by-2 cross section) inches from the lower edge of the base as shown. Lay a straight edge from one mark to the other and draw a line that extends across each of the temporarily fastened future end wall studs.

Temporarily attach an 8-foot 1-by-2

(future end-wall bottom plate shown in blue) along the base opposite the diagonal line you just drew – be sure that it fully overlaps the two end-wall studs already attached to the base's sides (Figure 5). Measure 16 inches from each of the base's edges and mark the bottom plate. Position two 8-foot 1-by-2 studs (shown in yellow) on the 16-inch centers using the bottom plate as a guide, mark them for cutting using the diagonal line to determine the angle.

Lay a fresh 8-foot 1-by-2 (shown in green) with its lower edge on the 5-foot 6-inch and 7-foot 6-inch marks. Mark the 1-by-2 at both edges of the temporarily attached end wall studs (shown in red) – this will be the end-wall top plate.

Cut the four red and yellow studs and green top plate where you have marked them. Cut blue bottom plate to length ($50\frac{3}{4}$ inches) and fasten the red end

wall studs to its ends using 3-inch deck screws. Drill pilot holes for all screws used to fasten the frame together. Fasten the upper ends of the red studs to the ends of the green top plate. Fasten the two yellow center studs between the upper and lower plates. Repeat this process to build the other end wall frame.

Front wall framing

I arbitrarily assigned the taller wall with the door and window as the front and the shorter solid wall as the rear.

Lay an 8-foot 1-by-2 on the longest stud on one of the end wall frames (built in the previous section) and position one end $\frac{3}{4}$ inch (the smaller dimension of your 1-by-2) from the bottom edge of the end wall's bottom plate. Mark the top end of the 1-by-2 on both edges beneath the side wall frame's top plate and draw a line connecting the marks to pick

Figure 10: Back wall. See Box E detail in Figure 11.

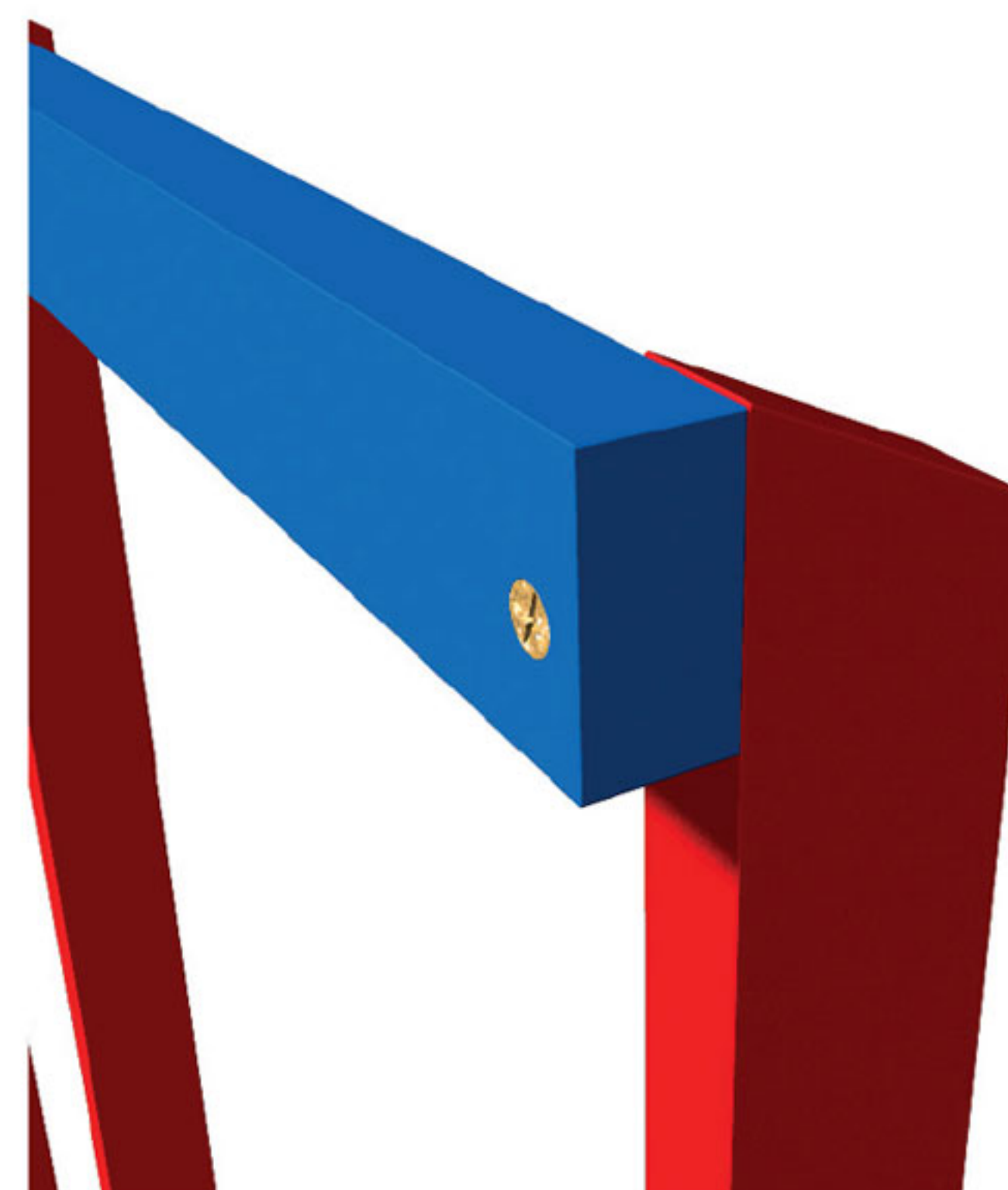
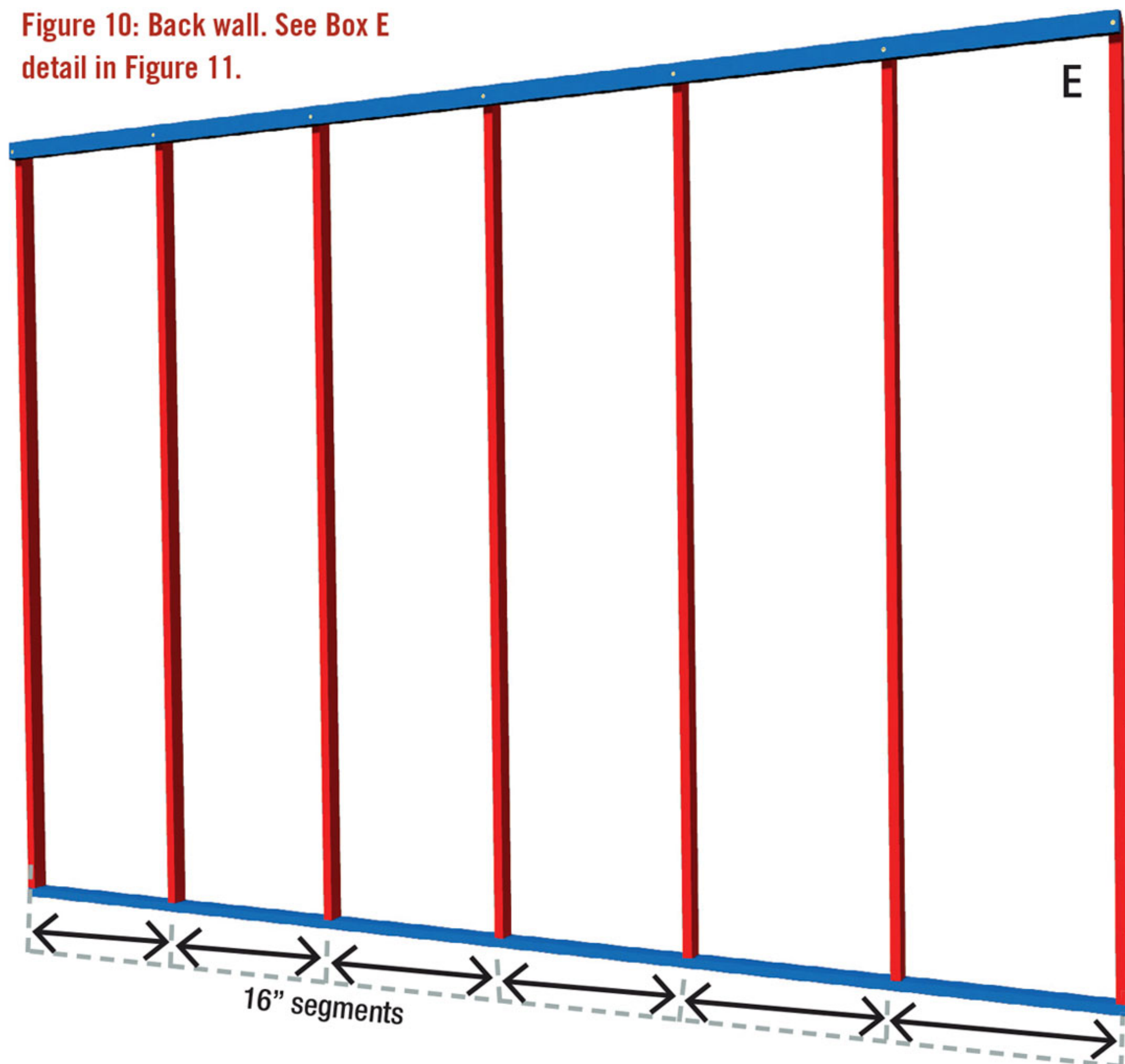


Figure 11: Top plate of back wall.

up the angle. Cut this 1-by-2 on the line to make the first front-wall stud. Using this stud as a pattern, mark and cut five more studs (shown in red in Figure 7).

Take two fresh 8-foot-long 1-by-2s and mark them at 16 inches on center. One will be used for the front wall's top plate and the other for the bottom plate (shown in blue in Figure 7). Cut a 31½-inch piece of 1-by-2 for the door header (shown in green in Figure 7). Screw the six red front wall studs to the blue bottom plate. Center your 30-inch door between the middle two – insert an approximately ¾-inch-thick spacer between the door and the bottom plate.

Next, insert a 1-by-2 between the side of the door and an adjacent stud – be sure one end is snug against the bottom plate. Mark this 1-by-2 at the door's top and cut it and another 1-by-2 to length. Remove the door (and spacer) and fasten these 1-by-2 trimmers (shown in yellow in Figure 7) to the inside of the studs on both sides of the door opening and install the 31½-inch-long door header (shown in green in Figure 7, detail in Figure 8) on top of them. Now take a short piece of 1-by-2, set it on the door header's upper surface and against one

of the adjacent studs. Mark the 1-by-2 to match the stud's angled end, cut to make a cripple stud (short studs placed between the header and top plate or between a sill and bottom plate; shown in orange in Figure 7) and screw it in place, centered above the door header.

Complete the front wall framing by attaching the top plate to the inside surface of the studs. Use a short 1-by-2 scrap positioned on the beveled end of the studs to ensure the top plate won't interfere with the rafters (Figure 9).

Back wall framing

Lay an 8-foot 1-by-2 on the shortest stud in one of the end wall frames (see Page 48) and position one end ¾ inch (the smaller dimension of your 1-by-2) from the bottom edge of the end wall's bottom plate. Mark the top end of the 1-by-2 on both edges beneath the side wall frame's top plate and draw a line connecting the marks to pick up the angle. Cut this 1-by-2 on the line to make the first back-wall stud. Using this stud as a pattern, mark and cut six more studs (shown in red in Figure 10).

Take two fresh 8-foot-long 1-by-2s and mark them at 16 inches on center.

One will be used for the back wall's top plate and the other for the bottom plate (shown in blue in Figure 10). Screw the seven back wall studs to the bottom plate as shown. Attach the top plate to the inside surface of the wall studs flush with their pointed ends as shown in Figure 11.

Assemble the wall frames to the floor

Fasten the front and back wall frames to the base with the bottom of the wall frames even with the bottom of the base using ¾-inch-long deck screws. Fasten the end wall frames to the base, and front and back wall frames using 1½-inch deck screws (as shown in Figure 12).

Mark the inside of all wall studs at 36 inches from the floor. Measure and cut lengths of 1-by-3 to fit inside the greenhouse and screw them to the frame with their upper edges on the marks as shown in purple (Figure 12). The 1-by-3 framing will support the shelving. Square up the front wall frame with 1-by-2 diagonals shown in yellow (Figure 13).

Next, construct the vent window frame by screwing two 52⅞-inch-long 1-by-2s to one 13½-inch 1-by-2 and one 13½-inch 1-by-3 (as shown in Figure 14).

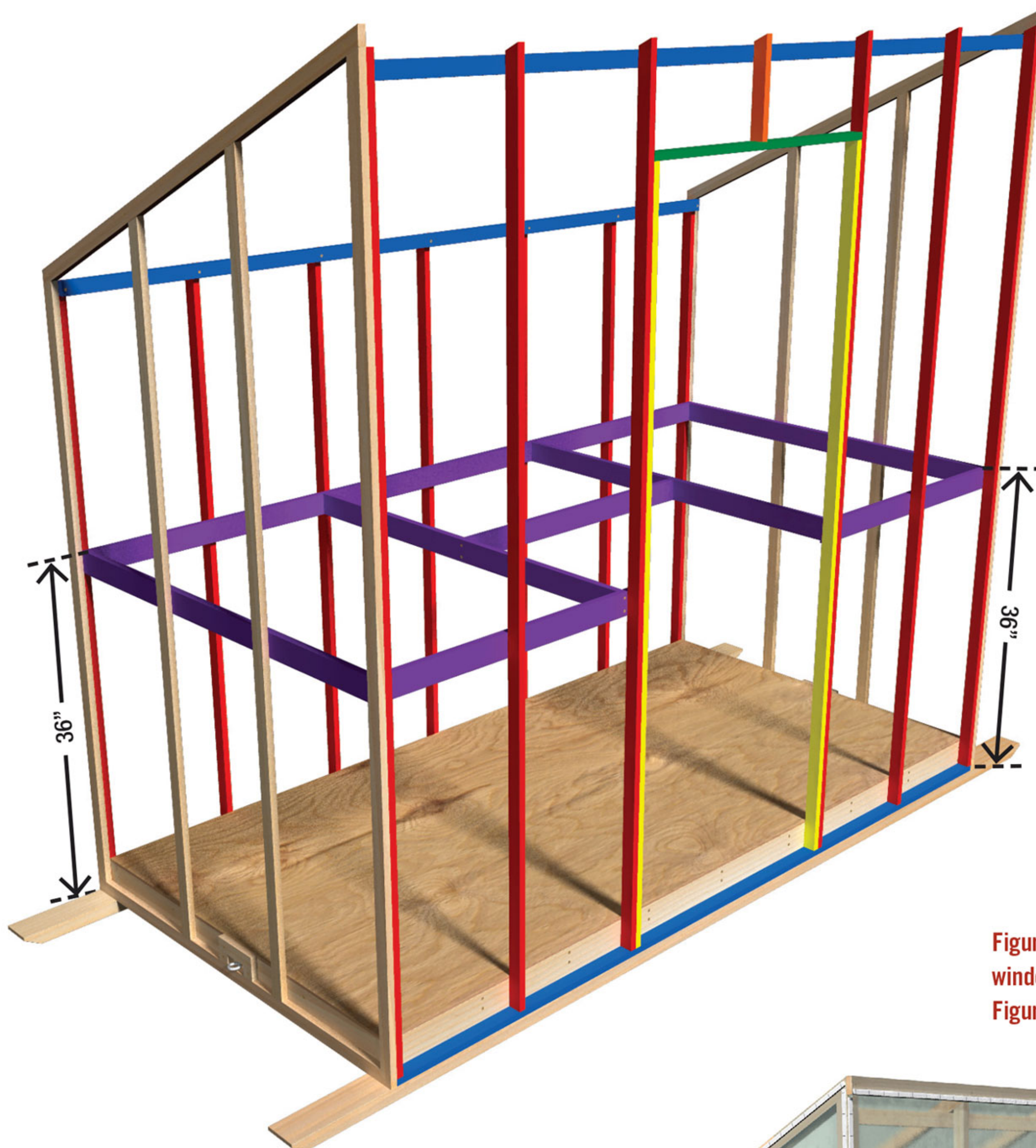


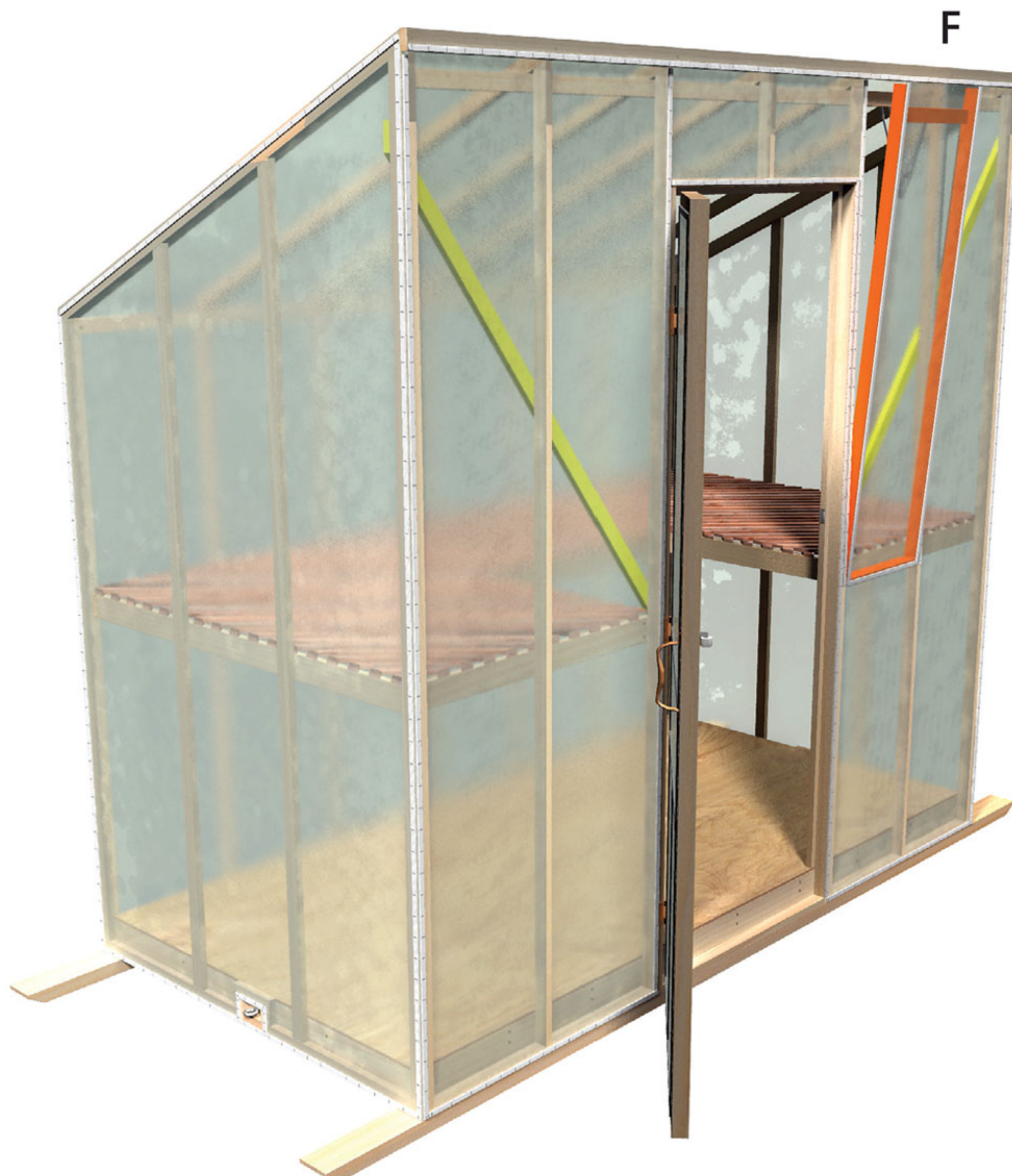
Figure 12: Walls attached and support frame in place.

Figure 13: Diagonal braces, installed vent window, and cut lattice. See Box F detail in Figure 14 on Page 51.

Place the frame in one of the openings on the latch side of the door. Fasten two hinges on the underside of the window frame and the underside of the 1-by-3 shelf support (Figure 13). Install the vent opener to the top of the window frame following the manufacturer's directions. You might need to position some blocking to complete this step.

Place the 4-by-8 piece of lattice on the support frame and cut it to fit (Figure 13). Fasten the lattice to the frame with No. 8 1¼-inch deck screws.

To create a surface for the door to seal against, measure and cut a piece of 1-by-2 that will extend from the outside of one trimmer to the outside of the other at the top of the door frame. Attach this to the inside of the frame so that it extends below the header $\frac{3}{4}$ of an inch. Measure, cut and install two 1-by-2s in a similar fashion on the inside surface of the trimmers.



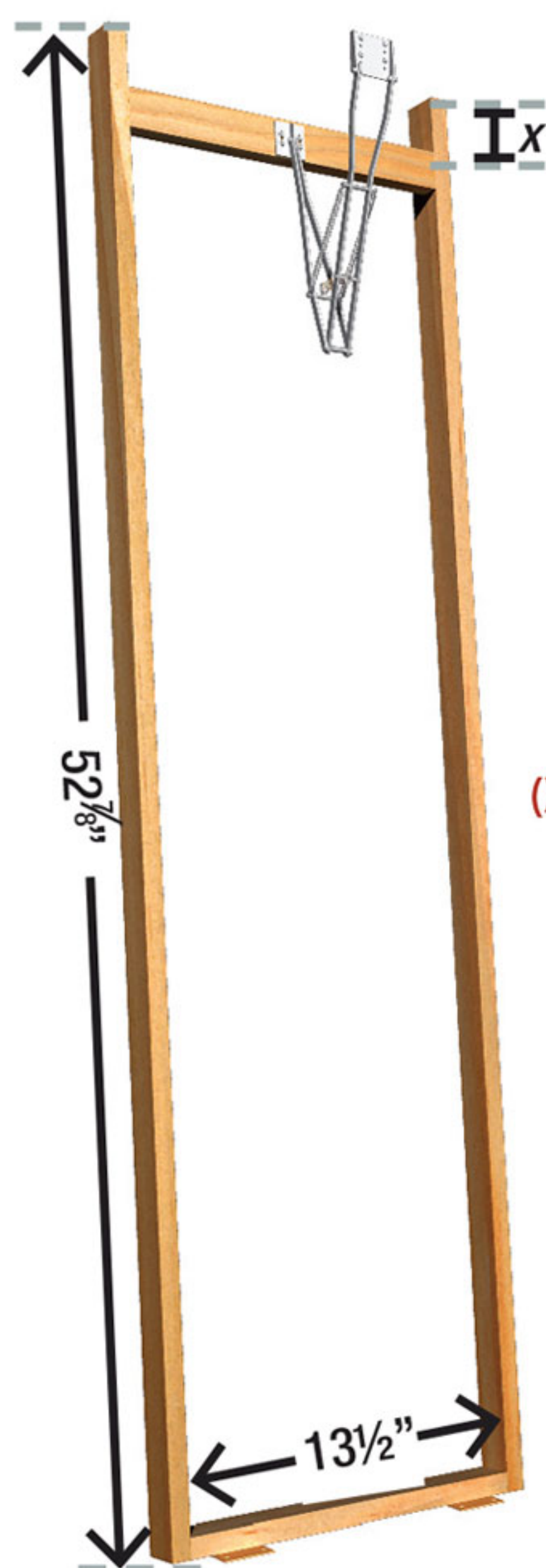


Figure 14: Box F, vent window frame. Distance of first cross piece from top (X) determined by hardware.

Install your door following the manufacturer's instructions. Don't be surprised if you have to do a little trimming to get the door to fit, swing and latch correctly.

Assemble the rafters

Position a piece of 1-by-2 directly inside and along the top plate of one end frame and trace the bevel at both ends. Cut this and six others to make the rafters. Fasten two rafters (shown in blue in Figure 15) alongside the end frames' top plates using No. 8 1½-inch deck screws.

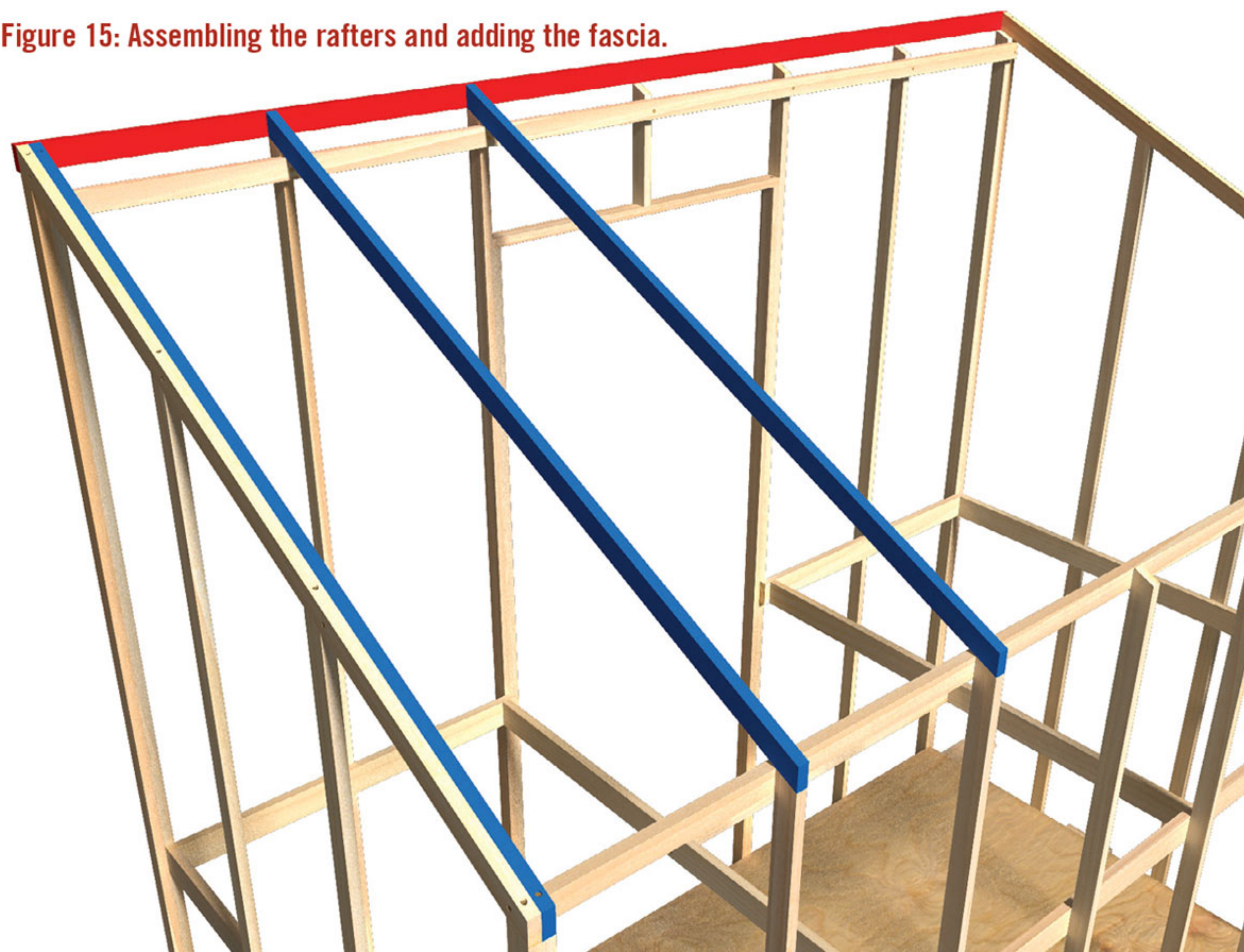
Fasten the ends of the five interior rafters to the tops of front and back wall studs with 2-inch deck screws. Fasten a 1-by-2 8-foot-1½-inch long 1-by-2 fascia (shown in red in Figure 15) to the front ends of the rafters with 2-inch deck screws.

Attaching plastic

Cut two pieces of plastic (about 5 feet by 9 feet) that will cover the end frames generously. Staple (sparingly) the plastic to the frame, being careful not to stretch it so tightly that the frame is distorted. Leave the excess plastic for now.

Cut a piece of plastic about 9 feet by 20 feet. Mark the center of the 9-foot dimension every 3 or 4 feet along its

Figure 15: Assembling the rafters and adding the fascia.



length. Carefully tip the greenhouse onto its front. Center the bottom edge of the plastic on the bottom of the greenhouse with the edge covering about 5 inches of the bottom (skid must be removed). Staple at the center of the bottom edge of the plastic. Then adjust the plastic so the center marks are over the center stud and the center rafter. Staple at the top of the center rafter and then sparingly along the bottom edge.

Fasten a skid to the bottom with 3½-inch screws 1 foot apart and 2½ inches from the outer edge. Gently stretch the plastic over the greenhouse and staple onto the end frames, alternating sides to pull the plastic evenly.

Tip the greenhouse in the other direction far enough to make the other bottom edge accessible. Gently stretch the plastic over the edge of the bottom and staple. Fasten the other skid to the bottom. Finish fastening the plastic; wrap it around the corners and staple on the end wall.

Staple batten tape around the perimeter of the end walls (Figure 16). Then carefully trim the excess plastic. Staple batten tape on both sides of the perimeter of the door and window. Slit the plastic along the outer edge of the door and window between the two sets of batten

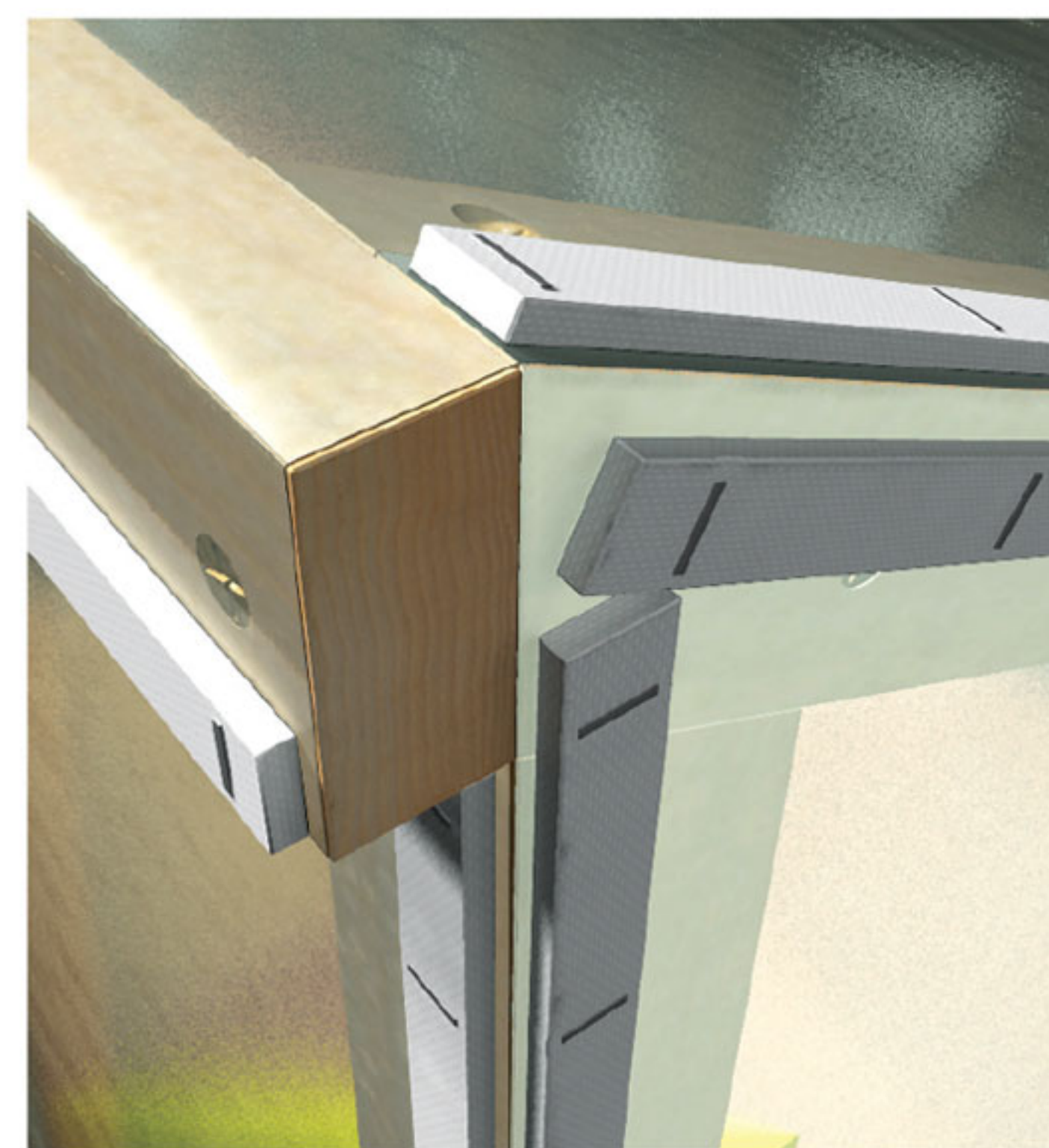


Figure 16: Batten tape installation detail on front right corner.

tape and add a slit for the door handle (see Figure 13).

Good growing

Once completed, your greenhouse will supply years of service with little maintenance, and you can use it to extend your growing season at both ends. Since it's mounted on skids, you can move the greenhouse around the yard or garden with ease, and slide it into your barn or shop for winter or to replace the plastic and touch up the paint. My greenhouses have given me plenty of good growing. I know yours will, too. 🌱

DIY

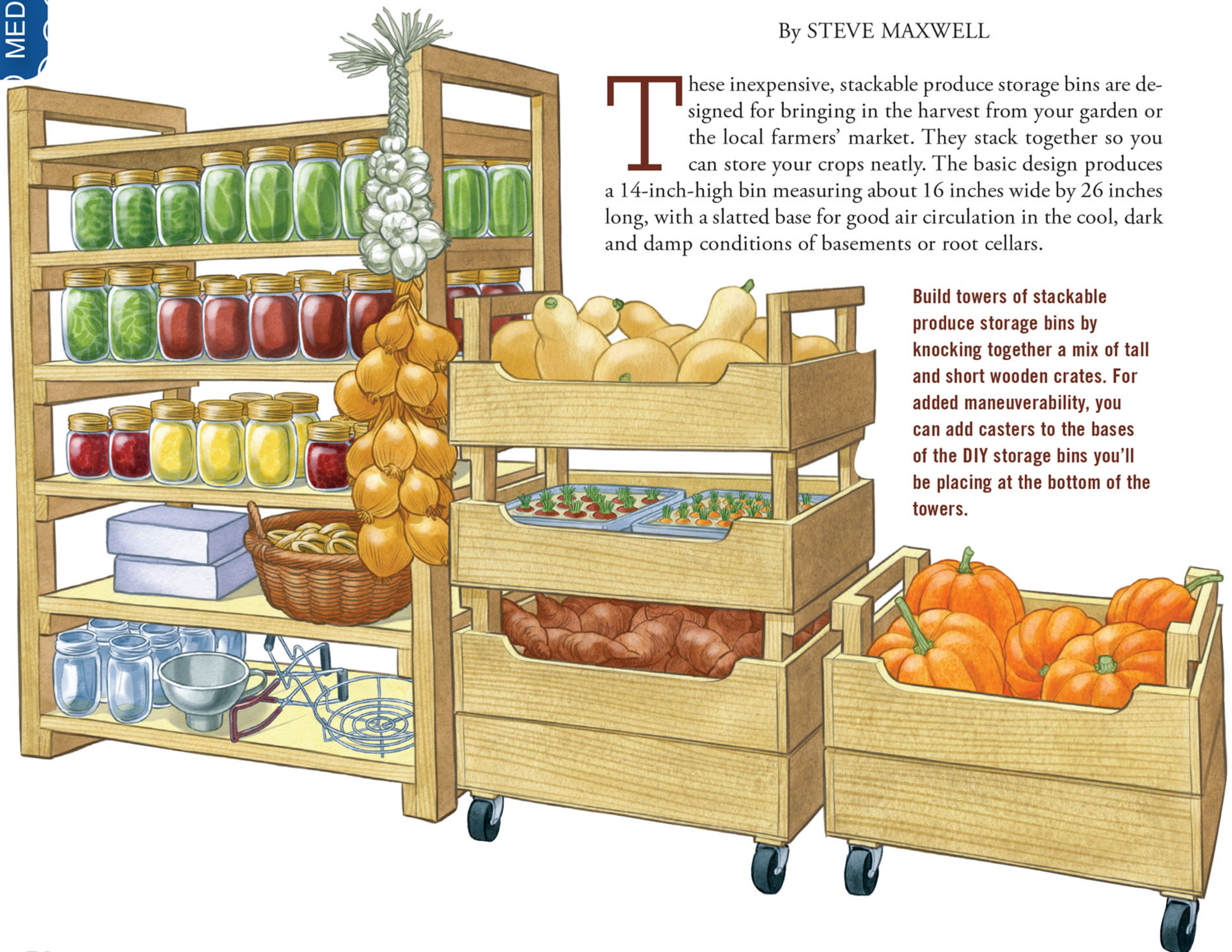
Produce Storage Bins

Turn your pantry or basement into a portable storehouse with fresh crops stashed in these stackable produce bins.

By STEVE MAXWELL

These inexpensive, stackable produce storage bins are designed for bringing in the harvest from your garden or the local farmers' market. They stack together so you can store your crops neatly. The basic design produces a 14-inch-high bin measuring about 16 inches wide by 26 inches long, with a slatted base for good air circulation in the cool, dark and damp conditions of basements or root cellars.

Build towers of stackable produce storage bins by knocking together a mix of tall and short wooden crates. For added maneuverability, you can add casters to the bases of the DIY storage bins you'll be placing at the bottom of the towers.



Also included are specifications for how to build a wooden crate that's shorter and more suitable for storing vegetables in a pantry or closet. Standing about 10 inches high, these bins are easier to move than the tall bins when fully loaded with produce. If you plan to use these DIY storage bins in your kitchen or pantry, you can opt to make them with solid plywood bottoms to prevent vegetables from dropping dirt as you carry bins of freshly harvested produce into your house.

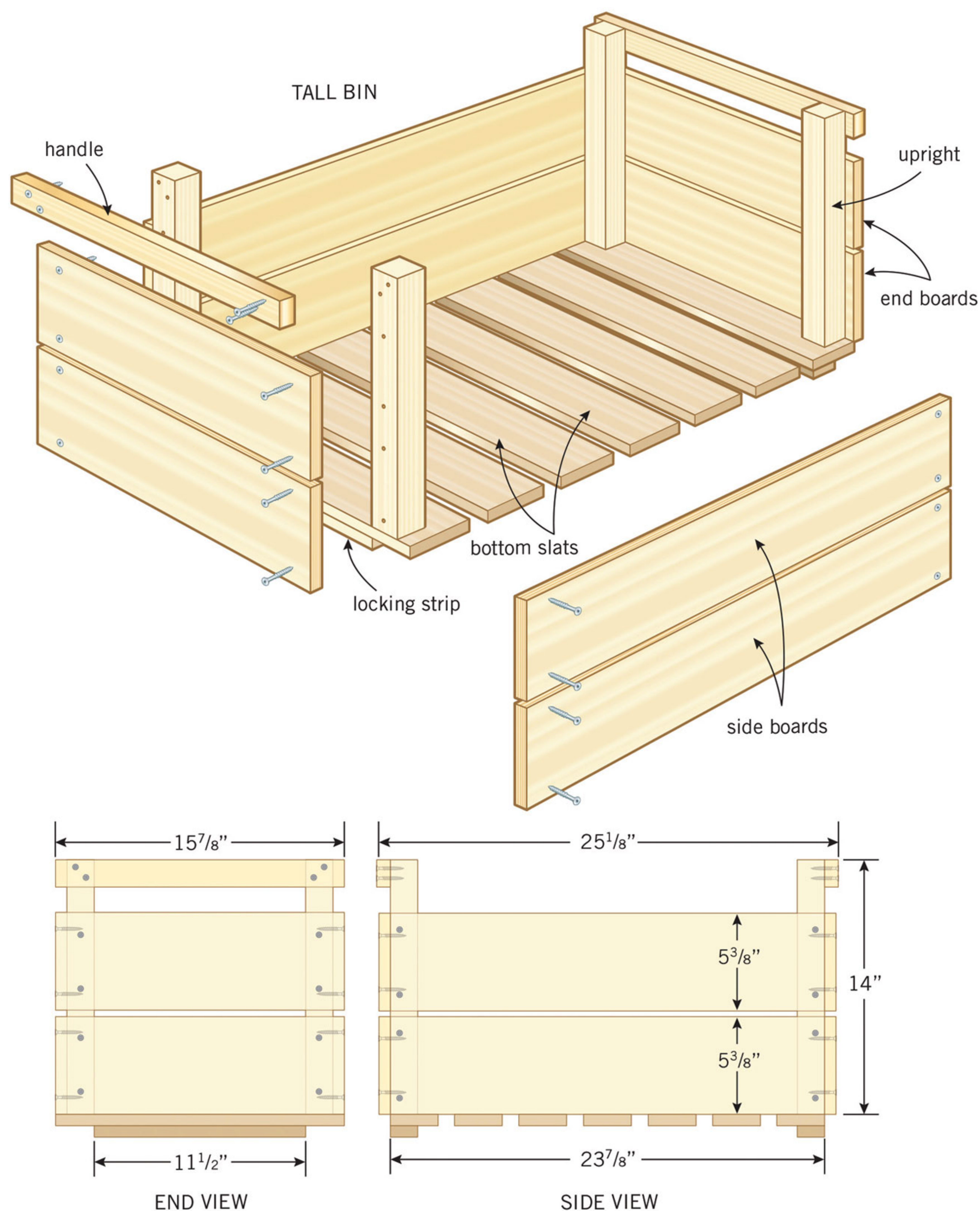
Also, if you prefer a taller, all-in-one unit that's not stackable, check out the storage rack with pull-out shelves on Page 54.

How to build a wooden crate

Simple tools, common materials, and basic building skills are all you need to make these produce storage bins. Lightness and strength are their standout features because they're made mostly of standard cedar fence boards. Stocked at every building supply outlet, such boards are lightweight, long lasting, and easy to work with.

Typically marketed as "three-quarters-inch thick," commercial cedar fence boards actually measure only $\frac{5}{8}$ ths of an inch, which is perfect for this project. You can construct the uprights from $1\frac{1}{2}$ -inch square stock, and the handles from $\frac{3}{4}$ -inch-thick hardwood.

Make your first cuts. To begin, you'll need to cut all the side boards, end boards, slats, uprights and handles for as many pantry storage containers as you intend to build. The cutting lists on Page 54 provide measurements for individual pieces, as well as the total lumber needed for each size of



You can build tall produce storage bins by following these drawings closely, or build short bins by eliminating the upper side and end boards, and shortening the uprights.

crate. You can make them longer and wider if you prefer – just adjust the cutting list measurements.

Consider setting up a sawing assembly line in your home workshop to speed up the process. A stop block with a miter saw is one powerful way to cut all components to precise lengths. Prepare some kind of out-feed support or table, and clamp a block to

the support so it will stop your wood at exactly the right point for crosscutting. Your setup time will be minimal, and you'll be happy with the results – fast, perfectly consistent cutting.

To create a pair of slats, simply cut standard 8-foot cedar fence boards into lengths of $15\frac{7}{8}$ inches, and then rip them in half lengthwise. Each fence board will produce 12 slats.

MATERIALS LIST

Use these lists to calculate how much material and hardware you'll need to build a collection of DIY storage bins. Note the lumber required for each bin type, and then follow the cutting list to trim all the pieces needed to assemble that bin.

Pay attention to the optional parts listed. The solid bottom panel could be installed on either bin instead of slats. Omit the locking strips if you install casters to create a rolling bin.

OPTIONAL PARTS

BOTH BINS:

- 1 bottom plywood panel, $\frac{1}{4}$ " x $15\frac{7}{8}$ " x $25\frac{1}{8}$ "
- 4 swiveling casters with plate mounts, 3"

TALL BIN (14 INCHES HIGH)

SLAT BOTTOM

Total lumber and hardware required:

- 3 cedar fence boards, 8 feet long
- $1\frac{1}{2}$ " square stock, 57"
- $\frac{3}{4}$ " x $1\frac{1}{2}$ " hardwood, 32"
- 40 No. 8 screws, $1\frac{3}{4}$ "
- 18 No. 6 screws, $1\frac{1}{2}$ "

CUTTING LIST:

- 4 side boards, $\frac{5}{8}$ " x $5\frac{3}{8}$ " x $23\frac{7}{8}$ "
- 4 end boards, $\frac{5}{8}$ " x $5\frac{3}{8}$ " x $15\frac{7}{8}$ "
- 4 uprights, $1\frac{1}{2}$ " x $1\frac{1}{2}$ " x 14"
- 2 handles, $\frac{3}{4}$ " x $1\frac{1}{2}$ " x $15\frac{7}{8}$ "
- 7 bottom slats, $\frac{5}{8}$ " x $2\frac{5}{8}$ " x $15\frac{7}{8}$ "
- 2 locking strips, $\frac{5}{8}$ " x $1\frac{1}{2}$ " x $11\frac{1}{2}$ "

SHORT BIN (10 INCHES HIGH)

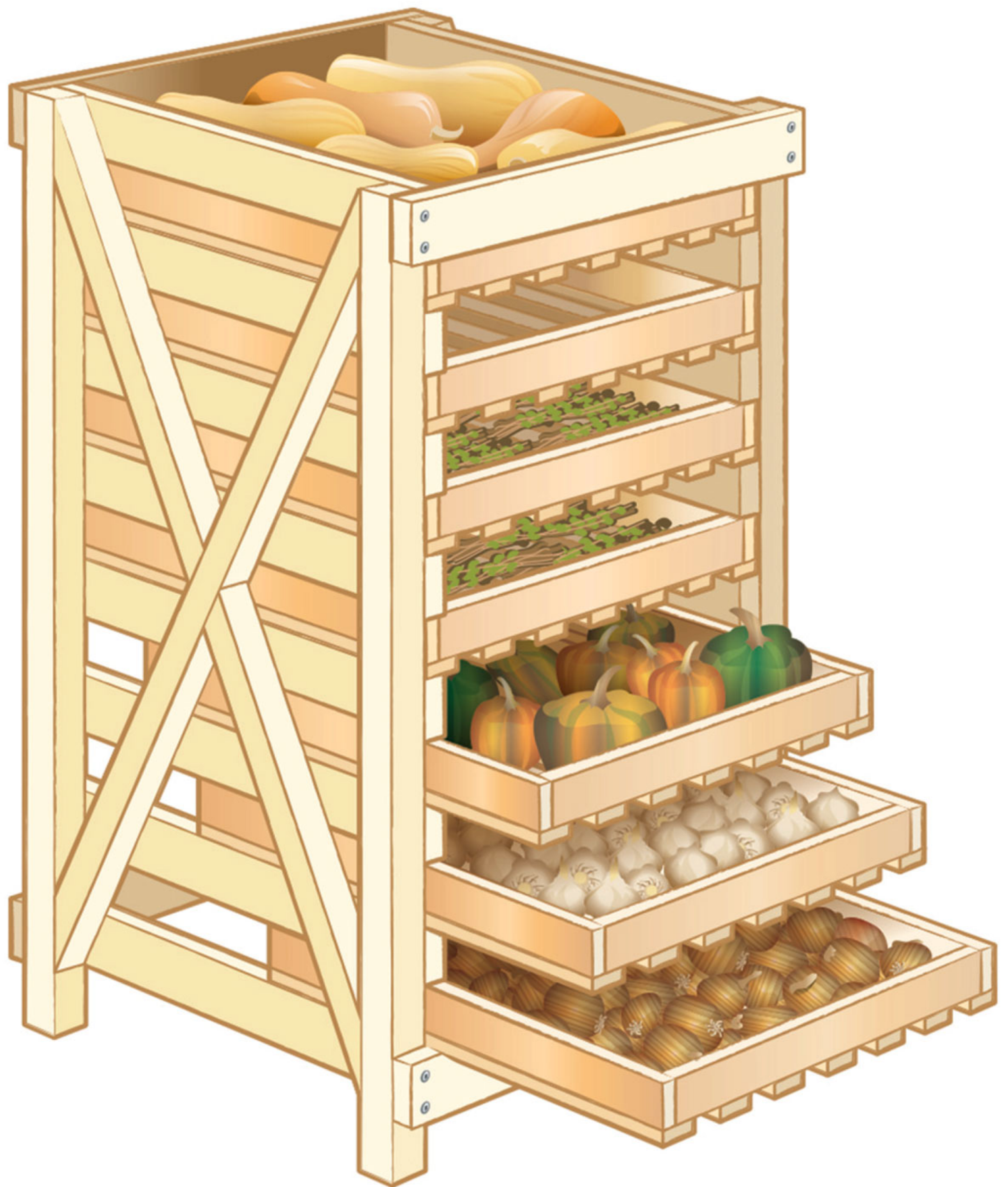
SLAT BOTTOM

Total lumber and hardware required:

- 2 cedar fence boards, 8 feet long
- $1\frac{1}{2}$ " square stock, 41"
- $\frac{3}{4}$ " x $1\frac{1}{2}$ " hardwood, 32"
- 24 No. 8 screws, $1\frac{3}{4}$ "
- 18 No. 6 screws, $1\frac{1}{2}$ "

CUTTING LIST:

- 2 side boards, $\frac{5}{8}$ " x $5\frac{3}{8}$ " x $23\frac{7}{8}$ "
- 2 end boards, $\frac{5}{8}$ " x $5\frac{3}{8}$ " x $15\frac{7}{8}$ "
- 4 uprights, $1\frac{1}{2}$ " x $1\frac{1}{2}$ " x 10"
- 2 handles, $\frac{3}{4}$ " x $1\frac{1}{2}$ " x $15\frac{7}{8}$ "
- 7 bottom slats, $\frac{5}{8}$ " x $2\frac{5}{8}$ " x $15\frac{7}{8}$ "
- 2 locking strips, $\frac{5}{8}$ " x $1\frac{1}{2}$ " x $11\frac{1}{2}$ "



Find directions for constructing this food storage rack made with pull-out shelves at <http://bit.ly/1AUa8c0>.

You'll need seven slats to build a base for one slat-bottomed bin.

Assemble the sides. Although you could use a carpenter's square to ensure 90-degree corners when you assemble the sides of the bin, it's easier to use a sheet of plywood or wafer board with the original, uncut factory edges as a reference guide for creating a square assembly.

Place two of the uprights you've cut onto the sheet, aligning their bottom ends with one edge of the sheet, and positioning one of the uprights in a corner. Fasten a side piece cut from a cedar fence board across the top of

the uprights with weatherproof wood glue and $1\frac{3}{4}$ -inch No. 8 deck screws driven into pre-drilled holes. If you're building the taller crate, fasten a second board on the uprights next to the first one, with a $\frac{3}{8}$ -inch ventilation gap between them. Repeat the process to assemble the second side.

You don't need to wait for the glue to dry to complete the box. Stand both side assemblies upright on one end on a flat floor, and connect them with a single cedar end board secured with No. 8 screws and glue. Carefully flip this assembly, then add an end board to the opposite side of the crate. You'll

need to add a second board to both ends if you're building the tall bin.

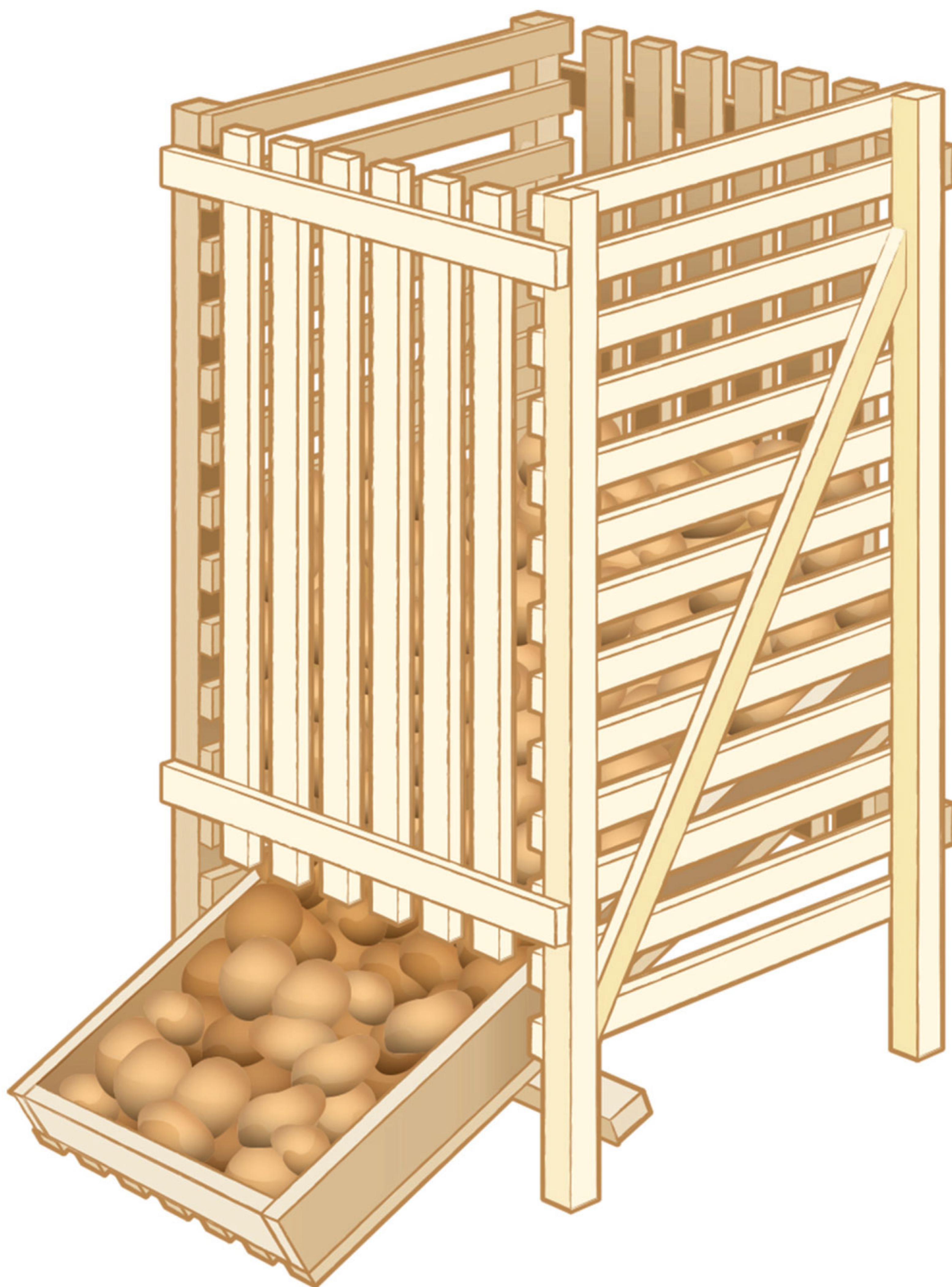
Slatted or solid bottom?

The next step, no matter which height of container you're knocking together, is to install the bottom. These plans allow you to choose between two different styles of base: solid or slatted.

- **Solid bottom.** To install continuous wooden bottoms on your DIY storage bins, simply flip them upside down and secure a $\frac{1}{4}$ -inch plywood base measuring $15\frac{7}{8}$ inches by $25\frac{1}{8}$ inches with glue and finishing nails. If you'd like the bottom to be replaceable, use $1\frac{1}{2}$ -inch No. 6 screws instead.

To make a rolling crate, skip the locking strips (described below) and screw the plate mounts of swiveling dolly casters to the corners of the base, but remember that this wheeled crate will always have to be placed at the bottom of a tower.

- **Slatted bottom.** A slatted base will provide better air circulation, which is helpful for most stored crops. Turn your crate upside down and lay out seven cedar slats, evenly spaced across the base. Fasten each slat to the bottom edges of the side boards with glue and $1\frac{1}{2}$ -inch No. 6 screws driven into $\frac{3}{32}$ -inch pre-drilled pilot holes.



How to make these produce storage bins stackable

Locking strips. Complete the bottoms of both the tall and short bins by adding two $1\frac{1}{2}$ -inch-by- $11\frac{1}{2}$ -inch locking strips onto the base at the ends (see construction drawing on Page 53). When you stack your pantry storage containers, the locking strips will nest between the uprights of the crate below to create a secure tower. You can cut the locking strips from leftover cedar fence board. Use two No. 6 screws per locking strip.

Handles. Add the hardwood han-

Build this potato storage bin by modifying the plans found at <http://bit.ly/1AUa8c0>.

dles to the top of the crate's short ends by pre-drilling holes for two $1\frac{3}{4}$ -inch No. 8 screws in both the handle and upright pieces, then fastening the handles to the uprights with glue and screws. Because the short bin is shallower and lighter, you could use 2-inch-wide pieces of cedar fence boards for the handles instead of the hardwood, if preferred.

Don't bother applying wax, varnish or shellac to finish these produce stor-

age bins. Finishes would be difficult to apply due to the rough surface of the cedar, and even nontoxic options, such as boiled linseed oil, could affect the smell and taste of your produce. You don't want anything to taint the great meals that will be made from home-grown food stowed in wooden storage crates of your own making.

Important Note: Pre-drill all the holes to prevent splitting when you drive the screws. 🛠️

The Ultimate DIY Backyard Chicken Tractor

MEDIUM PROJECTS



Let your chickens forage on fresh ground every day.

Article and photographs by
ELIZABETH WILLIAMS

In a perfect world, our chickens would be able to free-range all of the time, eating grass, bugs and seeds to their hearts' content. Unfortunately, chickens are rather low on the food chain and prove easy targets for any number of predators. After losing a few of my birds to some foxes, I knew it was time to consider an enclosure for them.

I wanted an easy-to-build, inexpensive portable pen that would keep them safe from predators. It would need a nest box, roost, and a place to hang a feeder while providing them

shade and protection from the elements. It would also need easy access in order to feed, water and collect eggs, and be easily movable for one person. I also wanted to be able to break it down for winter storage.

After piecing all of these requirements together, the resulting chicken tractor I constructed is based on a series of six panels and a nest box. The panels are connected with loose pin hinges for quick assembly and disassembly.

Instructions

Gather and cut all wood according to the materials list.



Give your flock room to range while keeping them safe from predators. This chicken coop is light enough for one person to move easily by herself. The nest box on the back allows for easy access for collecting eggs.

TOOLS

- Tape measure
- Wire cutters
- Table saw or Skilsaw
- Radial arm saw, jigsaw, or crosscut hand saw
- Screw gun with Phillips bit
- 6-inch speed square

BINDERS & HARDWARE

- Exterior wood glue
- ¾-inch drywall screws – 1 pound
- 1-inch drywall screws – 1 pound
- 1¼-inch drywall screws – 2 pounds
- 2-inch drywall screws – 4
- 3-inch drywall screws – 4
- Exterior paint and primer
- 1 set of 2-inch hinges
- 1 hook and eye latch
- 9 sets of 3-inch loose pin hinges

MATERIALS: JIG

- (J1) 4-by-6-inch piece ½-inch plywood – 3
 (J2) 1-by-4-by-6-inch plywood – 3

Make the corner and side assembly jigs. For the corner jig, take two (J2) pieces and hold ends to form a 90-degree angle. Fasten with glue and 1-inch screws. Next, attach two (J1) pieces so plywood extends ½ inch beyond bottom edge of the 1-by-4-inch panel (photo top right). For the side jig, take one (J1) piece and one (J2) piece. Fasten the two pieces together with glue and 1-inch screws so one edge is flush with ends and the plywood extends ½ inch beyond the opposite edge of 1-by-4.

MATERIALS: BODY

- (A) 1-by-4-by-94½-inch side panel top and bottom rails – 4
 (B) 1-by-4-by-29-inch side and end panel stiles – 10
 (C) 1-by-4-by-45-inch end panel top and bottom rails – 4
 (D) 1-by-4-by-38-inch end panel middle rails; roof panel stiles – 6
 (E) 1-by-4-by-12-inch door panel – 2
 (F) 1-by-4-by-46¼-inch roof panel rails – 4



Constructing a corner jig ensures that all frame pieces will end up square, and it can also help with construction of the J gussets.



Exterior of a side panel, ready for paint. Note that the design accounts for shade and protection from harsh elements as well as fresh air and ventilation.

- (G) 1-by-4-by-48-inch roof panel overlap – 1
 (H) 36-by-48-inch piece ¼-inch lauan side panel skins – 2
 (I) 3-by-6-inch piece ½-inch plywood door panel gussets – 10
 (J) 7-by-7-inch piece ½-inch plywood cut in half diagonally; triangle gussets – 20
 (K) 6¼-by-6¼-inch piece ½-inch plywood; nest box panel bottom gussets – 2
 (L) 6-by-9¾-inch piece ½-inch plywood;

- nest box panel top gussets – 2
 (M) ¼-by-1½-by-46½-inch side panel strips (from 2-by-4) – 4
 (N) ¼-by-1½-by-33-inch side panel and door panel strips – 4
 (O) 48-by-48-inch piece ¼-inch lauan; roof panel skins – 2
 (P) 36-by-48-inch piece ¼-inch hardware cloth; side panels – 2
 (Q) 36-by-45-inch piece ¼-inch hardware cloth; door panel – 1
 (R) 9¾-by-38-inch piece ¾-inch plywood; door panel, top filler – 1



The nest box frame and the nest boxes themselves are designed so that a person can collect eggs and access the nest boxes for cleaning without entering the chicken tractor.



Outside of door panel (not shown in illustration on Page 60): Two (S) pieces are at the top of the door frame, and two vertical (N) pieces on the sides.

- (S) ¼-by-1½-by-45-inch strips; door panel top and bottom – 2
 (T) 12-by-12-inch piece ¾-inch plywood; door – 1

SIDES

Build side panels. Use wood glue and 1-inch screws for all frames unless otherwise noted.

Lay two (A) pieces on the ground, parallel to each other and 30 inches apart. Place one (B) piece at each end, between (A) pieces, forming a rectangle. Using the corner jig, square up one corner of the panel. Position a gusset (J) in the corner. Attach (J) gusset with glue and 1-inch screws. Repeat for the three remaining corners.

Measure 47¼ inches from the ends of top and bottom rails to find center, and place another (B) piece in the middle of the rectangle. Using the side jig, position (J) gusset, then attach it. Repeat for the opposite end. Flip the frame over so that it rests on the gussets. Position one (H) piece so that one end is flush with the right end of the frame, and the other end rests on the middle (B) with the top and bottom flush with the frame. Check for proper fit, remove the plywood, and apply glue to the frame, stopping 4 inches from the center. Reposition plywood, and screw to the frame with ¾-inch screws, stopping 4 inches from center. That's one side panel ready to paint. Repeat for the other side.

END PANELS

Build the nest box end panel and door end panel. Using two (C) pieces for the top and bottom, two (B) pieces for the sides, two (L) gussets for the top, and two (K) gussets for the bottom (using the corner jig), make a frame. Add (D) piece to the bottom, just above the (C) bottom rail so that it fits flush with the top of the (K) gussets. Add another (R) piece just below the (C) top rail, again flush with the gusset (top photo).

To make the door end panel, use two (C) pieces for the top and bottom rails, two (B) pieces for the sides, and four (I) gussets. Next, place one (D) piece near the bottom of the panel, parallel to the (C) bottom rail, leaving 12 inches between the top of the bottom rail and the bottom of (D) piece.

Use two (I) gussets on either side of (D) piece. Place two (E) pieces be-



Wheel assembly orientation of the wheel handles and stop blocks can be done one of two ways, see photos Page 56 and 61.



The end blocks of the dowel handle will be attached from the inside with 3-inch screws, and you can position the handle to accommodate varying heights, whatever is most comfortable.



Stout branches make solid roosts for your birds, and can be easily attached to the mesh with washers and screws.

tween the (C) bottom rail and the (D) piece, perpendicular to (C). Use one (I) gusset on each end of each (E) piece.

You will have a 12-by-12-inch hole left for the door opening.

ROOF PANELS

Build two roof panels separately. Using two (F) pieces, two (D) pieces, and four (J) gussets, make a frame measuring 46 $\frac{1}{4}$ -by-45 inches. Position one (O) piece on top of panel, leaving a $\frac{1}{4}$ -inch overhang on all sides. Attach with glue and $\frac{3}{4}$ -inch screws. Repeat for second roof panel. These panels are held together by (G).

MATERIALS: NEST BOX

(N1) 12-by-12-inch (rear) and 12-by-15-inch (front) pieces $\frac{3}{4}$ -inch plywood; ends and dividers – 4

(N2) 12-by-37 $\frac{3}{4}$ -inch $\frac{1}{4}$ -inch lauan; bottom and back – 2

(N3) 3-by-37 $\frac{3}{4}$ -inch piece $\frac{3}{4}$ -inch plywood; top strip – 1

(N4) 11-by-37 $\frac{3}{4}$ -inch piece $\frac{3}{4}$ -inch plywood; top panel – 1

(N5) 3-by-37 $\frac{3}{4}$ -inch piece $\frac{1}{2}$ -inch plywood; kick plate – 1

(N6) 1-by-2-by-36 $\frac{1}{4}$ -inch batten – 1

(N7) $\frac{3}{5}$ -by-1-by-37 $\frac{3}{4}$ -inch scrap wood; bottom stop block – 1

(N8) $\frac{3}{4}$ -by-2 $\frac{1}{2}$ -by-37 $\frac{3}{4}$ -inch scrap wood; cleat – 1

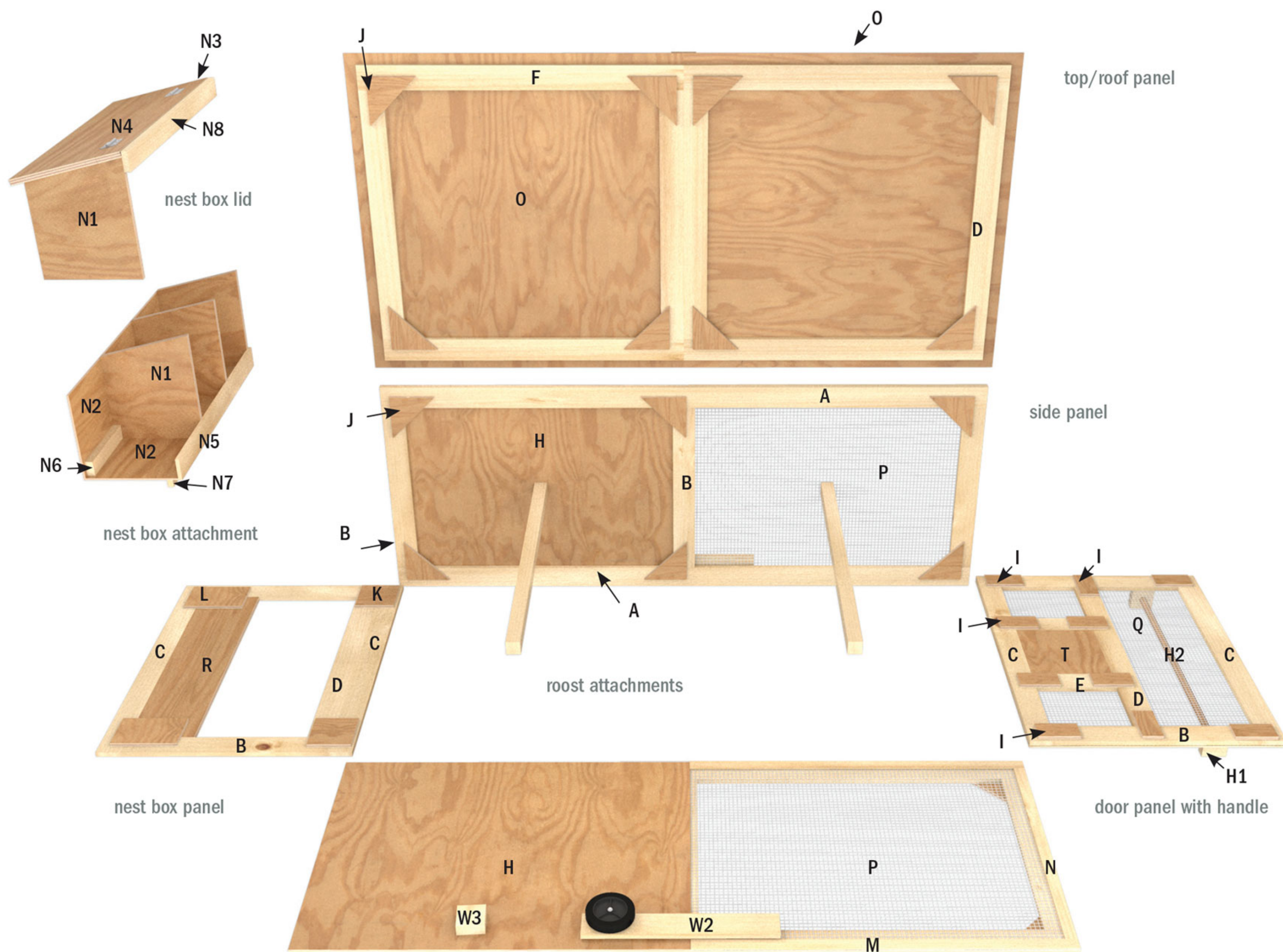
To build the nest box, the $\frac{3}{4}$ -inch plywood end pieces are 12-by-15 inches in front and 12-by-37 $\frac{3}{4}$ inches in the rear. Attach the (N2) bottom to the end (N1) pieces. Attach the back (N2) to the end pieces. Position (N6) in inside bottom rear corner and attach back and bottom to it.

Attach (N5) to the bottom front. Attach (N8) at the top front, leaving 1 $\frac{1}{2}$ inches sticking up above the top of the end pieces. Place (N3) across the slanted top so that it touches (N8), and attach. Place (N4) just below (N3) and install hinges. Attach (N7) to the bottom of the nest box 1 $\frac{1}{2}$ inches from the front edge. Install two (N1) dividers at equal distances from the ends to make three nest boxes. Notch the corners to fit over the batten.

Putting it all together

Paint all pieces with primer. When dry, apply a coat or two of exterior latex paint.

Install hardware cloth. Lay one side panel flat, gussets down, so the wood skin is to your left. Lay hardware cloth (P) over right side of the



panel so it is flush with frame edges. Tuck the end of the wire under the edge of (H) on center piece (B), and screw the edge of (H) down with $\frac{3}{4}$ -inch screws.

Place one (M) strip on the top of the panel and another (M) strip on the bottom of the panel.

Using 1-inch screws, attach strips to the panel, sandwiching the wire between the frame and the strip. Attach one strip (N) to the end of the panel, same as above. Repeat for second side panel (see above).

Lay the door panel flat, gussets down. Lay (Q) hardware cloth on top so it is flush with the edges of the panel. Attach (S) top strip, sandwiching the wire as above. Cut out a 13-by-13-inch square for the door.

Attach bottom (S) strip and (N) side strips. Staple door opening to frame

(photo Page 61). Attach (T) door to the door frame with 2-inch hinges. Install hook and eye latch.

MATERIALS: WHEEL ASSEMBLY

- (W1) 6-inch lawn mower wheels – 2
- (W2) 1-by-4-by-24-inch handles – 2
- (W3) 2-by-4-by-3½-inch stop blocks – 2
- (W4) ½-inch nyloc nuts – 4
- (W5) ½-inch bolts – 4
- (W6) ½-inch washers – 14
- (W7) ⅝-inch nuts for spacers – 2

Attach the wheel assembly. (*Editor's Note: Orientation as shown in the illustration is recommended, although orientation as shown in photos – with handles W2 facing rear – also works. Note photo on Page 61 compared to Page 56.*)

Place one (W2) flat horizontally. Make

a mark 1 inch from the top edge and 2 inches from the left end. This is for the axle. Make a second mark 1 inch from the bottom edge and 3½ inches from the left end. Drill a ½-inch hole through the handle at each mark. Place a third mark on the bottom of side panel 36¾ inches from the nest box end and 2½ inches from the bottom edge. Drill a ½-inch hole at your mark. Flip the handle up on edge so that the axle hole is on top.

Place one washer on a ½-inch bolt, and insert bolt through the hole from the back of the handle. Place another washer on the bolt from the front of the handle, followed by a spacer nut. Place the wheel on the axle bolt, another washer, and a nyloc nut. Tighten.

Place a ½-inch washer on a bolt. Insert the bolt through the second hole on



the handle, this time from the front. Place a washer on the bolt, then a $\frac{5}{8}$ -inch spacer nut, then another washer. Insert the bolt through the hole in the tractor. Place a washer on the bolt, followed by a nyloc nut and tighten.

Flip the handle so that the top of it faces the rear of the tractor. Attach one (W3) stop block at the bottom edge of the tractor.

The exact placement will be $21\frac{1}{2}$ inches from the nest box end of the tractor and $2\frac{1}{2}$ inches from the bottom edge. The block will be at an angle to match that of the handle at the point at which the wheel just touches the ground.

Use 2-inch screws and glue. Repeat the above steps for the opposite side of the tractor. This assembly will be a mirror image of the first one.

Assemble the tractor. The end panels must fit inside the side panels, and all gussets should face toward the inside of the tractor. Position door

end panel inside the hardware cloth end of side panels. Install the hinges 3 inches from the top and 3 inches from the bottom. Repeat for the remaining corners.

Install nest box by sliding it in at an angle, top first, followed by the bottom. Level it until the top cleat and the bottom stop block hit the panel.

MATERIALS: HANDLE

(H1) 2-by-4-inch end blocks – 2

(H2) 1-inch dowel – 1

Install the handle on the door panel at a height that is comfortable for whomever will be moving the tractor. Pre-drill two $\frac{3}{4}$ -by- $\frac{1}{2}$ -inch screw holes in each block, and a 1-inch hole, centered in the side of each block, for the dowel.

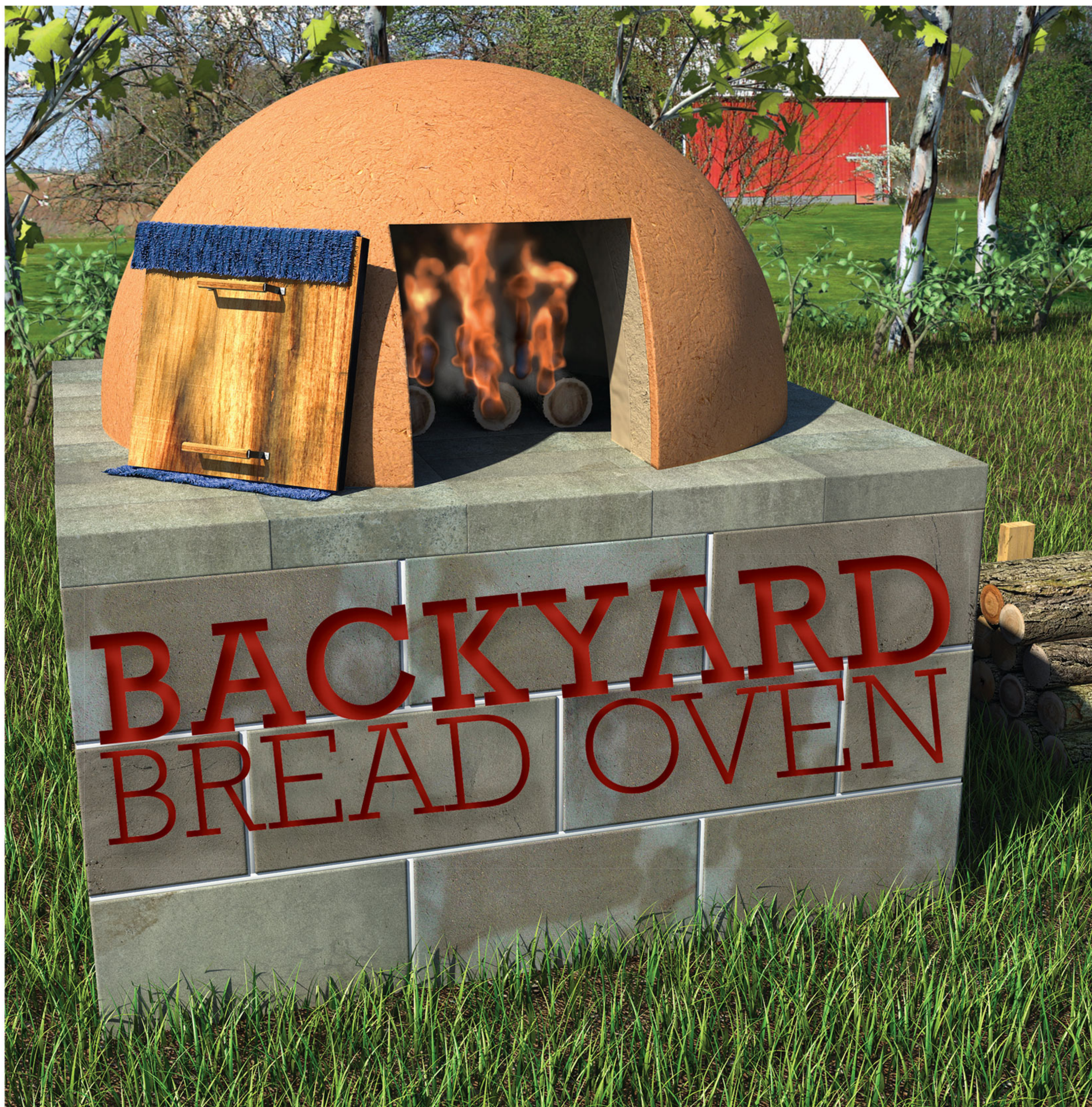
Place the end of one (H1) block against the panel in the desired position, then screw it from the inside using two 3-inch screws. Slide the (H2) dowel into the holes in both

blocks. Place the end of the second (H1) block in position and screw from the inside with two 3-inch screws (photo top right on Page 59). Place the roof panels side by side on top of the tractor. The frames of the panels should fit inside the tractor so that the roof panels fit tightly against the sides. Reinforce two panels together with piece (G) on top of roof panels.

Install the roosts. Cut two $46\frac{1}{2}$ -inch branches (between 2- and 4-inch diameter). Install branches in desired locations using one 2-inch screw and two washers on each end (photo on Page 59).

If you do not have access to branches, 2-by-2-inch lumber will also work. Cut one 44-inch branch and install it just below the roof in the center of the tractor to hang the feeder from.

Your chicken tractor is now ready to roll! It should accommodate six chickens, or 10 Bantams. Keep them on fresh ground for best results. 🐔



Build this easy adobe cooker in a weekend.

By CATHY WILSON

My husband and I first spied an outdoor bread oven while strolling through our neighborhood. The beautiful brick dome was situated at the end of an overgrown driveway. It was so intriguing that we knocked on the house's door and met the oven's owner – a frail Italian granny. She graciously shared her story, which was inseparably intertwined with the oven.

"We came here for the coal mines in the '20s," she said, "You couldn't get good bread here, not like in the old country, so we built this oven. All the neighborhood ladies would get up early to start their bread dough, and I'd be up by 4 to fire the oven. It took five hours to heat that oven, and it was big enough to hold all the loaves. We'd drink tea, gossip and bake our bread. During the summers, some of the men went up to the mountains to herd sheep. I'd go up there to make them bread. I built ovens up there out of clay dirt and baked bread

every few days. Those men could eat a lot of bread!"

The woman's fascinating story motivated us to research outdoor bread ovens, with the goal of building one for ourselves. Clay is readily available at our place and was our material of choice. After some serious research and with help from the best adobe-oven-making book ever, Kiko Denzer's *Build Your Own Earth Oven: A Low-Cost Wood-Fired Mud Oven*, we gave it a try. (The book is available at www.Grit.com/shopping.) Using Denzer's thorough, friendly instructions, I built an oven in our yard, several ovens for the local school district,

and one for a mountain-man rendezvous. This year, my husband and I built the more refined model covered in this article out in our pasture.

This oven only takes about three days to build, start to finish, working a couple of hours a day.

A fine foundation

Although you can build them on the ground, we decided to raise our new adobe oven to a convenient working height. For simplicity, we built a foundation for the oven using concrete blocks held together with a construction adhesive such as Liquid Nails. Since Liquid Nails isn't technically a load-bearing mortar, you won't want to build your base more than about three blocks tall. Depending on their size, it will take about 30 concrete blocks to build the foundation's perimeter walls. Once the adhesive has set, fill the container with rubble (broken pieces of concrete, big rocks, etc.). Top the rubble with gravel and sand, to about 8 inches below the rim. Next, add a 5-inch layer of vermiculite or perlite for insulation. And, finally, top this layer with sand; tamp it level with the top of the blocks (see Figure 1).

Make a bed for fire

You will build your oven's fires on a layer of firebrick. Place the bricks on the sand and kiss them together, tapping with a rubber mallet to straighten. If they don't go down perfectly, just pick them up and try again. On our oven, we elected to cover the whole top of the foundation with firebrick.

Domes made of sand

Our base was about 4-feet square, so we used a string and pencil to scribe a 28-inch-diameter circle for the inside of the oven and a 42-inch-diameter circle for the outside. You will want to adjust those values somewhat if your base has different dimensions than ours. Just be sure to leave enough space to allow 7-inch-thick walls on your completed oven (see Figure 2).

Shape a lovely dome with wet sand and be sure that it fits inside the smaller

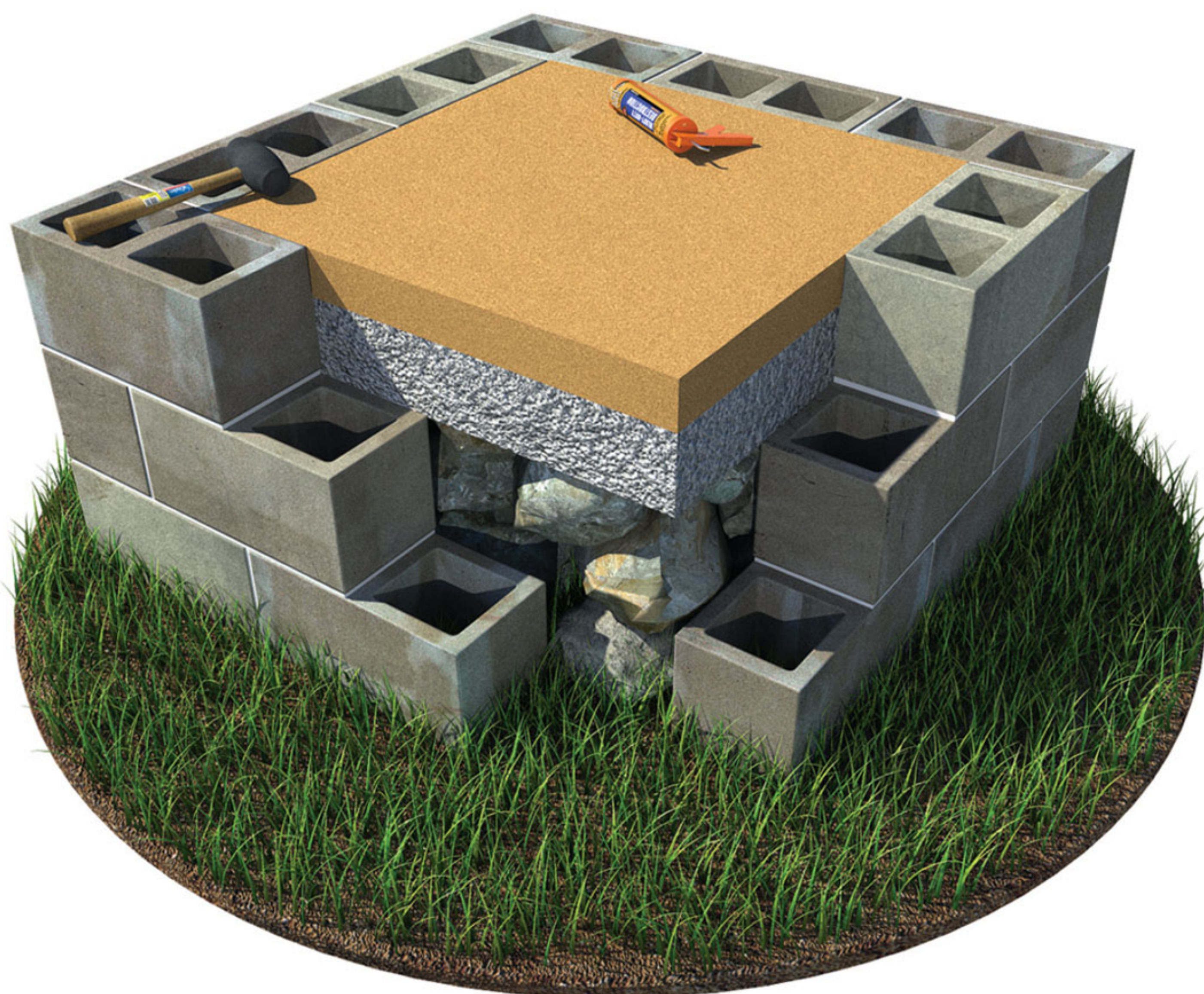


FIGURE 1. Preparing the base: Concrete block walls are filled with rubble topped with layers of a gravel/sand mixture, vermiculite and sand.

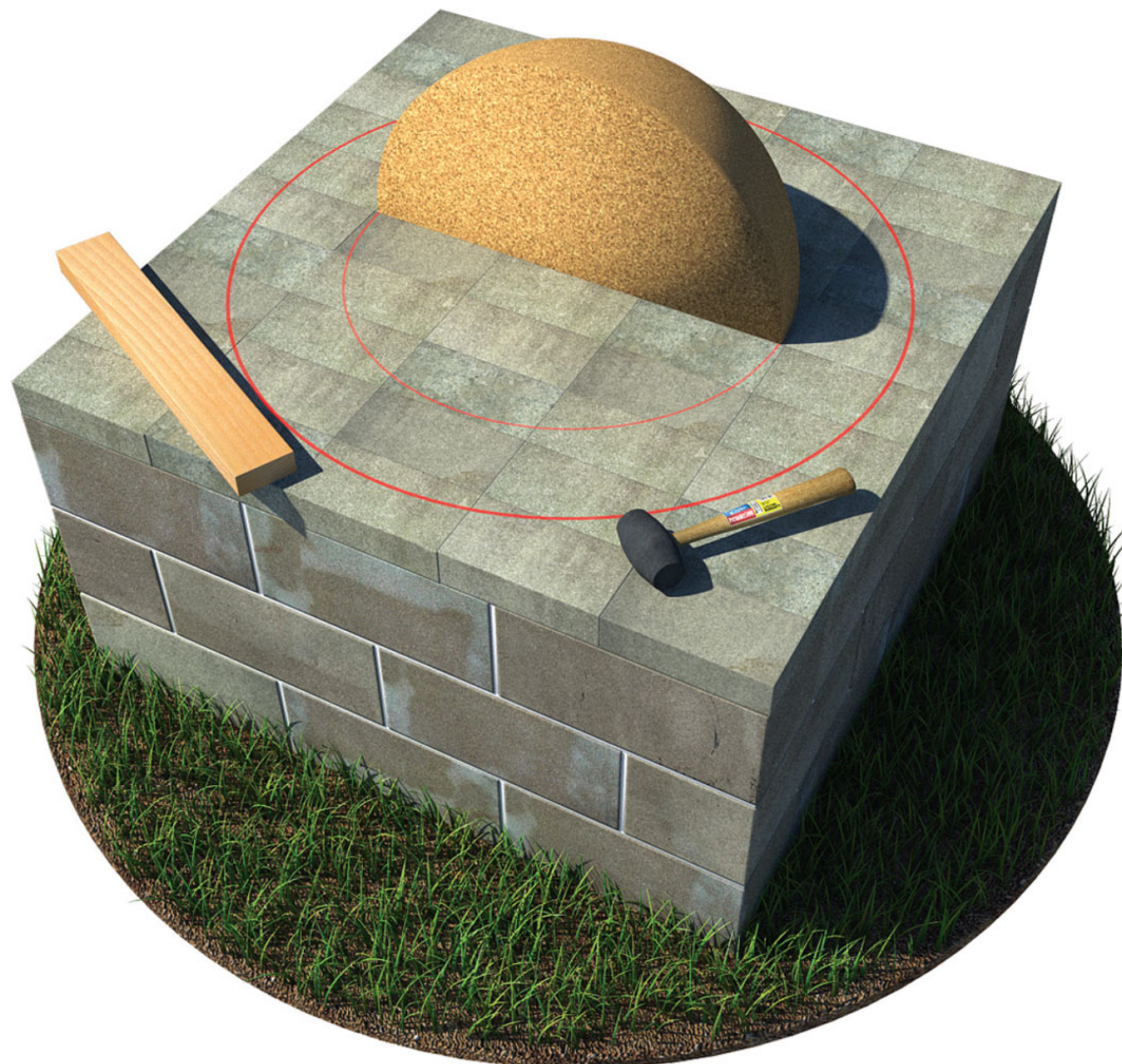


FIGURE 2. Marking the walls: Scribe two circles on the center of the base, one with a 28-inch diameter and one with a 42-inch diameter.



FIGURE 3. A cross-section of the oven shows the sand and three adobe layers.



FIGURE 4. After the door is cut, carefully remove the sand, and gently scrape or brush it from the interior.

of the two circles. Take your time to make it gorgeous, and spray lightly to keep the sand wet. This shape will create the interior of your oven. Before you go on to the next step, measure the exact height of the dome and make a note of it. You will need this figure later.

Play in the mud

The ideal mud mixture for an adobe oven is 25 percent clay and 75 percent sand. Shovel three measures of sand onto a tarp and add a single measure of clay initially. If your clay consists of a clay/soil mix, add proportionally more to the sand. Mix the materials together thoroughly – we used our bare feet. Periodically pick up the corners of the tarp and roll the adobe to the center and mix again.

Continue adding and mixing components until the proportions look and feel right. You should be able to hear the sand “bite” as you roll the mud in your hand. Periodically test the mud by making a golf-ball-sized sphere and dropping it from your waist onto a hard surface. If it breaks apart, the mud is too dry, if it flattens significantly, it is too wet. Add small amounts of water or clay/sand to correct for high or low moisture content.

The first layer

Place brick-sized lumps (approximately 3 inches wide) of adobe around your dome, building up as you go. After completing one row, add another right on top of it. Continue until you have completely covered the sand dome with a 3-inch thick coating of mud (see Figure 3). If the adobe slumps some during the process, use an old knife and slice off the excess adobe on the bottom.

Use a short piece of 2-by-4 to “rock” over your adobe to smooth and adjust any distortions in the form.

Let the first adobe layer set overnight. If it stiffens up nicely, you should cut the door before building the second layer.

If it is still quite soft, you can wait until the second layer is done to cut the door. If the mud seems too soft and wet, your mix may need more clay.

For our oven, we realized our mix was not drying hard and it needed clay, so we

pulled the whole thing off and remixed the adobe. It was an easy fix.

The second layer

Mix adobe for the second layer as before, but add some chopped straw to it, to hold it together and help prevent severe cracking.

Chop your straw with a weed-whacker in a wheelbarrow or trash barrel and mix the chopped straw into your adobe as you make it. The second layer is built just like the first, up and over. Use the 2-by-4 to rock over the form once more (see Figure 3).

Finishing touch

Mix up some wet, soft adobe, using more clay than sand and very finely chopped straw, which you make by running the weed-whacker longer in the straw in your container.

If you have some pretty clay, perhaps red, use it for your plaster. Enjoy spreading it evenly over the entire surface of your oven.

Open the door

In North America, traditional ovens tend to have doors that are 63 percent of the height of the oven's interior, so multiply the height of the dome by 0.63 and cut your door that high, using a large kitchen knife. (Be sure to make it wide enough to allow convenient access.) Remove the sand, using a trowel and your hands. Gently scrape the sand from all the interior surfaces and brush it off the brick floor (see Figure 4).

Close the door

Trace the shape of your oven's opening on a piece of paper, and cut a piece of wood to fit the shape. It doesn't have to be perfect but try to get it close. Fashion a handle from a scrap piece of wood or buy one and attach it to the door.

Let it dry

It can take weeks for your oven to dry, but you can speed the process by building small fires to help it along. Some cracking is to be expected during this process and as you use the oven, if large cracks develop, fill them with damp clay.

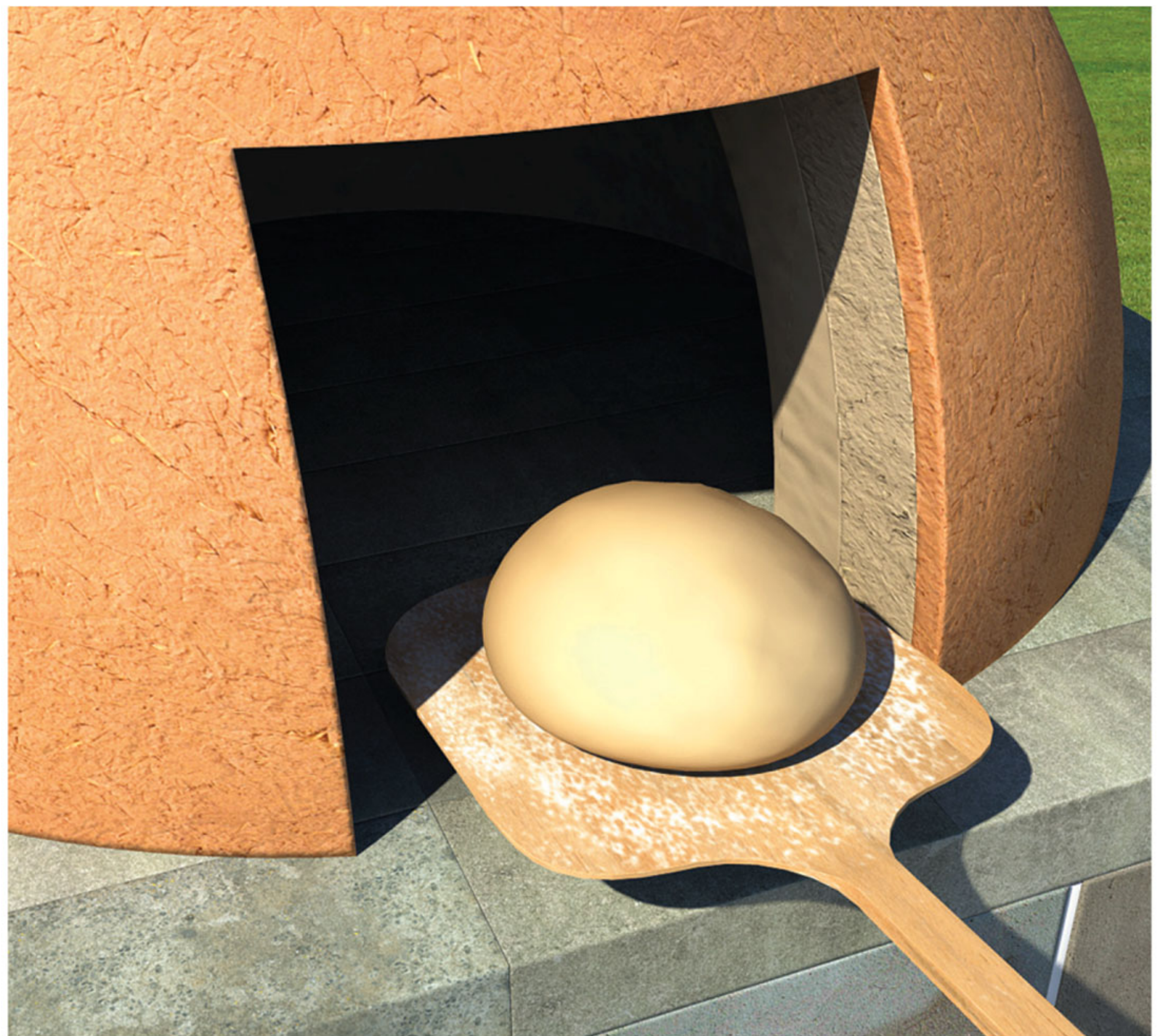


FIGURE 5. A “peel” is used to deposit the loaves into your oven. To heat the oven, build a fire inside and keep it going for about three hours; any good bread recipe should work.

Now, bake some bread!

Light a large fire built with sticks and small pieces of wood inside the oven. When it dies down, build another. Continue this process for about three hours. While the oven is heating, make your dough.

Any good bread recipe will work in your adobe oven. (See “Adobe Bread Recipe” on Page 66 for one suggestion.) Use an oil-free recipe for a crispy, European crust.

Let the bread rise, punch down, and form into round or long loaves. For the final rising, place loaves on cornmeal-covered cookie sheets.

Remove all the ashes and unburned wood from the oven. Nail or screw a rag to a stick, wet the rag, and “scuffle” out the bricks so they're clean. Let the oven sit or “soak” for about 10 minutes. Wet an old piece of towel and wrap the door with the towel inside. In a few minutes, remove the door and towel.

Gently place a risen bread loaf on your peel (the shovel-like tool for moving bread). Put the peel into the oven and with one sharp jerk forward, slide your bread right onto the hot bricks. Repeat with all your loaves (see Figure 5). Close the door, using the wet towel as a seal.

Let bread bake according to your recipe, but pay attention with your nose and intuition to know when it's done.

You will be tempted to cut into your loaves immediately, but let them cool for 10 to 15 minutes. Your bread finishes baking as it cools. Now you can cut it or tear it, add butter or other toppings, and enjoy crisp-crusty European bread, fresh from your own adobe oven.

Cooking other foods

You can cook anything in your oven, including meats and vegetables, pies and pizzas. For pizza, prepare your pies to put into the hot oven right after you scuffle out the ashes; don't soak the oven. For meats and vegetables, put in a covered pot after the soak. Remove the cover the last 15 or 20 minutes. Cook pies in a pie tin, but try to avoid fruit spilling over onto the brick floor. Of course, anything you wish to cook in the oven has to fit through the door.

Maintaining your oven

Cover the oven during rain or snow. If you build an open-sided shed around your oven, it can last for years. If food sticks to the oven floor, you may need to scrape it out once in a while.

ADOBE BREAD RECIPE

This bread can be baked in an outdoor, adobe cooker. Begin to fire your oven about three hours before you plan to bake. The breadmaking process takes about an hour and a half, so plan accordingly.

3 cups very warm water

3 teaspoons salt

¼ cup sugar, honey or sweetener

3 tablespoons bakers' yeast

7 to 9 cups flour of any kind

Cornmeal

Optional: If you use whole rye or other specialty flour without much gluten, add ½ cup gluten flour.

1 In large bowl, combine water, salt and sweetener. Sprinkle yeast on top and allow to foam, about 15 minutes.

2 Mix in flour until mixture becomes stiff but not dry.

3 Turn onto floured countertop (hint: sprinkle cold water on the countertop and smooth lengths of plastic wrap on it to facilitate

easier cleanup) and knead until springy. If you add flour during kneading, make sure dough remains moist, not dry. Kneading should take about 10 minutes.

4 Clean your bowl and oil it; place kneaded dough into bowl and allow to rise almost double.

5 Sprinkle cornmeal on cookie sheets.

6 Divide dough into four pieces and either roll into long loaves or shape into round ones. Allow to rise again until almost double.

7 Just near the end of this rising, remove ashes, sweep the oven floor clean, and close the door with a damp towel to "soak."

Carry your risen loaves carefully to bread oven. Open door and set aside. Gently set each loaf on peel, position peel inside oven, and with quick thrust, set loaves on oven floor. Close door.

8 Bread should bake about 20 minutes, but there are many variables with your handmade oven. Keep your nose and intuition attuned for when bread is done. Loaves should be brown and crusty. You can tap on loaf and listen for hollow sound to double-check. Use peel to remove loaves when done. Allow loaves to sit for 10 to 15 minutes before cutting. 🍞



Last train out to get off the grid?

Amazing “Solar Generator” Is Like Having A Secret Power Plant Hidden In Your Home!



BY MIKE WALTERS
STAFF WRITER, OFF THE GRID NEWS

New solar powered backup provides instant electrical power in any outage or disaster.

If you have ever wanted to have an emergency backup system that supplies continuous electrical power, this will be the most important message you will ever read.

Here is why.

There is now a completely portable (and ultra-high efficient) solar power generator which produces up to 1800 watts of household electricity on demand when you need it most. News of this “solar backup generator” (it’s the first “off-the-grid” breakthrough in 50 years) is spreading like wild fire all across the country!

Why?

The answer is easy. You see, this solar generator is extremely powerful and yet very simple to use. It produces continuous electricity and runs with absolutely no noise whatsoever. It emits no fumes. But the best part about the solar generator is that once you own one, you can...

Generate Free Electricity From The Sun!

Charged by the sun with a powerful solar panel, the unit then stores the power for your use when you need it. We all face natural disasters, with hurricanes, tornadoes, snow and ice storms cutting off electrical power to millions of Americans each year.

Then there are man-made disasters and outages. Blackouts and rolling brownouts are becoming common in many parts of the United States as our grid gets stretched beyond its capacity.

The truth is, we are extremely vulnerable to all kinds of meltdowns that can create temporary or even permanent electrical outages. That’s why if you are one of the few Americans that thinks ahead, you need to...

Have A Solar Powered Backup In Place!

When you compare a solar generator to a gas generator, the difference is pretty remarkable. Here’s why. First, gas generators make an incredible amount of racket... if you can even get them started in the first place. With a gas generator, you pull and pull some more, all because your generator has been sitting in the cold and the carburetor is playing hard to get. This, of course, is not a lot of fun in the dark. Another reason to avoid gas generators is that you just can’t safely run one in your house. But the number one reason you don’t want to be caught in a time of crisis with a gas generator is...

Gas Stations Can’t Pump Gas Without Electricity!

It’s true. When the power goes out, you’re left with whatever gas you have on hand because the gas station pumps all run on electricity. A few gallons stored in a gas can means a little electricity for a little while, then it’s quickly “back to black.”

Here’s the thing: I could go on and on about life without electricity and what a nightmare gas generators can be. But here’s the bottom line: Solutions From Science is now offering an amazing power generating system that can provide plenty of electrical power in the event of an outage or emergency. And the best part is that you can have the power safely in your house.

A True Breakthrough In Home Power Generation!

Let me try to explain the features and benefits of a solar generator as simply as possible. If I could bring one over to your house and let you start plugging in appliances, you would immediately understand what all the fuss is about. But I can’t do that. Anyway, here are some of the reasons I think you’ll want a solar generator:

#1. Maximum Power In Minimum Time.

The solar generator can be set up in just a few minutes. Then, all you have to do is start plugging things in. It can run both AC & DC appliances anywhere... anytime.

#2. Back Up Power When You Need It Most.

It’s called a “solar backup” because it’s designed to come to your rescue when power trouble starts and your lights go out. Run a small refrigerator (high efficient ones are best) to keep your food from going bad.

#3. Portable Power.

If the going ever gets too tough where you are and you decide to “get the heck out of dodge,” you simply throw it in the car and take off to a safer destination.

#4. Generates Permanent Power.

The unit provides 1800 watts of electricity at peak power. That’s enough to run many appliances in your house. The generator is recharged constantly by the sun allowing you to use the system while charge it at the same time. Many users choose to keep appliances plugged in permanently to reduce electrical costs and help pay for the unit.

#5. Multiple Uses.

You can use your solar backup to run essential

appliances when emergencies arise. You can recharge phones, run shortwave radios, televisions, lights, fire place or furnace fans, as well as computers and printers. Plus, if you need to work in the woods at the cabin or in a boat, you can use the solar backup to run power tools, trimmers, blowers and coffee makers.

#6. Plug And Play Means Instant Power.

The emergency backup system comes ready to go. Just start plugging in your favorite household essentials.

By the way... the units go for about \$1797.00 plus shipping and handling.

But I’m going to show you a way around that. I have negotiated a very special offer for Grit readers.

Here’s the deal. You can use coupon code **GC112** to get one for \$200.00 off as a Grit reader. To do that, the absolute fastest way to get one is by going to the website at:

www.PowerSource1800.com

If you would like to order by phone, you can call toll-free by dialing **877-327-0365**. Tell whoever answers that you want the “Solar Backup Generator” system rushed to you and you have a coupon from Grit.

Or, if you prefer to pay by check or money order (payable to Solutions From Science), simply send your payment to:

**Solutions From Science
Dept. Solar Backup GC112
2200 IL Rte. 84
P.O. Box 518
Thomson, IL 61285**

I’m so convinced every American household needs a Solar Generator, that I’ve arranged for this special deal to get one to you at this dirt cheap price. (When you call, ask about their free shipping offer as well.)

Just hurry, call 877-327-0365.

Sincerely,
Mike Walters

P.S. One more thing. It’s very important. Make sure you use coupon code **GC112** to get all the discounts you have coming as a Grit reader.

P.P.S. The website again is PowerSource1800.com. There’s a ton of informational videos there for you to do some research on solar powered backups.



How to Build a GRAIN BIN HOUSE

It might start as a simple metal cylinder, but many people have found that a grain bin house provides an affordable, efficient and versatile place to dwell.

LARGE PROJECTS



By TROY GRIEPENTROG

On thousands of farms across the continent, round metal grain bins (called “grain silos” in some regions) are standing empty or being torn down and sold for scrap because they’re no longer in use. Architects and builders have started to use these durable, inexpensive structures to construct grain bin homes, storage buildings, offices and barns. After the bin is in place, it requires virtually no maintenance.

All sorts of interesting methods can be utilized in order to use individual bins or group them together to make an attractive, comfortable home. We encourage readers to explore unique uses for metal grain bins – especially used bins – and we talked with several people who live in these structures to learn what there is to like about a grain bin house.

Earl Stein, of Summit County, Utah, says, “My grain bin home, ‘Montesilo’ (inspired by Monticello), is designed to be energy efficient. After ‘talling’ (raising) the silos, we cut our way in and framed the interior with 2-by-6s on 1-foot centers. To insulate, we sprayed 2 inches of low-VOC foam against the metal and followed that with blown-in fiberglass insulation. Montesilo is easily one of the strongest and tightest buildings in the county.”

Stein’s structure utilizes passive solar heat that’s assisted with computer technology. The windows allow winter sun to warm the rubber-covered concrete floor. A computer controls draperies to retain the heat at night. For added comfort, Stein installed electric radiant heat in the floors.

“Even when indulging myself with warm morning floors, my heating bills have been a fraction of what it would cost to heat an 1,800-square-foot house in this harsh Utah environment at 7,100 feet,” Stein says. “Experimentally, when no extra heat is applied, the lowest recorded interior temperature was 62 degrees Fahrenheit in midwinter.”

He chose steel because it’s unique, eco-friendly and low maintenance.

“My main motivation in building a house from a galvanized steel bin was that I never wanted to pick up a paintbrush again,” he says. “In 50 years, my shiny steel



Two bins create this home in the Uinta Mountains of Utah. **OPPOSITE:** An energy-efficient grain bin house uses foam and fiberglass insulation, plus computer-assisted passive solar heating.

home will only mellow to a gray patina, but I won’t have to paint it.”

After moving in, he realized there were also advantages to living in a round structure. “There’s a certain non-empirical value,” he says. “It does something to your head – it’s soothing and inspirational. We’ve had incredible brainstorming and musical jam sessions in the house.”

Building the house, even using new steel bins, turned out to be a good financial decision. “Even with all the custom work, Montesilo came in below \$200 per square foot – well below average building costs for the area,” Stein says.

Brian Liloia lived in a straw-bale-insulated grain bin at Dancing Rabbit Ecovillage in Rutledge, Missouri.

“Living in a grain bin was a pretty novel experience,” Liloia says. “For the most part, it worked pretty well, but careful consideration is needed around designing windows and doors. Overall, it was great living in a round structure, and telling people you live in a grain bin makes for some great reactions.”

Louise and Vance Ehmke turned a steel grain bin into a structure where they can live and work. It serves as a scale house (where grain trucks are weighed) on their farm near Healy, Kansas.

“Our grain bin office/scale house/residence is just cool,” Louise Ehmke says. “It turned out far better than our expecta-

tions. Everybody who comes here – including the governor of Kansas – says it is one of the neatest things they have ever seen. The structure itself, a real grain bin, is clearly unique, but the rustic and high-tech interior takes it off the charts!”

A bin within a bin

Mark Clipsham, an architect from Ames, Iowa, is working on a new technique for using steel grain bins to produce strong, energy-efficient homes. His main concept is to put one round steel bin inside another and fill the space between them with foam insulation, which creates a single, monolithic structural insulated panel. Following is an interview with Clipsham in which he describes the idea, where to find bins, insulation and more.

• *Why would anyone use a grain bin as a house?*

Metal grain bins are strong, inexpensive – especially if you buy used bins – and can be recycled when you’re done using them. Plus, they’re round and have conical or domed roofs. Ironically, these attractive curved forms are used in either the most expensive and prestigious buildings or the most utilitarian and primitive ones. These forms have evolved out of use because of changes in available materials, labor costs, and prevailing building methods. But why not use something utilitarian and affordable – a grain bin – to build what is



In Kansas, the Ehmke family uses this bin as a residence, an office and a scale house (where grain trucks are weighed). TOP: The interior includes some metal, but is primarily traditional.

otherwise in the realm of the expensive and exclusive?

• **How much do new bins cost?**

Prices vary depending on the cost of steel, your location and the season. Bins cost as little as \$30 per square foot – sometimes even less. Because there are so many variables, get estimates from several companies before making a decision. Buying a used bin is the most cost-effective option.

• **How do you find used bins?**

In Iowa, and I'm sure many other places, we have what are referred to as "government bins." They are invariably 18 feet in diameter and about 18 feet tall at the eaves. These bins are no longer deemed

commercially viable and are routinely scrapped. To find used bins, put an ad in farm magazines, check Craigslist, or talk to a local bin dealer or bin erector.

• **How do you move an old bin?**

Companies that sell and install bins can usually move them also. Bins up to 36 feet in diameter can be moved "whole." The bin is first separated into two sections, then the top is collapsed onto the bottom. Cradles are used for moving 18-foot-diameter bins tipped on their sides.

You can also disassemble a bin to move it, but use new bolts when you reassemble the bin. The gauge (thickness) of metal is usually mixed in the same bin – thicker

toward the bottom. Be sure to label the sheets as you take them apart so that you put them together correctly.

• **If the two bins are the same size, how do you reduce the size of one grain bin so it fits inside the other?**

Undo enough bolts on one unit to allow you to use a cable and squeeze it down to a smaller diameter, and then install new bolts and holes as necessary.

• **How do you get one bin inside of another one?**

Use a crane to set the larger unit around the smaller one. To allow the crane to lift the outer bin, fasten cables through bolt holes at the ridges of the roof sheets near the fill hole and around steel bars that fit into the roof sheet ridges in at least six evenly spaced locations. (The fill hole is the opening at the top of the bin where grain is dumped in.)

On the outside of the inner bin, use tapered shims, preferably made of rigid insulation, at least 2 feet long and thick enough to resist being crushed by the outer bin as it's lowered. The bottom of the shims should guide the bottom of the outer bin into the desired position (wall thickness). Use a minimum of six shims.

• **What kind of foundation do you recommend?**

Footings can be concrete, a bearing plate of galvanized steel, or treated wood on compacted, crushed stone.

• **Which type of insulation system do you recommend?**

My preferred insulation for this building system is closed-cell foam at least 3 inches thick on the inside surface of the exterior bin. Ideally, fill the entire cavity between the inner and outer bins with slow-cure, pourable (or fast-cure, injected) foam through small openings cut into the inner bin. A continuous 3 inches of 2-pound foam gives an R-value of about 15 and also acts as a vapor barrier. (The International Energy Conservation Code recommends R-13 to R-21 for walls.)

If you use only one bin, you could spray on insulation or line the interior of the space with straw bales and finish the bales with natural plaster. If you use straw bales for insulation, you should still use at least 1 inch of rigid insulation (fastened in place with adhesive) on the inside of the bin to



The size of the bin has been reduced without cutting; instead it has been “squeezed.”



Sealing gaps and shedding water are important for window and door installation.



“Rain screens” add visual interest over the windows; the joints do not need to be sealed.

prevent condensation on the inside of the bin wall. Otherwise, the warm, moist air from the conditioned interior will migrate through the straw, hit the cold steel and turn from water vapor to water, and the straw won't dry out.

• *Is it possible to install a second floor in a grain bin, or can these only be built with one level on a concrete floor?*

You can easily install a second floor. You can use standard joist hangers for floor framing as long as you drill holes for the supports on the peaks of the corrugations. This may mean using hangers that are for larger joists to ensure getting enough fas-



Mark Clipsham remodeled a grain bin to be a playroom and storage space. **BELOW:** The custom-made door is carefully sealed against rain and snow, and it's also protected by an awning.

teners in each hanger. The metal must be thick enough to hold the fasteners, too.

For vertical point loads (such as where your main floor frame meets the walls), you can use support columns down to a traditional footing. Fasten the columns to the wall for added stiffness.

• *Can you install windows or additional doors?*

Yes, but be sure to reinforce the edges of the breaks in the bin structure. Doors and windows can be installed using a modified bin “human door frame” designed for grain bins. The frame has a built-in drip cap, but you need to extend the vertical frame to use it as a door.

Before you start building

While not absolutely necessary, professional services and support are recommended for implementing these concepts if the bins are to be modified in a substantial manner. All applicable building codes should be followed for safety and compliance reasons. 🛠️



How to Build a STONE CULVERT



LARGE PROJECTS

Learn how to build a stone culvert with dry-stacked and flared wing walls to divert water.

By DAVID REED

Many property owners with driveways that cross over creeks or streams already have culvert pipes in place. In this project, you'll learn how to build a stone culvert with dry-stacked walls around the intake end of one of these pipes.

The 4-foot-diameter culvert shown in the photo on the opposite page allows a creek to run beneath my driveway. When I first moved to the property, the outflow end of the culvert – a concrete-block wall faced with stone – was still in good shape. The dry-stacked stonework at the inflow end, however, had collapsed into piles of stone on both sides of the pipe's opening, and the slope from the driveway down to the top of the pipe was caving in. The simplest and most practical solution was to stabilize the bank by dismantling the old stonework and restacking the stone walls.

One tip before you start a similar project: Unless the creek or ditch is dry, there's no way to avoid getting wet as you build the stone walls of a culvert! You'll be standing right in the bed of the creek or ditch as you work. To minimize soggiess, wear a pair of tall rubber boots. Making a few walkways by placing boards just above water level will also help.

Dismantling the old stonework

I started work when the creek was low. First, I completely dismantled the old stonework on the right-hand side of the inlet end. In order to redirect some of the creek water away from my work area and off to the left, I removed some of



A stone mason uses a hammer and chisel to shape stone. **OPPOSITE:** David Reed's completed stone culvert with flared wing walls.

the largest stones and placed them in the creek itself.

Some of the original stones were suitable for restacking. The others, irregular in shape, were good backfill material, so I saved them to thicken the new wall and add to its ballast. To supplement the usable recycled stones, I handpicked about ½ ton of stone at a stone yard.

Stacking flared wing walls

During heavy spring rains, the volume of this creek increases dramatically. Sometimes, the water level reaches the bottom edges of the capstones on the right-hand side of the culvert, in front of the hemlock tree. I therefore decided

to build dramatically flared new wing walls – ones that would funnel this rush of water into the pipe. Because the water flow is sometimes extremely heavy, I also knew I'd have to use very large stones.

I dry-stacked the right-hand wall first. I started by wedging stones between the outside surface of the pipe's opening and the soil bank to make sure that water wouldn't flow behind the pipe. Then, to clear a site for the first course of the wall, I removed a few stones that jutted out from the creek bed. Next, I laid out the first course of the wall by placing some of my largest stones directly into the creek.

As I stacked this wing wall, I set the first stone in each course to overlap the



Building a dry stone wall will take more materials and more time than a stone culvert.

lip of the pipe. I also rounded the wall dramatically in order to make sure that water flowing out of a smaller creek on the right would hit stones rather than soil as it entered the larger creek. To backfill the wall, I combined the irregularly shaped culls that I'd saved with crushed limestone that I had on hand and small stones gathered from the creek. The creek was also a good source for shims, wedges, and the smaller stones across the top of the pipe.

As I continued to stack courses, I had to remove the lower branches of the hemlock tree in order to provide working space. I took care to leave enough soil and space for the tree's future growth.

After capping off the section of the wing wall in front of the tree, I cut a shelf in the bank behind the tree and stacked a couple of courses of that wall. Then I shifted my attention to the wall on the left-hand side of the creek.

First, I had to move the water-divert-

ing stones that I'd set in the creek. I placed these at the opposite side to divert water from my new work area at the left-hand side of the culvert. Then I stacked the new wing wall, using my largest stones in the bottom course and backfilling as before.

The final stage of this project was stacking the wall just beneath the road, which I did in the usual fashion.

Working with new culvert pipe

If you have a small creek on your property and would like to install a culvert pipe with a pathway over it, try the following project. If, however, your creek is large and you want to build a driveway over the culvert, I strongly recommend that you consult with a professional. You can certainly dry-stack the stones at the ends of a large culvert, but setting the pipe, gravel, and road bond will require the use of heavy equipment,

and will likely also require inspections. For smaller projects, you'll only need a pick-up truck to haul the pipe, gravel and stones – though check local ordinances to make sure you satisfy code.

Culvert pipe is cylindrical in shape and made of rigid plastic or heavy-gauge galvanized steel. Diameters can range from 1 to 10 feet. To create a 6-foot-wide path over a small creek, a pipe 10 feet long and 3 feet or smaller in diameter will be sufficient. To find a local supplier, just look in your telephone book, under "Pipes" or "Culverts."

Have the pipe cut to length before you pick it up or before it's delivered. Most pipe sellers will deliver, but if you don't want to pay for this service, a small truck can usually transport short sections. You can join these with a connector once they're at your site. Elbow sections that allow pipes to be joined at 90- and 45-degree angles are also available.

Determining the diameter of the pipe you'll need is tricky, as there's no way to gauge exactly how much water will flow through the pipe at any given time. One way to estimate the diameter is to observe the volume of water in the creek after a heavy rainfall. Take note of the water's width and depth at the spot where you want to set the culvert; your culvert pipe must be able to cope with that volume of water.

Order a pipe the diameter of which is slightly larger than the diameter you think you need; you never know when the hundred-year flood will hit! If your creek is small and the culvert site is close to its headwater (where the creek begins), the volume of water may not change drastically from season to season or day to day. If, on the other hand, the site is below a number of tributaries that feed into your creek, or if much new development is taking place upstream, the water can rise dramatically.

Setting the pipe in place

Work on this project during a dry season, when the water level in the creek or stream is low. To divert any water flow, refer to the tips presented at the beginning of this article.

As you visualize the finished project,

keep in mind that the bottom lip of the culvert pipe should sit at or slightly below the bottom of the creek bed. The pipe should slope slightly downward from its intake end to its discharge end.

Start by clearing out any rocks that protrude from the creek bed; set them aside to use in the walls at each end of the pipe.

The creek bed must be free of any material that will keep the pipe from sitting evenly along the bottom. Use $\frac{3}{4}$ -inch (2 cm) gravel to fill any holes left by the rocks you remove.

Next, spread a shallow gravel bed down the center of the creek, sloping it downward toward the discharge end and shaping it slightly to match the contour of the bottom of the pipe. The depression in the gravel will ensure good contact between the bed and pipe.

Ideally, the lower lip of the pipe should rest at or slightly below the bottom of the creek at the intake end, so don't make the bed too deep.

To position the pipe on the gravel bed, simply roll it into the creek and adjust it by hand. If you're working with two sections of pipe, band them together with a metal collar after placing them on the gravel bed. Large diameter pipes must be set by heavy equipment.

After the pipe is in place, stabilize it by placing a few stones along both sides, 1 foot (30 cm) in from each end.

Then, toward the center of the pipe, start pouring and tamping layers of gravel in the spaces between the creek banks and the pipe. Your goal is to create a tightly tamped bed that buries most of the pipe and fills the area above it from one side of the creek to the other.

Leave enough space at the ends of the pipe to dry-stack walls around the pipe's openings.

Building the wing and head walls

At the inlet end, you'll build angled wing walls that flare out so they'll funnel water into the pipe. The wall at the discharge end will be perpendicular to the pipe rather than flaring outward. Use the same instructions from before to dry-stack the inlet-end walls first; then



It may be time to replace the stones surrounding this water drainage pipe in North Carolina.

stack the wall at the outlet end. As you stack the stones, you'll probably have to add extra gravel behind them to fill the space between their backs and the gravel you poured earlier.

Stack both walls until they're tall enough to ensure that your pathway will be at the height you desire. To stabilize them, add capstones. To make a pathway over the gravel above the culvert, just add a layer of soil, pea gravel, small crushed stone, bark mulch, wood chips, or tamped road bond.

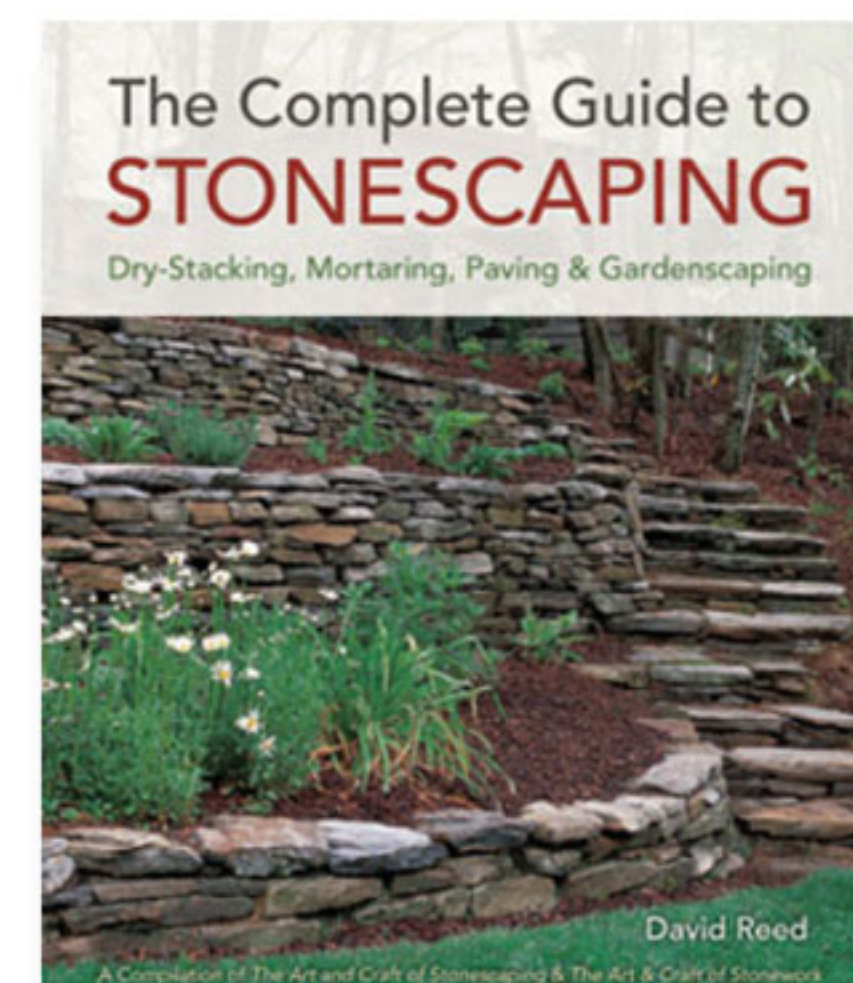
When the creek floods

Some friends of mine live in a beautiful valley with a large creek flowing through it. Shortly after moving in, they noticed that during heavy rains, the 4-foot-diameter (1.2-meter) culvert beneath their driveway couldn't handle the volume of water in this creek. Excess water flooded the driveway and eroded its edges.

When the culvert was built, it was more than adequate in size, but substantial development upstream had significantly increased the water volume. New rooftops, paved driveways, and other hard surfaces had almost doubled the runoff into the creek.

To remedy this situation, my friends widened the creek at their bridge and installed a second, 4-foot-diameter culvert next to the first. 🛠️

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LARGE PROJECTS

Build the Homestead Classic: *The Outhouse*



Ideally, you'd like to situate an outhouse with space and access to the pit behind the structure. Equally important is making sure the slope of the ground is fairly even or downsloping from water sources.

For homesteaders in remote areas, a properly managed privy might be a better idea than a full-blown septic system.

By ELIZABETH ALLYN

One of the very first and most important buildings needed on a remote homestead is a privy, which isn't as complicated to construct and maintain as you might imagine. Both the surface privy and the pit outhouse are simple, straightforward, and easy to understand. As long as you follow some general rules for building an outhouse, you can hardly go wrong modifying either type to suit your own particular materials, skill or location.

A properly managed privy is at least as healthful for people and the land as a septic system and is far more than a

place to evacuate waste. Ours is a sanctuary in which to be quiet with no one to ask why you aren't busy; to think or read with no one waiting to get in to shave; to watch a small, pretty piece of the day pass outside (one of the clapboards on our outhouse has a crack that's perfect for viewing through, like Arctic sunglasses). It's a place where body and self are at peace with the rest of the natural world.

Old homestead backhouses were typically screened by a spreading lilac and "going out to smell the lilacs" has long been a useful euphemism in our family. Our antique accommodation was also christened "The Reading Room" by my father for its quantity of old catalogs and magazines, and it

is next to impossible — while selecting a page of the right texture — not to get interested in an article from an old *Ohio Farmer* or *Saturday Review*.

For that matter, no one will disqualify you for using commercial toilet paper in an outhouse. It doesn't provide much in the way of reading matter, but it's made for things of this nature and does disintegrate rapidly.

I suppose open-pit privies are necessary for the great numbers of people who visit parks and other remote locations, but I find such designs disagreeable. Our old Reading Room located on a gentle hillside of sandy loam is kept healthy by earth, air, bacteria and regular doses of ashes or lime.

Wood ashes are best. If every use of an outhouse is topped by a cupful of them, the building will always have sweet earth smell with never an odor. Coal and trash ashes are almost as good. Superfine agricultural quicklime does a fair job too, if you don't



An outhouse not only serves its purpose in the way of waste disposal, it can also be a beautiful piece to the landscape structure puzzle. Log cabin design is always a nice look.



Having some signal that an outdoor privy is occupied prevents those awkward encounters; plus a rustic-looking sign becomes part of the structure itself.

mind the strong smell of lime hovering around.

The advantage of The Reading Room's slope setting becomes apparent at cleaning time (about once every two months for a family of two). There is an 18-inch space between the ground and the first board on the back of the building from which we rake the accumulated waste with a strong old garb rake saved especially for the job. A few inches of each peak (we try to give our "three holer" balanced use) comes off in a mass – that's the least pleasant part of the operation – and the rest is just gardening. Under the peaks, the material is as mellow as good garden soil (when covered with wood ashes), very grainy (coal ashes) or a bit lumpish (lime).

We rake the privy's contents down the slope, cover the peaks with the rest, and sprinkle it all again with ashes and earth. About once a year we load the plateau of compost on the spreader and take it out to the fields. It's only work ... the material smells like earth.

Building the outhouse

Second, build a wooden form in which you can pour a concrete ring sill that is 4 inches thick, with outside dimensions of 4-foot-10-inches by 4-foot-10-inches, and that has a hole in its center measuring 3-foot-8-inches by 3-foot-8-inches.

Pour the ring sill and center and level it over the excavation.

Next, build another form in which a slab of concrete 4 feet square and 2½ to 3 inches thick may be poured. If this slab is poured flat, a wooden riser box with cover will have to be constructed and mounted on the slab later. The riser may also be made of concrete and poured as part of the slab.

All concrete, of course, should be suitably reinforced with steel rod with eye and anchor bolts embedded in the sill and slab as needed.

Cover the privy with sound siding, and paint it inside and out. Corrugated metal roofing may be used on top of the outhouse, or the structure may be topped with roll roofing.

LOCAL LAW

Before building an outdoor privy, always check the local ordinances for requirements, which are likely to vary from locale to locale.

You may prefer to build in adjustable ventilation such as screens-with-covers, leave an unadjustable 4 inches of vent space across the front and back of the privy, or, in the case of the less fragrant (with the regular addition of wood ashes) surface privy, cut only a small, traditional, new moon or star in the door. It's six of one and half a dozen of the other, depending on the climate of your region. Remember that less vents also mean less light inside the building. Screens with covers are the best all-round approach.

The outbuilding should be framed in with 2-by-4s and a vent built for the pit. This vent may extend above the roof line, or merely run out the back of the house.

NOTE: These instructions are purposely a little loose because there is no "one best" way to build a privy. As long as you strictly follow the general rules you should be OK. And check your local laws and ordinances!

General rules for building outhouses

1. A privy should always be located so that it will not pollute any domestic water supply. Generally this means that the outhouse should always be on the downgrade side of the water supply and at least 100 feet from it (check your local building codes).

2. The outbuilding should be of adequate capacity, well designed, substantially built and easy to maintain in a sanitary condition.

3. The best privies are fly-tight and constructed to remain that way. Flies and mosquitoes that breed on human waste can carry typhoid fever, dysentery, and other bad news. Pit privy mosquitoes can be controlled by pour-



If your privy isn't air-tight, you can use screens to try to limit access by flies and mosquitoes. Those insects in such a setting can carry disease.

ing a cup of kerosene into the cavity every 10 days or so, among other methods.

4. Both the excavation and building of a pit-type outhouse must be properly vented to prevent odors. Surface privy odors can be controlled quite effectively by sprinkling a cup of wood ashes over every fresh stool.

5. Make a lid for each outbuilding "seat" and keep the lids in place at all

times the privy is not in use.

6. Never dump garbage or other waste into a privy.

7. Surface privies must be raked clean at regular intervals, and the waste properly disposed of. When the hole under a concrete slab pit privy is filled to within 18 inches of the surface, the house should be moved over a new hole and the old excavation filled with clean dirt. 🐞



EASY DIY Garden Shed Plans

**Anyone can build a small, simple
and sensational shed.**

By STEVE MAXWELL

Almost all of us need a little place to store outdoor stuff—garden tools, recycling bins, the lawn mower, bicycles or other outdoor gear—and building a shed is one of the best ways to create additional

storage space. Our garden shed plans are simple and require the creator to have only basic carpentry skills.

A garden shed can be strictly functional, but it can also be a decorative focal point around which you design your garden or yard. These plans will help you build a basic shed, but don't stop there! To customize your shed, you could create

a combination toolshed and greenhouse, put a martin house on top, or use part of the shed for a chicken coop or rabbit hutch. If you're feeling even more adventurous, you could create a living roof of moss or succulent plants.

Build the floor

The best spot for a shed is level, well-drained ground close to where you work in your garden or yard. The location doesn't need to be perfectly flat; the foundation design shown in the plans allows



for adjustments to make the floor level. Small sheds require only a top-of-soil foundation, even in locations with freezing winter temperatures. Precast concrete deck blocks work perfectly for this.

To eliminate the need for any kind of floor beams, you'll need a deck block at each corner, with two more blocks equally spaced along the 8-foot sides and one in the center of each 6-foot side. If you expect to store particularly heavy items, consider installing three deck blocks between each corner on the 8-foot walls, instead of two.

Deck blocks include a central pocket sized to fit the standard 4-by-4 vertical posts that typically hold up a deck. In the case of this shed, pressure-treated 4-by-4s function in a similar way, but in short lengths – just enough to compensate for any variation in the shape of the ground.

Start by setting deck blocks on the ground, positioned as shown in the plans

on Page 82. While the area doesn't have to be perfectly level, you should make the ground roughly level where each block will rest. Temporarily place some straight 2-by-6 lumber on edge in the top grooves of the blocks to orient the blocks in a straight line. Arrange two rows of four blocks parallel to each other to form both long walls, then measure diagonally across the outside corners to determine how square the arrangement is.

If the two long walls are parallel, and diagonal measurements taken across corners are equal, then each corner is guaranteed to be 90 degrees. Finish up by placing one deck block in the middle of each 6-foot wall after you have aligned and squared the 8-foot walls.

Remove the 2-by-6 lumber guides, then put a 12-inch length of 4-by-4 lumber into each deck block, positioned vertically in the central recess. These 4-by-4s will be slightly too long right now, but

that's what you want at the moment.

The 2-by-6s that form the outer perimeter of the floor frame rest on the outside top edge of the deck blocks, tight to the outer faces of the 4-by-4 posts. Use a 4-foot level and an 8-foot 2-by-6 to determine the highest deck block in the group, then use this as your starting point for installing the floor frame. Use a single galvanized 3½-inch deck screw to lock the 2-by-6 to the 4-by-4 on the highest deck block, and raise the other end of the 2-by-6 so it's level before locking the other end of the 2-by-6 to its 4-by-4. The 2-by-6 won't rest on all the blocks, but should rest on at least one.

Continue working all around the floor frame in this manner until all perimeter 2-by-6s are in the same level plane. Trim all excess 4-by-4s flush with the top of the 2-by-6s using a chain saw or reciprocating saw, then add 2-by-6 floor joists running between the two 8-foot walls.

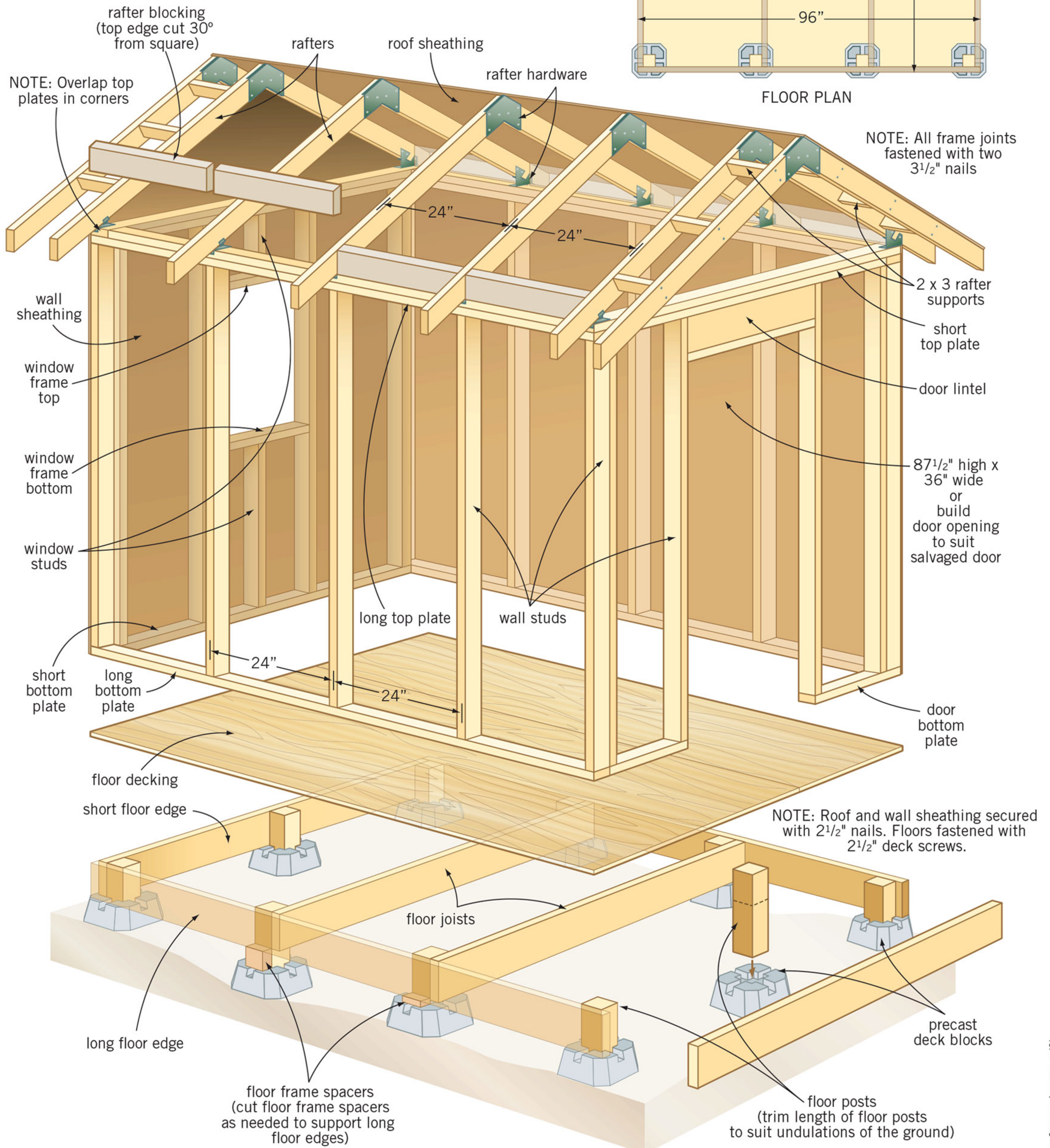
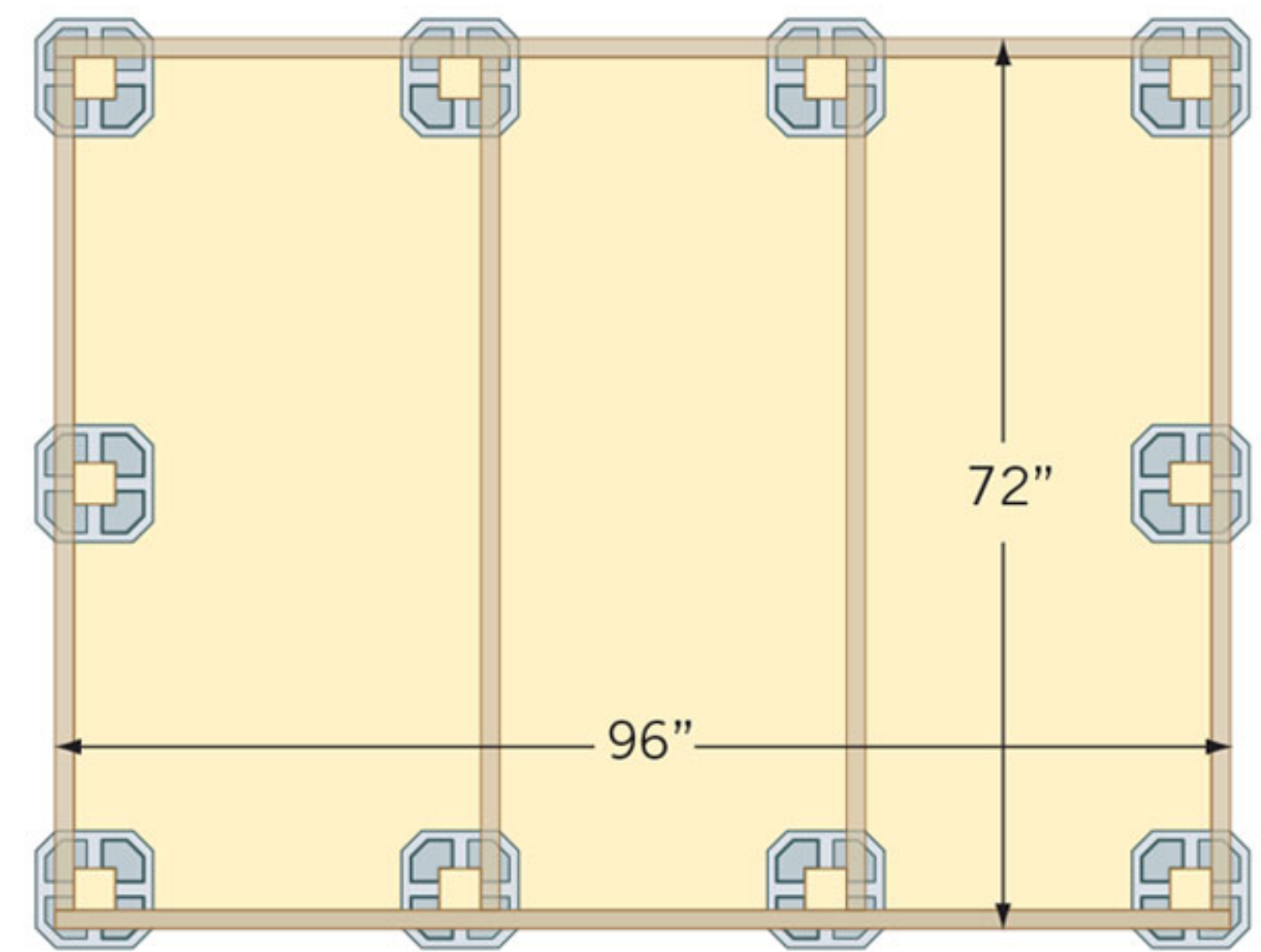
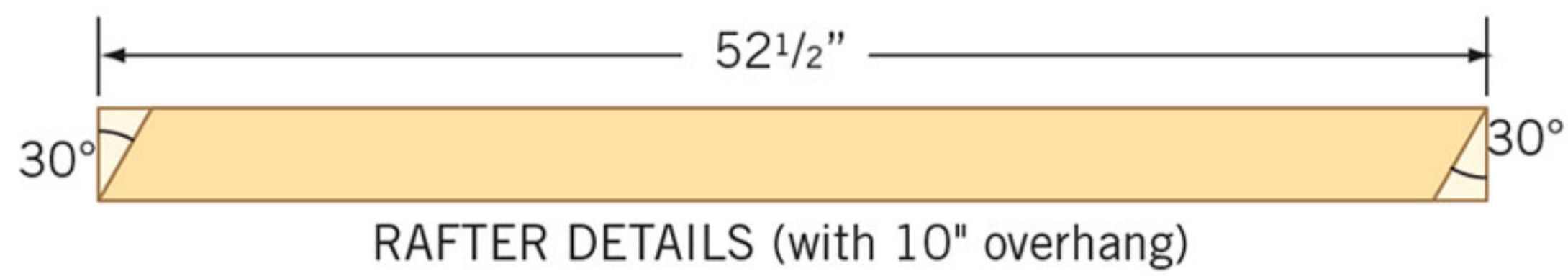
Make sure each joist fits tightly within the outer edges of the floor frame, and then fasten the joists to the side of the 4-by-4s with screws.

Complete the floor frame by driving three 3½-inch deck screws per joint, then custom-cut spacers out of 1½-inch-thick construction lumber to fill the gap between the underside of the 2-by-6s and the top of the deck blocks. You can't rely on screws alone to hold up the floor frame in the long term. Finish up by installing a pressure-treated, ⅝-inch-thick plywood subfloor on top of the floor frame, secured with 2½-inch deck screws driven every 6 to 8 inches.

Frame the walls

This shed's walls are built in the same way that the walls of most full-size homes are built. The plans show how 2-by-4 top plates and bottom plates extend horizontally around the perimeter of the building, with vertical studs defining wall surfaces. Notice that the two short walls fit inside the two longer ones, fastened together at the corners with 3½-inch deck screws and overlapping top plates.

To build the framing for each wall, begin by temporarily screwing a 2-by-4 top plate and 2-by-4 bottom plate together face to face, then set this pair on its edge



on the plywood floor. Next, mark the position of the wall studs on the edges of both of these 2-by-4s, spacing the center of each stud 24 inches apart. The plans show detailed layouts for all walls and how to frame door and window openings. The plans don't offer measurements for these openings though, because this shed is perfect for using scrounged windows and doors, and these can be of any size. You can hinge doors directly onto the rough frame of the shed, but attaching windows will work a little differently.

A salvaged wooden sash can be fixed permanently into the shed frame, but beware: Fixed windows such as these attract and trap flies, making a buzzing, dirty mess. I suggest using another type of window. If you do, you'll need to create a rough window frame opening large enough to accommodate the entire window unit, with an extra ½-inch clearance on the sides, top and bottom to allow for adjustments.

Separate the 2-by-4 plates, space them about 8 feet apart on the floor, and nail nine 2½-inch-long studs between them.

Immediately after you've built one long wall, get some help to tilt it upright, then use 4-inch deck screws to fasten the bottom wall plate to the floor, positioning the screws so they sink into the edge of the 2-by-6 floor frame. Assemble and raise the other walls, adjust them so they're plumb in the corners and fasten them with deck screws. Add a second layer of wall plates on top of the first, overlapping across the corners. Complete the walls by covering the frame with sheathing.

Exterior-grade plywood siding is an easy, inexpensive choice. It includes vertical grooves for decoration and accepts any kind of paint or stain. Regardless of what you use, don't wrestle with cutting window openings before adding sheathing. Instead, apply sheathing to the walls from the outside, covering them completely, then cut the window and door openings afterward, following the framed openings from inside using a chainsaw or reciprocating saw.

Build the roof

The simplest way to make a roof frame for a small shed is to use steel connector

GARDEN SHED MATERIALS LIST

- 14 rafters, 1½-by-3½-by-52½"
- 12 rafter supports, 1½-by-2½-by-8½"
- 8 rafter blocking boards, 1½-by-5½-by-22½"
- 10 deck blocks, precast concrete, for 4-by-4 posts
- As needed floor posts, 3½-by-3½-by-12"
- As needed floor frame spacers, 1½-by-3½-by-length*
- 2 long floor edge boards, pressure-treated, 1½-by-5½-by-96"
- 4 floor joists, pressure-treated, 1½-by-5½-by-69"
- 1½ sheets pressure-treated floor decking, ⅝-by-48-by-96"
- 18 wall studs, 1½-by-3½-by-92½"
- 6 long bottom/top plates, 1½-by-3½-by-96"
- 6 short bottom/top plates, 1½-by-3½-by-65"

- 1 door lintel, 3½-by-width as needed-by-length as needed
- 2 window studs, 1½-by-3½-by-length as needed
- 2 top/bottom window frames, 1½-by-3½-by-length as needed
- 6 or 7 sheets*** wall sheathing (plywood or OSB), ⅞ to ½-by-48-by-96"
- 4½ sheets roof sheathing (plywood or OSB), ⅞ to ½-by-48-by-96"
- Metal rafter hardware

Note: All materials should be construction-grade lumber unless otherwise noted. Dimensions are actual – for example, 1½-inches-by-3½-inches are the actual dimensions of a 2-by-4.

*Cut to length as needed

**Cut upper top plates to overlap corners

***Depending on the size of door and window you select

plates made especially for the job. Using this hardware eliminates the need for fancy cuts on the rafters and will create a strong roof.

Cut the 2-by-4 rafters at 30-degree angles (see the plans), then bring them together on top of the building using steel plates (peak brackets) and screws.

With the rafters in place, cut two triangular pieces of wall sheathing to close in the gable ends, fastening them both to the top of the wall and the faces of the outermost rafters with nails.

Notice how the roof frame sits on top of the walls and that there are spaces between the rafters. If you leave these open, birds, bugs and rodents will get into your shed. The best time to fill spaces between rafters is now, before the roof sheathing goes on. Cut 2-by-6 blocking to fit within each space. If you have access to a table saw, use it to angle the top sides of the blocks to match the roof slope. Fasten the blocks to the top plate with screws.

Even a small shed looks best with a roof overhang on the triangular front and back ends of the building. So, before you cover the roof with ½-inch plywood, extend the roof frame by attaching three rafter supports to each end rafter with screws, then fasten overhanging rafters to supports.



Customize your garden shed to be a decorative focal point of your yard or garden.

It's much easier to safely handle rafters, roof sheathing and shingles when you're standing firmly on a scaffold than when you're balancing on a ladder. Set up the scaffolding inside the shed for roof construction, then move it out next to the eaves as a shingling platform.

DIY sheds offer great value, great durability, and the opportunity to exercise your creativity. Build one yourself, and you'll wonder why anyone would ever do it differently. 🧰



Build a ROOT CELLAR

These unique plans show you how to build a root cellar for food storage by adapting a new concrete septic tank.

By STEVE MAXWELL

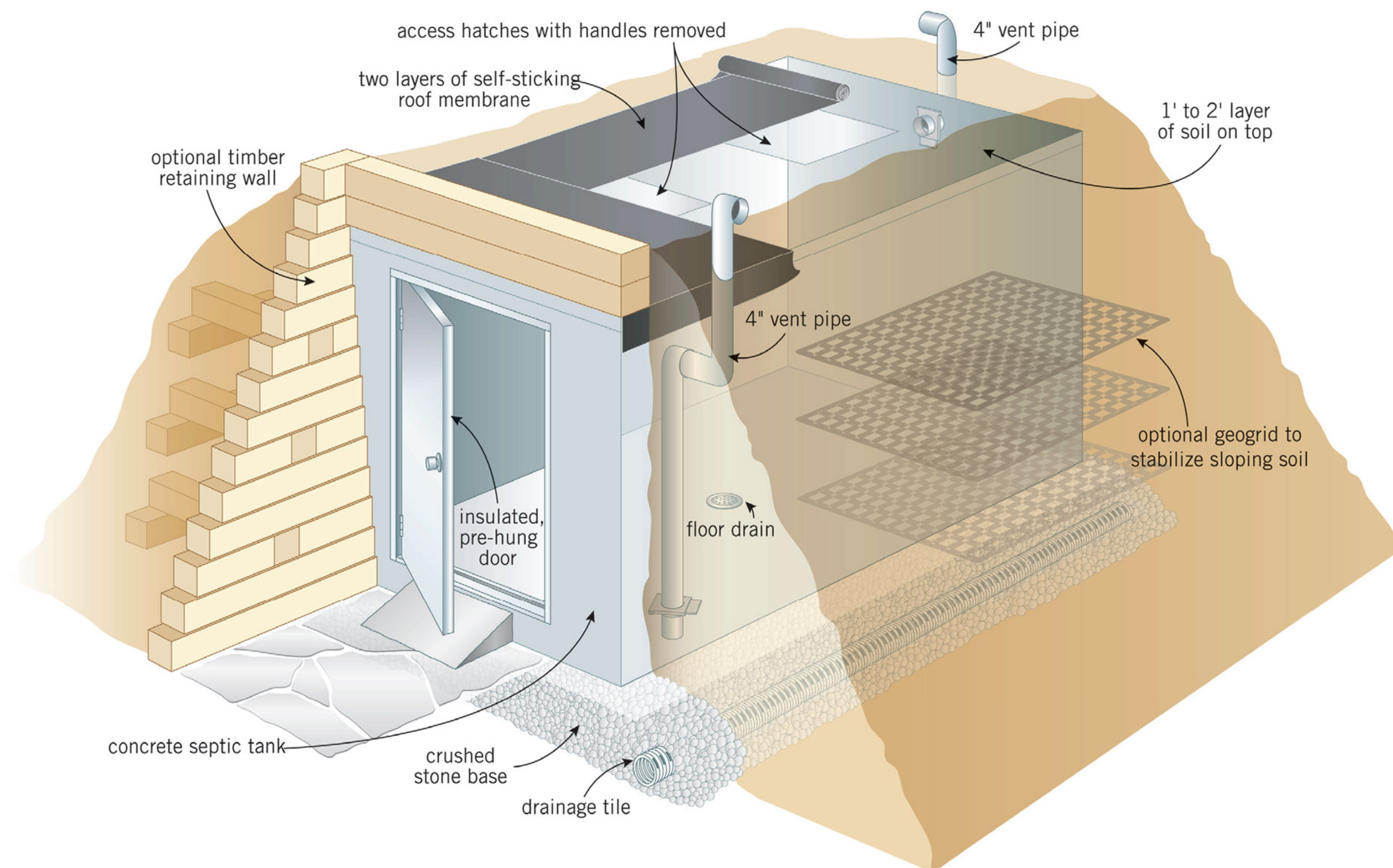
The cool, moist and dark conditions of a root cellar make it the perfect place to keep many fruits and vegetables crisp, fresh and delicious for weeks – even months – of storage. And while there are myriad ways to store vegetables, our in-

novative root cellar plans show you how to build a root cellar by modifying a new, precast concrete septic tank.

By following these plans, you'll cut an entrance, install a door, add a pair of vent pipes and cover the tank with soil to bring an old-fashioned, walk-in cellar into your modern life – just outside the back door – for any number of storage purposes.

Choose a concrete septic tank

You'll want to buy an unused septic tank for this root cellar design, but look for a deal to avoid paying full price. A percentage of all precast concrete septic tanks end up with small manufacturing defects that prohibit them from being used for sewage treatment. Suppliers sometimes offer discounts on these flawed tanks. As long as the tank is solid and sound, a chipped edge or a patchable hole won't prevent it from being a root cellar. You won't need the plastic fittings or effluent filter found inside most septic tanks, so ask the supplier to remove these before delivery.



Keep your root cellar dry with roofing membrane on top and a perforated drain pipe to direct water away from the base. OPPOSITE: Make this root cellar by burying a new concrete septic tank into a hillside.

Tank size is another detail you'll need to consider when planning how to build a root cellar from a septic tank. The capacity of septic tanks is measured in gallons, with different models being taller or shorter. While you might be tempted to buy a 1,000- or 1,200-gallon tank because they're common, you'll get more food storage space and headroom with a tank that's 1,500 gallons or larger. Standard 1,500-gallon tanks typically measure about 5½ feet wide by 5½ feet tall by 10 feet long, while a 2,500-gallon tank provides more than 6 feet of interior headroom. Don't choose a low-profile tank because it will be much too short to work in. Prices for new, undamaged 1,500-gallon tanks start at about \$1,100, and 2,500-gallon models can be found for as low as \$1,600. Discounts for damaged tanks may be as much as 50 percent.

Most septic tanks have an internal partition that must be opened or removed to

build from these root cellar plans. Try to find a tank without a partition, or ask your supplier to remove it before delivery. You can also punch through the partition yourself as part of the doorway-cutting process.

Best sites for root cellars

The perfect location for a root cellar is nestled into an existing soil bank in a well-drained location 10 to 20 yards from your house. Ideally, the door should face north to keep out the sun's heat. You'd be fortunate indeed to have all of these conditions, and most people have to modify their sites. Expect to pay from \$50 to \$100 per hour for a backhoe and operator to excavate your site for three or four hours.

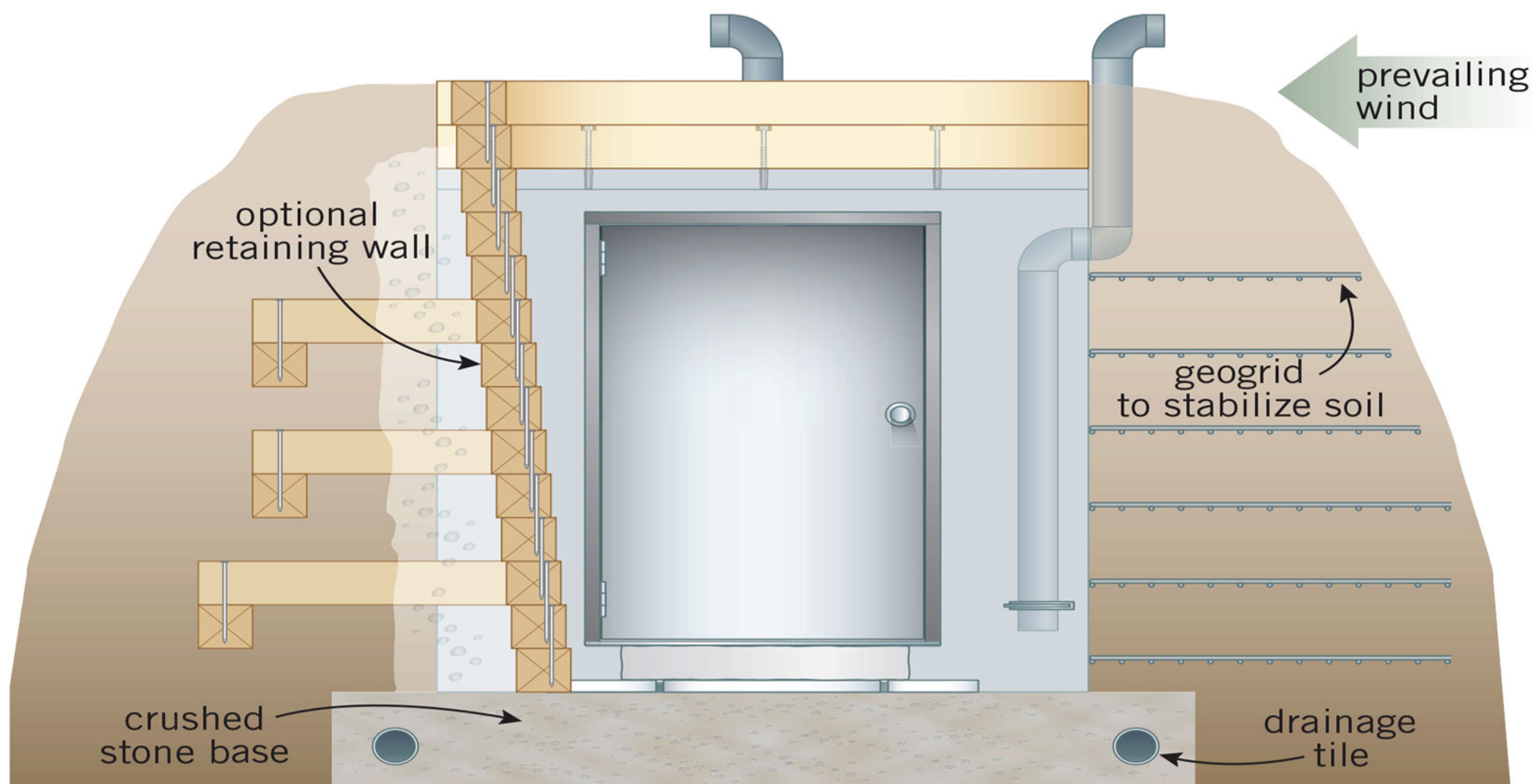
Spread a 1-foot-deep bed of ¾-inch-diameter crushed stone beneath the excavated tank site and the planned entryway to support foot and wheelbarrow traffic. Crushed stone is easy to move

around to make a level surface for your tank. Suppliers usually offer a delivery service using a boom truck to set down the tank wherever you want. Check the tank with a 48-inch level after the boom-truck driver has set it into place. If the tank isn't level, have the driver lift the tank so you can get a rake underneath to move the crushed stone. Keep setting, checking, adjusting and replacing the tank until it sits flat and level.

Install a door and vents

The tank should be in its final position before you cut the door opening, because removing concrete could weaken the tank enough to cause damage if it were moved again. Use a level and pencil to mark a rough opening on the end opposite the effluent pipe hole. Locate the bottom of the door 4 inches above the floor to keep dirt and rainwater out of the cellar.

A concrete-cutoff saw is the tool of



FRONT VIEW

Stabilize soil at the root cellar entrance with a timber retaining wall anchored by T-shaped tiebacks, or with horizontal bands of geogrid.



Building a root cellar, no matter the design, helps you preserve more food for your family.

choice for making a door opening (see “Cutting Concrete” on Page 87). Set up a large work platform a couple of feet lower than the tank’s top, don eye and ear protection, and recruit a second pair of hands to hold the masonry saw from above as

you move along the top horizontal cut line. Make the two vertical cuts next, then tackle the horizontal cut across the bottom. Leave a small amount of concrete uncut in the upper corners to hold the slab in place until you’re ready to bust it

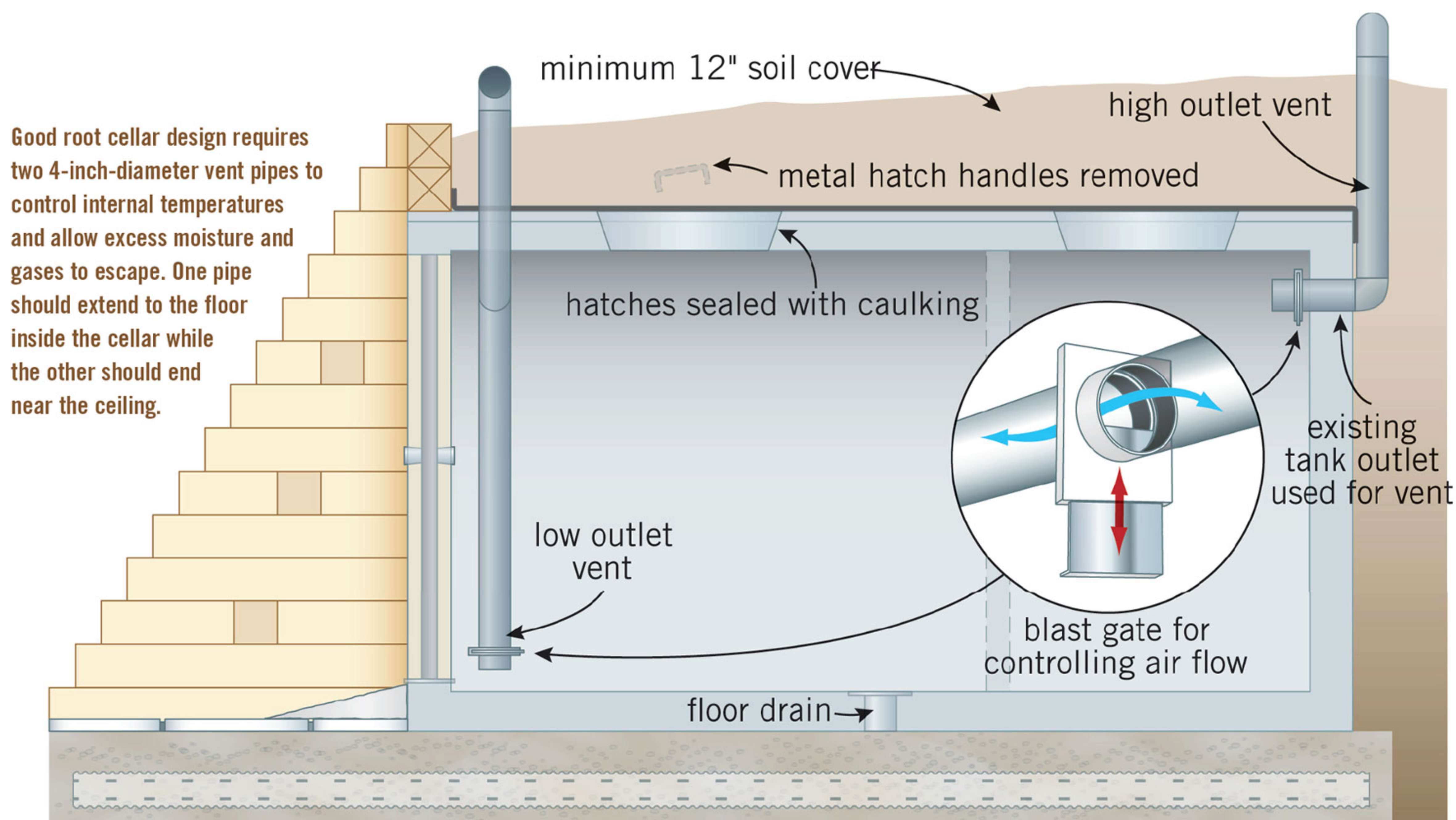
into the tank with a sledgehammer. Repeat this process to remove the inner partition if your tank still has one.

You can make your own root cellar door out of wood, but getting it to seal well will be difficult. Consider using an insulated steel residential door pre-hung in a frame. Exterior steel doors provide exceptional seals. Choose one without a window because darkness is essential for maximizing the storage life of produce.

Good root cellar design requires two 4-inch-diameter vent pipes to control internal temperatures and allow excess moisture and gases to escape. One pipe should extend to the floor inside the cellar while the other should end near the ceiling. This difference in height encourages air circulation. All septic tanks have a hole for a 4-inch pipe at one end, which will work for a ceiling vent, but you’ll need to bore a hole somewhere else for the longer vent that extends down to floor level – just inside the door is best. While you’re at it, bore a 4-inch drain hole in the floor so you’ll be able to hose out your root cellar.

Finish the roof and backfill

The tops of concrete septic tanks have access hatches that must be sealed. Apply



SIDE VIEW

a generous bead of polyurethane caulking around the perimeter of the hatch openings and close the hatches for the last time.

Next, use a hand-held grinder to cut off the hatches' protruding metal handles.

Now that the tank is flat on top, you'll need to apply a watertight barrier to prevent roof leaks. Use a heavy, self-adhering water-and-ice shield designed to be used as roofing underlay.

The best shields are thick and have a peel-and-stick adhesive backing – my favorite products include Blueskin self-adhesive water-and-ice barrier, and Grace water-and-ice shield. Apply two layers of shield that extend over the top in overlapping sheets and fold down the sides 4 inches lower than the joint where the tank's top and sides meet.

Because your tank will be tucked into the earth, you'll need a secure way to hold back the soil at the entryway. The illustrations show how to build a root cellar retaining wall using 6-by-6 timbers, with a lintel across the top to stop backfilled soil from falling down over the door.

Find instructions on building a timber retaining wall anchored by T-shaped tiebacks in the article, "How to Build a Retaining Wall With Crossies" (<http://bit.ly/1g8zI9U>).

Another option is to construct a retaining wall using interlocking concrete blocks. Retaining walls ensure the best cellar performance in cold climates because they maximize the amount of soil contact on both sides of the door, and soil's insulating factor is what stabilizes the temperature inside a root cellar and makes it suitable for storing vegetables.

If your climate doesn't experience severe winters, an easier alternative involves banking up the soil as steeply as possible on both sides of the doorway while leaving some of the front wall exposed.

Instead of building a tall retaining wall, you could install horizontal layers of geogrid (a polymer material used to reinforce soils) in the dirt as you backfill around the door, building as steep a slope as possible.

Haul in soil and spread it around the sides and top of your tank. Because backfilling by hand is hard work, you'll probably want to hire the backhoe and operator for several more hours. Sandy, light soil is best for backfilling because it reduces soil pressure on the sides and top of the tank, drains better, and is easier to shape and contour. Aim for a layer of 1 to 2 feet of soil on the roof.

Plant grass on the backfilled soil, build

CUTTING CONCRETE

These root cellar plans require you to cut through the walls of concrete septic tanks. To do so, you'll need to rent or borrow a gas-powered masonry cutoff saw spinning a 14-inch-diameter diamond wheel to make the door opening, and an electric rotary hammer with a 4-inch carbide coring bit to bore vent and drain holes. Be sure to use a saw that accepts a garden hose because water injection will tame the clouds of dust. The rotary hammer with coring bit needs no water. Septic tanks usually have reinforcing rods embedded in the concrete, so ask for a coring bit and masonry blade that can handle metal.

shelves and bins inside your cellar, load 'em up with your healthy, homegrown foods – and you're finished with these root cellar plans. Money can't buy the feeling of security and satisfaction you'll get from a winter's worth of good eating sheltered by your own root cellar. 🍷

Author Steve Maxwell co-authored *The Complete Root Cellar Book*, available at www.Grit.com/shopping.

Homemade Wind GENERATOR

Providing your own power
with a wind generator might not be
as complicated as you think.

By ROBERT D. COPELAND

Are you headed for the beach or going camping in the mountains? Maybe you live on a boat, often visit a remote cabin, or you're living off-grid. Electricity is yours for the taking as long as the wind is blowing and you can get it on the cheap with an easy homemade wind generator. Light up that storeroom or barn, or use the generator to keep all your vehicle batteries charged as well.

My off-grid cabin's electricity comes from solar and wind power, stored in 6-volt golf cart batteries. A charge controller and battery minder keeps my system from under- and over-charging. The whole shebang cost less than \$1,000, and I have lights, fans, television, stereo, refrigeration, and a disco ball for special occasions.

If you can turn a wrench and operate an electric drill, you can build this simple generator in two days: one day of chasing down parts and one day assembling the components.

The four basic components include a GM pickup truck alternator (\$40 new), a GM fan-clutch assembly (\$35 used), the bracket for mounting the generator on a tower or pole (\$25 galvanized pipe and fittings version), and a tower or pole (\$20 for 15 feet of 2-inch tubing, used).

If you're a Ford guy or a Mopar gal that's fine, just make sure the alternator has a built-in voltage regulator.

You'll also need some electric cable or wires to hook it up to your storage battery. I used 8-gauge, three-strand copper wire pilfered from the oil

patch. (And they said the transition from fossil fuels to renewables would take years. Pfft!)

My wind generator parts list

Car/Truck Alternator – GM 1988, 350 motor, alternator with built-in regulator (used in illustration). Almost any alternator with a regulator will work, but use a new one. It should have a warranty.

Car/Truck Fan Clutch Assembly – GM 1988, 350 motor – used.

Bracket assembly for mounting alternator/fan

If you have a welder, making a bracket is simple. I used 1-inch square tubing for all the bracket pieces and a 2-foot-long piece of 1-inch pipe for the rotating stem that fits inside the pole. If you don't have a welder, fear not. The Bracket Assembly can be fitted up with ½-inch galvanized pipe and fittings. Here's a list of the pipe fittings you'll need:

- ½" tee (5X)
- ½" elbow (2X)
- ½" x 12" nipple (2X)
- ½" x 6" nipple (2X)
- ½" x 1½" nipple (2X)
- ½" x 2" nipple (2X)
- ½" x Close (2X)

A tail fan to spin the generator around to line it up with the wind's direction must be attached to the 12-inch nipple at the back of the bracket. Cut a fan out of old tin siding or roofing with tin snips or a cutting torch. A right angle triangle shape works best. Drill three holes in the nipple.

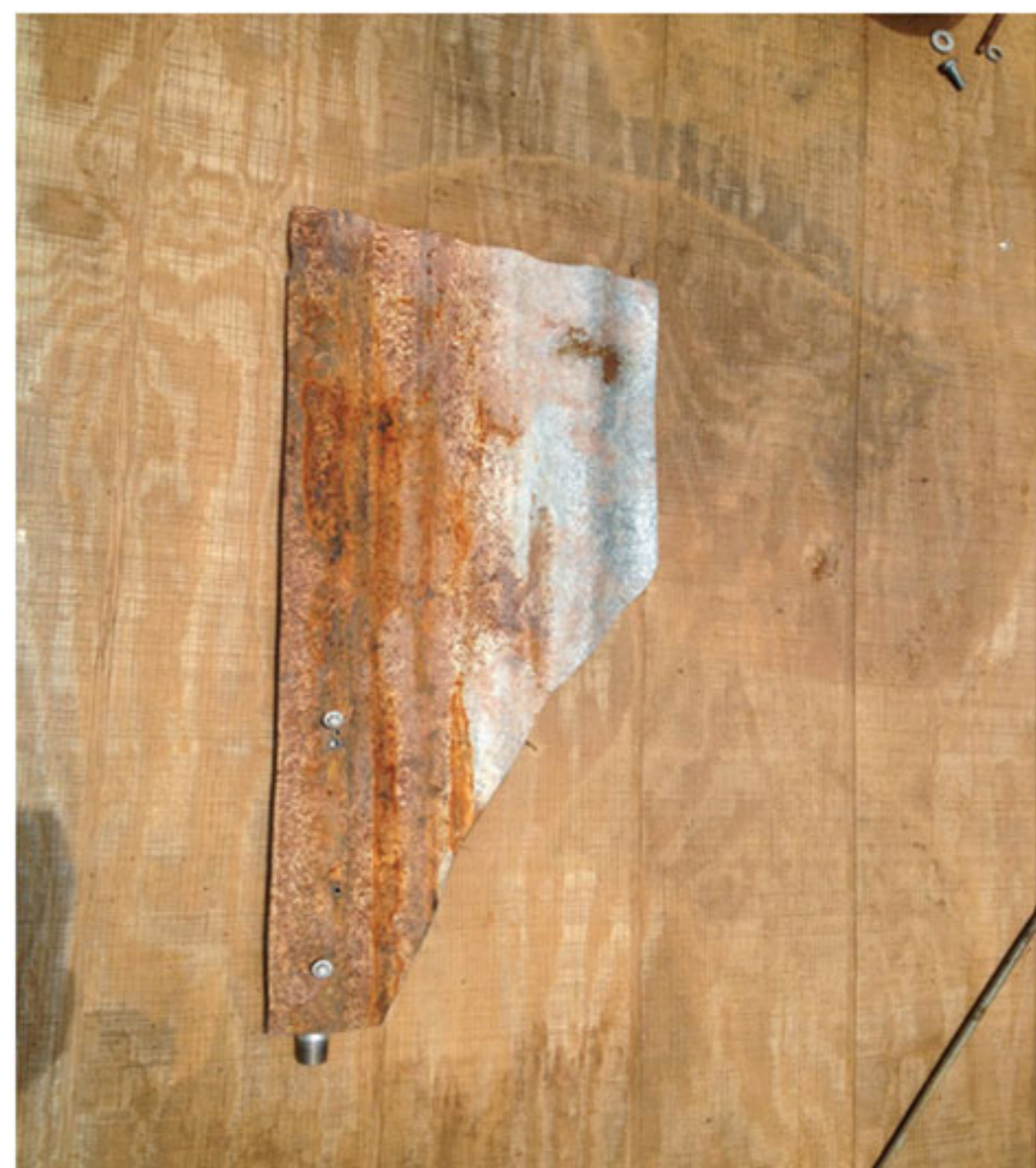


Use self-tapping screws (steel roofing screws work well) to affix the tail to the nipple. (See photos on Page 89.)

Tower/pole

I used an old TV television antenna tower 20-feet tall with a 2½-inch-diameter pipe top piece. You'll also need a stop at the top of the tower which lines up with the stop on your bracket assembly. This can be welded or bolted onto the tower. The stops will only allow the generator to turn 360 degrees clockwise and counterclockwise so your cable doesn't get twisted around and around the pole/tower.

A joint of 2⅜-inch oil field tubing anywhere from 10 to 20 feet in length (height) attached to a building or bolted to your truck bumper makes a good tower. Make sure it is secure, and you may need to use guy wires. If you aren't sure how to mount the genera-



CLOCKWISE FROM TOP LEFT: Use self-tapping screws to affix the tail to the nipple; a lock washer needs to be added for each bolt in the assembly for the alternator shaft; a car/truck fan clutch assembly is needed for the generator; along with a car/truck alternator; the completed wind generator; and a view of the assembly from the back, before the tail has been added. **OPPOSITE:** The completed wind generator in place on the tower.

tor, send me a message and I'll try to help (rdcopelandjr@yahoo.com).

Fan clutch to alternator attachment

The fan clutch hub can be welded directly to the alternator hub, just make certain the fan is perfectly straight and in line with the alternator shaft. Make sure the alternator's built-in wire plug ins are located on what will be the bottom of the generator. If you don't have access to a welder, create a union from the 3-inch washer and four bolts, which will fasten the two major components together. Drill four holes to match the holes in the fan clutch. Use a 1/4-inch tap to cut threads in the holes. Unscrew the alternator pulley nut, and remove the pulley and small fan. Slide the union over the alternator shaft – bolts pointing away from alternator – then reattach the alternator fan and nut onto the shaft (leave pulley off). The large nut will hold the union in place. Attach the fan clutch assembly to the bolts now protruding from the alternator. Tighten nuts with

lock washers in place.

You'll need:

- 3" washer, 3/16" thick, 5/8" hole.
- Electric drill
- 1/4" steel drill bit
- 1/4" thread tap
- 1/4" x 1 1/2" to 2 1/2" bolts (4) and lock washers (4)

(To determine length of bolts, stack the fan on top of the alternator with both shafts in line, fan pulley on alternator pulley. Measure the length along the two shafts from back of alternator fan to back fan clutch hub. Use this length for the bolts.)

Once you have all the generator components fastened together, mount it on your pole or tower. Insert the pipe on the generator inside the larger pole pipe (or the top of your tower). Use two steel washers together to create a bearing between the generator and tower for a smooth surface for the generator to pivot 360 degrees. Attach the positive and negative wires to the alternator and secure with zip ties, baling wire and/or duct tape on the

bracket and along the tower. It isn't really homemade unless it has a little baling wire and duct tape on it somewhere, now is it?!

You'll need assistance standing the tower and generator upright as it will be pretty heavy. Ropes and a come-along will help if you're going up fairly high. If it's always windy in your location, you only need to be high enough off the ground to keep the moving parts safely overhead. Securely fasten your tower in place. The wind can be deceptively strong so do not cut corners on this final assembly stage.

Now that you've erected the wind generator, connect the wires to your battery(ies) with a charge controller in between to prevent over-charge. Now you're ready to hit the lights, crank up the jams and bust out those old disco moves I know you've been saving up for an electric slide on the beach with your family and friends.

Build and use at your own risk. My generator works fine, but you are responsible for your work. Good luck and power up! 🎧



A Solar Cabin in Two Weeks for \$2,000

After finding himself without a home, LaMar Alexander moved onto inherited land and built a 400-square-foot cabin by himself.

By LAMAR ALEXANDER

I built my cabin about 15 years ago after a divorce and sudden illness left me homeless and broke. I had inherited a small piece of land

from my family's old homestead, and I set up camp on my property with an old camp trailer and truck. Working part-time while I cleared the land, I was able to save up \$2,000 and designed a 14-by-14-foot cabin that I felt I could build by myself.

With the full loft upstairs, it has almost 400 square feet of living space. The ceiling height in the main floor and loft is 7 feet, so an average adult can stand comfortably.

The cabin structure is made out of mostly new materials and the walls are 2-by-4-foot lumber, while the floor and roof are 2-by-6-foot lumber.

It has a tarpaper wind and water barrier and is fully insulated, with an insulation rating of R-13 in the walls and R-19 in the floor and roof. When possible I bought blemished boards and asked for a bulk discount from various suppliers.

To keep costs down, I used recycled, double-pane, low-e glass windows and steel-insulated doors that I salvaged from an abandoned house that was being demolished.

For cabin trim and a porch I used log supports and rough-cut lumber from our local lumber mill and recycled cedar fence boards for the cabin's interior trim.

After the cabin was built I salvaged all of the appliances and other items from my old camp trailer: sink, stove, fridge, lights, water pump, propane tanks, shower, and lots of wiring and plumbing. Because they are smaller they fit the cabin perfectly and so did not cost anything.

I had a small solar electric system for the camper, so that went in the cabin. As I had the money, I expanded it and then added a small 400-watt Air X wind turbine. My present system produces about 580 watts of solar energy and 400 watts of wind energy.

I heat and cook with propane on a small woodstove. I have plenty of power for my laptop, lights, TVs, electric fridge, freezer, and other miscellaneous gadgets.

I designed a solar composting toilet. The portable toilet is emptied into the solar composter once a week and does not require any compost pile; it evaporates off the liquid and the extra heat helps break down the compost very quickly.

I direct greywater from the shower to a French drain where it keeps the grass and shrubs watered. I capture sink water and send it to the solar composter tank or use it on fruit trees and shrubs.

I hand-drilled an agriculture well and I am half-owner of a 300-foot free-flowing well on my brother's property. I refill a 25-gallon RV-style water tank under the sink from a hose and the entire cabin is set up much like a self-contained RV.

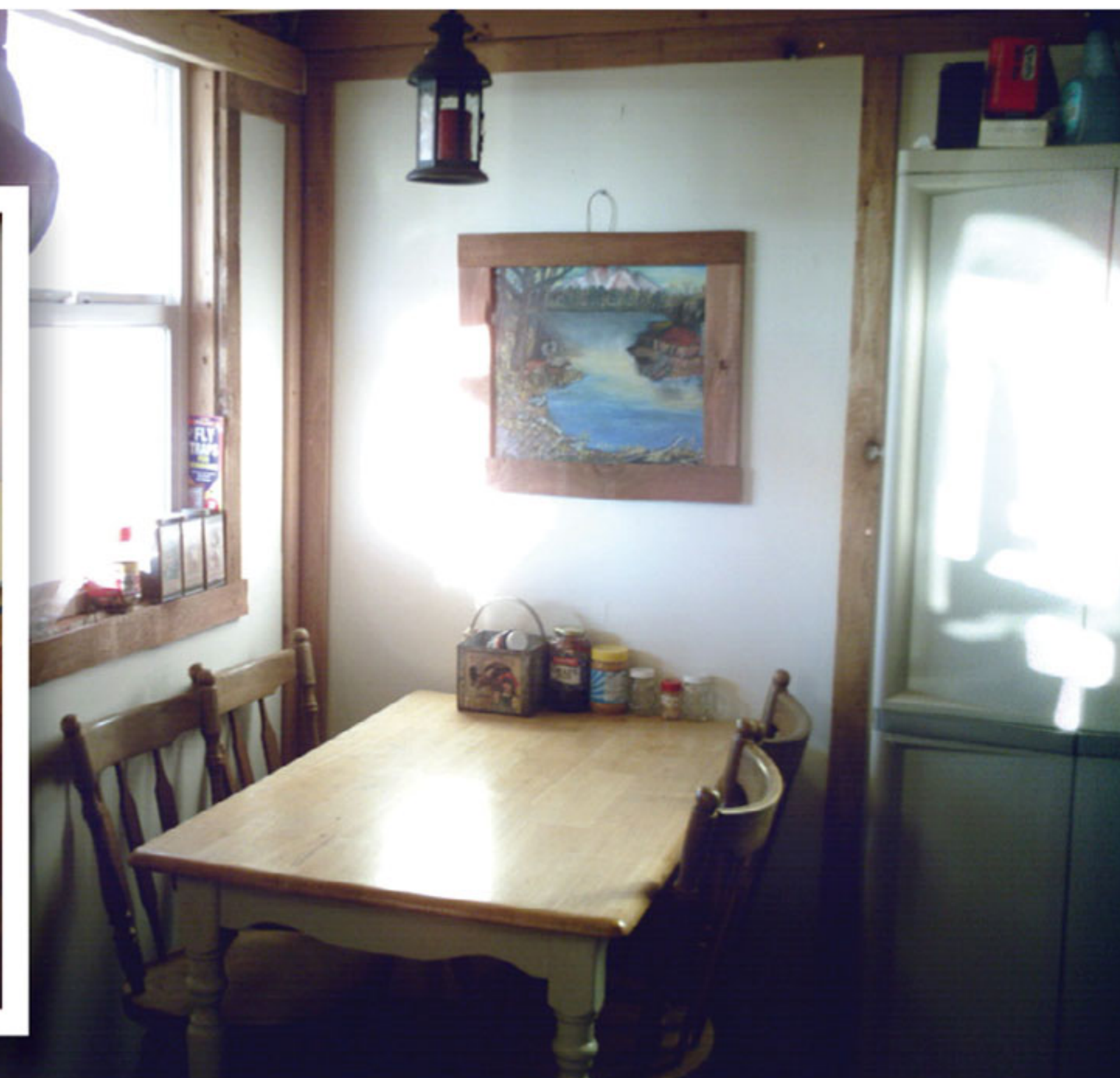
It took me two weeks to build the cabin structure by myself and the cost was just under \$2,000, not counting recycled materials or the solar and wind power system.

I have no house payments and no monthly utility bills, and I grow a garden, raise rabbits and chickens, and enjoy my outdoor hobbies.

Having no bills allowed me to start a small local business and an online business that are thriving, and I have been able to help my son, become sustainable and save for my retirement.

To help others who are looking for simple living and homesteading ideas, I set up a website to share my adventures and missteps at Simple Solar Homesteading (www.SimpleSolarHomesteading.com).

For other Debt-Free Home Reports, visit the online article at <http://bit.ly/19nWyYr>. 🐼



Alexander captures water from the sink to use in the composter or to water trees. The dining room is in one corner of the 400-square-foot cabin.



The trough surrounding the water pump creates the perfect place to water houseplants.



The garden is easy to access from the back door. OPPOSITE: Three views of the cabin as the building progressed.

The Burning RING OF FIRE

Create your outdoor cooking feature, and make it the focal point of all your backyard gatherings.

By PAUL GARDENER



Simple log-and-plank benches give this stone fire pit a nice look.

Maybe it appeals to your primal instinct, or you simply enjoy being outdoors. Maybe it's even that you get better results for a variety of reasons, plus cleanup is easy. Whatever the case may be, everyone seems to love cooking outdoors. It seldom gets any better than firing up the grill and tossing on a couple of quality burgers or steaks

and maybe roasting up some fresh veggies from the garden. Whatever your culinary passion, savory smoke and fresh air just seem to make food taste better. Many of us dream of adding to the tradition of charcoal or gas grill on the back patio, and taking it a step further by building an outdoor space – where family and friends can gather, laugh, cook, eat and share. It may be as simple as a

sturdy backyard fire pit for cooking hot-dogs and s'mores and for warming the gathered bodies on cool fall evenings. Or you might be looking for the full accompaniment of grill, fireplace or pizza oven and outdoor dining area. Luckily you're only limited by your imagination and willingness to do a little research and hard work.

Location, location

Any of these projects can be built to just about any size and shape desired, and out of any sturdy fireproof materials. That's the easy part. Deciding which to use and where to place it may be more difficult. From my experience of moving a fire pit because it just wasn't working where it was, I learned that the first and foremost thing to do in getting started, with any of these projects, is to determine where you'd like to locate it on your property.

Most cities have ordinances regarding minimum setbacks from yours and your neighbors' homes and structures, so make sure to talk to your local ordinance officer or fire department before digging in. You also may be required to submit a diagram for approval before building.

It helps my wife and I to do a little brainstorming whenever we try to determine where we want to locate a new structure or feature item in our yard, considering all the ways we intend to use our property in the future. Do you want a getaway fire pit that's away from the house and, figuratively, away from all concerns of the world, or are you look-

ing for a social gathering place right off the main entertaining area? Is your space limited, or do you have young children who still want to be able to kick a soccer ball around the yard? Perhaps you need the pit offset, or covered so as to make as much yard available as possible.

Walk the property and imagine you're entertaining friends and family. Now try to imagine the flow around your proposed installation. It also helps when you try to imagine any future structures you may have in mind, such as a pergola or a deck. You may not plan for them in the next few years, but if they are an option, keep them in mind at least.

As I mentioned earlier, these projects can be built from nearly any fireproof material. From stone to clay to steel or brick, the options for materials that can be used to build your outdoor fire pit, fireplace or oven are never-ending. Most commonly you will find rings made of steel, rock or prefabricated concrete pavers of some sort, but that doesn't mean you can't get creative. Maybe you have access to recycled concrete or urbanite (broken pieces of unwanted concrete) from a driveway that was torn out, which makes perfect building material. Another quick fire pit can be made from the cutoffs from large 2- to 3-foot-diameter concrete piping, and construction companies are usually very generous with this waste material.

Recycled bricks can also be used to create a beautiful rustic fireplace that will stun everyone. Depending on where you live, you may even be able to use your own soil – if it's heavy enough with clay – to build a durable and functional clay oven. The point is, thinking a little outside the box can not only save you a few dollars, it can help you create a functional and unique outdoor focal point.

Design and build

While you're designing your outdoor fire-feature, think of how you want to be able to use it. If cooking is going to be a consideration, and really it should be, then this is a good time to plan out how you will want to do that. As with campfires, there are a number of simple solutions available that can be placed over



If it's going to last, going all out for an outdoor fireplace is a worthwhile investment.



A well-fabricated fireplace and rustic chairs combine to make the perfect focal point in the rural backyard. Using brick adds a nice touch.

a pit to allow for grilling or cooking. Some are removable, others permanent and adjustable, but all should meet the requirements that you most commonly will be using them for.

I always like to look into a recycled,

reused or homemade option when I am planning a project like this. Frequently you can find used barbecues at thrift stores or in community bulletin boards online that come with perfectly serviceable cooking grates. With some simple



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modifications, these can make for perfect removable cook surfaces for a number of outdoor cooking applications. A simple tripod constructed of ½-inch rebar could easily be used to suspend a grill or cast-iron pot for instance, transforming your fire pit into a vintage “western” cowboy cookery.

If a fireplace is the option that you’ve chosen to go with, there are designs and products available that allow you to insert a grill for use in cooking that can be removed afterward to allow the fireplace to be used purely for ambience and enjoyment. You may even want to design your fireplace to be used more as a stone, brick or even clay oven for cooking pizza, breads or overnight slow cooking of meats or beans. Because these methods and materials have been in use for thousands of years, there is a wealth of information available for many methods of constructing them. (Turn to Page 62 to find our article for an outdoor bread/pizza oven plans.)

Probably the single most popular feature of this sort is the fire pit or outdoor fireplace. These serve as a focal point of any backyard get-together and can easily be taken to the next level and become an enjoyable addition to an outdoor cooking area.

Creating one can be as simple as repurposing an old cast-iron manhole frame (I’ve done this, and it works wonderfully) or as elaborate as a masonry or slate pit with intricate designs; the details are limited only by your creativity.

After determining what material you will use, you’ll naturally be guided to the correct way to begin your installation. Simple ring-over-earth fire pits like my manhole frame require little more than ensuring the ground is level and the site is a safe distance away from flammable objects. No special treatment is required of the ground beneath the fire area; it will essentially just become a permanent campfire of sorts and will require only the occasional shoveling out as ash begins to pile up.

On the other hand, a brick, rock or paver type construction – because it is built from many pieces – requires a somewhat more intense approach to en-



Simple tripod fabrication transforms a nice campfire into an outdoor kitchen.

A below-ground fire pit is ideal for slow cooking in cast-iron Dutch ovens.

sure that it is built on stable ground so it will last for many years to come.

Much like laying pavers, you will want to trench out a ditch and line it with a course drainage grade rock. In this case, dig to approximately 12 inches deep and the width of your pavers or bricks, and then fill the bottom of the ditch with a good 6 inches of rock. This allows for drainage around the stone base, preventing settling in rainy areas or winter heav-

ing in cold climates, as well as giving you a stable base to build the first layer of bricks on below-ground level. This will help to maintain the form and shape of the pit or fireplace as you continue to build. You could also choose to pour a cement base rather than laying your first course of stone below ground level. This is generally a good guideline for starting most outdoor hardscape construction, but more detailed instructions can be



Even sturdier, welded platforms and grates turn out excellent food and atmosphere.

found at your local hardware store or online – it all completely depends on your budget and skill.

What if you don't have room for a large feature in your yard space, or you simply don't want to dedicate the space you do have to something permanent, but you do want to take advantage of cooking outdoors or enjoying a fire with friends and family on occasion? There are always a number of portable fire pit options available for fairly reasonable prices. While they do easily solve the problem, all of the ones that I have come across are either lacking in size, durability or cooking features. That said, there's no reason you couldn't build a temporary fire pit or outdoor cook area that could easily be stored until needed.

Bricks can make great small, open fireplaces or fire pit rings by simply stacking them in a safe area. Even old 55-gallon drums can be cut down to 12 to 15 inches high, layered with brick or rock on the bottom, and used as temporary fire pits, and standard circular barbecue grills can easily be placed over the top to cook on. By elevating the ring on double bricks placed on three or four sides, you can even use it over your lawn with little if any damage to the grass.

Watering the area below is a good idea as well to keep the ground from overheating. I've even seen old wheelbarrows used as fire pits by placing a layer of bricks across the bottom (not recommended unless fixed to prevent tipping). Talk about multi-use!

So as you can see, there are numerous ways to go with an outdoor fire feature: large or small, permanent or temporary, and limited only by your desire and creativity. Whichever way you choose to go – fire pit or fireplace, granite or urbanite – as long as you take the time to plan thoroughly and you think about the ways you want to use the feature, and then build appropriately for the materials being used, you are sure to enjoy your outdoor cooking area for many years to come. 🔥



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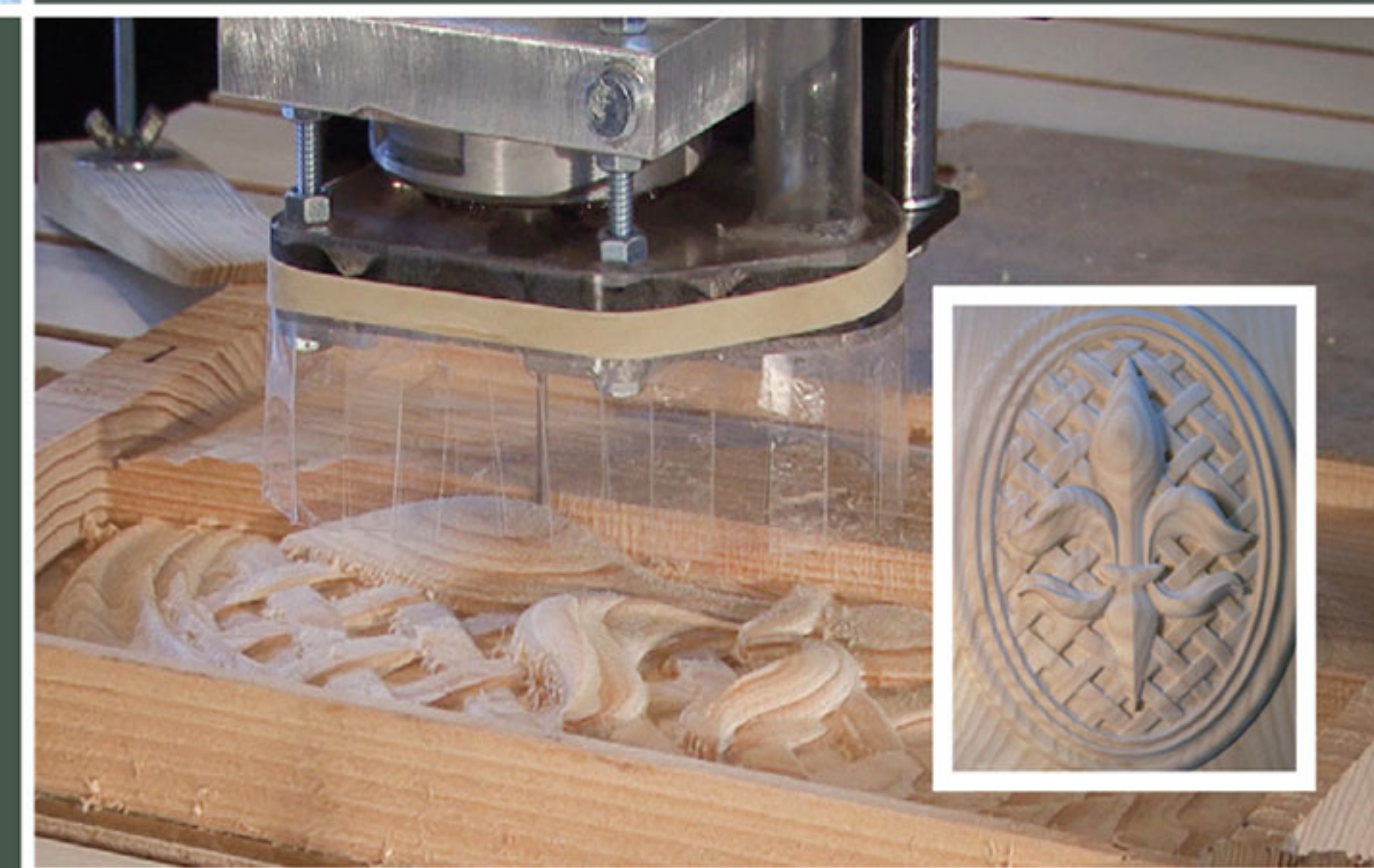
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