



BUILD YOUR OWN **Beekeeping** **EQUIPMENT**

How to Construct:

8- & 10-Frame Hives
Top Bar, Nuc & Demo Hives
Feeders, Swarm Catchers
& More

TONY PISANO

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BUILD YOUR OWN
Beekeeping
EQUIPMENT

Tony Pisano



Storey Publishing

I dedicate this book to my wonderful wife, Leila, a creative and kindred spirit who loves to make things with her own hands.

To my son, Joshua, who spent many hot summer days helping put up electric fences, chasing bears away, and lifting equipment as we checked the hives, and who hand-cranked literally hundreds and hundreds of pounds of honey through the extractor before we put a motor on it.

To my daughter, Mackenzie, my biggest cheerleader, who has always had faith in my abilities and has encouraged me all the way, even though she is terribly afraid of bees.

Finally, to all people young and old who want to feel a direct connection to the land and the joy of making something with their own two hands.

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Preface

Beekeeping is a fascinating adventure, whether you have one hive in the backyard to help pollinate your garden and supply a little honey to family and friends, or enough hives to produce honey for sale at your local farmers' market or co-op.

When I decided to get honey bees after a season of observing and helping my friend Paul Dugal, I jumped right in with both feet and really wanted to be immersed in the process. I ordered five packages of bees from Betterbee, in Greenwich, New York. I cut, ground, and filed an old lawnmower blade into a hooked hive tool. I scavenged the local landfill for cans to build a homemade smoker, and I built two complete hives plus most of the parts for the other three, minus the frames.

Bear in mind that everything didn't come out perfect. My boxes were a little too wide and the bees attached some extra comb to the sides. The spring I used for the smoker bellows was a little weak, and the nozzle was made from copper pipe fittings, so it didn't puff out clouds of smoke like the fancy store-bought models.

That didn't matter. What mattered was that I made them with my own hands, and they worked. At the end of the season, which, as beginner's luck would have it, was a banner year, I extracted 400 pounds of honey from those five hives! I will never forget it.

Why should you build your own beekeeping equipment? The sheer pleasure of doing it yourself is reason enough. Continuing the tradition of people working with their hands and solving their own problems is another good one. By the time you are finished, you will have a much better understanding of the parts that make up a hive, how they are constructed, and how they all work together as a unit. You can find and use sources of scrap wood that

will save you money and keep stuff out of the landfill. I guess a harder question to answer would be: Why not?

Most of the projects presented here have detailed step-by-step instructions to ensure your success on the first try. I've done my best to get things right by building each item in the shop, taking down notes and making sketches, writing up a plan, then going back into the workshop and using these instructions to build it again and tweak if needed. The projects are all centered on the table saw as the main power tool. I will assume that you have the basic skills needed to operate one, or know someone who does. (The saw operations in this book are very standard and straightforward, so if you need to ask a friend or neighbor with a saw to make some cuts, you won't owe him or her too much beer . . . or honey.) With this and a small variety of other tools, you can build every project shown here. And if you don't have access to a table saw, you can substitute with portable saws and a router.

The chapters are arranged somewhat in order from the bottom of the hive up to the outer cover. There is a separate section on building 8-frame hives. Go in order from beginning to end or jump around; the choice is yours. You can browse the book and start with the simplest projects first, like a hive spacer or entrance reducer, and work your way through the harder ones as you gain confidence and skills. None of the projects are all that hard, and once you learn to make the basic cuts you'll feel like a pro.

This book is not meant to be the last word on building beekeeping equipment. If it were, then I would have failed miserably. What it *will* do is show you how to build entire 8-frame and 10-frame hives (in traditional Langstroth style) that will be ready for frames and bees, as well as a top bar hive (if you want to keep things basic), and many other projects that make beekeeping easier. Hopefully the book also will spark your own imagination and creativity. By all means, use it as a reference and a starting

point. Make changes and improvements to the projects in these pages, and share them with others. Come up with totally new ideas. That's how we make progress.

Whatever you do, don't just sit on the couch and read through these pages. I want you to anticipate the smell of fresh-cut pine, the sound of a hammer driving home a nail, and the sight of a beehive as it materializes right before your eyes in your own shop. Lay the book on your workbench, crease the pages, and get them dirty. Put on your safety glasses and measure and mark. Flip a switch and listen to your table saw sing. You will be all the happier for it, and so will your bees.

CHAPTER ONE

Before We Begin

Being prepared is important for building a successful project. This means having a safe work area, using safe methods and the proper tools, and having the materials you need on hand. If you read more than once that safety is first and foremost, it's because it can't be stressed enough. This chapter is a rundown of all the tools and materials used for the projects that follow. The project instructions are written for those with a basic level of knowledge about working with wood. If your experience is less than basic, so to speak, see Getting Help on **page 13** for some ideas on places to start.

Safety First and Always

The one thing that should constantly be on your mind while doing any of these projects is *safety*. I could devote this entire book to the safe use of power tools and equipment, but that would leave no room for projects. Here are some tips:

- Know your machinery; read and reread the owner's manuals.
- Use all tool guards and safety devices. Some pictures in the book show tools with guards removed for clarity. In these cases, the tools were turned off and unplugged, and the photo was set up to show a particular step. Always use the guards that came with your machinery.
- Wear ear, eye, and dust protection or a respirator. Many people protect their eyes, but not their ears. Constant, loud, high-pitched noise can damage your hearing. Anything can cause injury, from a flying nail sent your way by a glancing hammer blow to a piece of wood caught by a bound-up saw blade. Cutting pressure-treated and other woods can produce harmful dust. Protect your

lungs from sawdust, fumes, and other hazards by using an appropriate dust mask or respirator.

- Wear gloves as appropriate. You should always wear gloves when cutting screen and sheet metal. As a general rule, you should *not* wear gloves when operating power tools. A drill bit or other rotating part can easily snag a cuff or fingertip of a glove and pull your hand into the moving parts.
- Don't wear jewelry or loose clothing.
- Keep your work area clean.
- Don't work when you are tired or distracted. You shouldn't be thinking about your upcoming vacation or what you need to add to your grocery list while you're pushing a board through a saw that's spinning at 3,500 rpm.

The Tools

I've tried to minimize the number of tools and techniques needed for these projects. If you have tools other than the ones listed, by all means use them. Whatever makes the work go easier and faster is fair game. For example, I usually use a shaper to cut rabbets on the ends of my boxes and for frame rests, but here I used the single blade on a table saw to be sure that it could be done with the simplest of setups. I also kept my dado blades packed away in the drawer. What follows is the mainstay of what I used to make everything.

Measuring and Marking

After planning your project, the next steps usually are measuring and marking the stock to be cut. This critical step must be done accurately. After all, the straightest saw cut on a line that's marked in the wrong place will not make for good work. As always, high-quality tools are a pleasure to use and will last for generations. Take your time and start off on the right foot, and your project will go smoothly.

Tape measure. I use a tape measure for quickly checking if a board is long or wide enough to use, or to measure for a rough cut. Other than that, it sits on the bench most of the time, and I use a scale instead.

Scale or ruler. For most measuring I use a 24" rigid aluminum scale. It has accurate markings and is my go-to tool when setting the fence on my saw or measuring something to cut. It's long enough to measure any piece of wood for beehive building and I wouldn't be without it.

Combination square. Though not essential, this is helpful for setting stops and saw blade heights. It also provides a quick way to draw a measured line down the side of a board for a nail or screw guide. A square with a protractor head lets you measure and mark angles as well.

Compass. This is great for drawing circles when laying out slots, but you can often find something the right size to trace around for a circle, and none of the round cuts we will make are critical.

Prick or center punch. This is used mostly for marking metal to keep the drill bit from wandering when you start a hole, such as

with the extending pole for the swarm catcher or some of the sheet metal parts.

Dial calipers. I use calipers for measuring something with a close tolerance, like checking the size of unmarked drill bits. I also used them for measuring the spacer and frame guides for the frame assembly fixture.

Pencil and marker. I prefer mechanical pencils because you can renew the point with a simple twist of the barrel. A marker is handy for marking screen.

Plan for Slips and Mishaps

Back in the early '70s, when I entered vocational school, our machine shop teacher gave us this advice: "Don't fear your machines; learn to respect them."

What he meant by this was, intimately learn how your tools operate. Get to know their dangers and also learn their limits. Don't try to make a tool perform something it's not made to do. And keep your tools sharp. A sharp tool is less likely to slip or jam.

Whenever I'm working with a tool even as simple as a screwdriver or chisel, I think, "Where are my hands in relation to the business end of this tool, and is there any chance my hands and the tool might meet?" If the answer is "yes," then I'm doing something wrong that needs to change immediately. The day will come when a chisel or screwdriver *will* slip or a drill bit will snap.

Always be alert. The best advice I can give you is: If anything you are doing, or are about to do, doesn't feel safe, chances are it isn't.

Cutting and Shaping

Cutting tools have come a long way. Carbide cutting edges on saw blades and router bits hold their edges many times longer than high-speed tool steel. Even today's handsaws have blade configurations that allow them to cut much faster than their older counterparts. No matter how advanced tools get with computerized controls, the old standbys still get the job done.

Handsaw. A good standard handsaw comes in handy for rough-cutting long boards for easy handling when you don't want to bother dragging out a circular saw and extension cord.

Keyhole saw. A keyhole saw has a long, narrow blade that tapers to a point. I use mine to cut out the slot in my inner covers.

Hacksaw. Hacksaws are used primarily to cut metal, but a new blade will give a really smooth cut in wood. I find myself using it for things like cutting the small stops for the foundation board or the angles on strips for bee escapes. Of course, a coping saw or fretsaw will also work for small wood parts.

Miter box. The miter box has been around for a long time. It's a hand-powered version of the miter saw. You set a backsaw (a small handsaw with a rectangular blade that has a stiff spine to keep the blade rigid) in the box and can accurately cut boards square or at

angles easily by hand. Simple miter boxes have fixed slots to guide the blade for 90-degree and 45-degree cuts, while adjustable miter boxes can cut a full range of angles. A miter box is great for parts like the risers on hive stands or the angled strips on the bee escape boards found in this book.

Tin snips. Snips are necessary for cutting sheet metal for hive tops and feeders, and to cut screen for various projects.

File. A *mill-bastard* file is a good general-purpose file for deburring metal after you cut it. A *wood rasp* can be used to round over the corners of boxes and covers.

Sandpaper. I don't mention sanding often in the instructions, but a quick once-over with a piece of 100-grit paper will quickly smooth edges and prevent splinters in your fingers.

Fastening

Most of the advances in fastening have been made in the categories of screws and adhesives. If you've ever driven a number of slotted screws with a standard screwdriver, you know why the word "frustration" is in the dictionary. Today's modern deck screws are corrosion-resistant, need no pilot hole (in many cases), have self-countersinking heads, and can be driven with one hand, using a power drill or driver. There also are a number of waterproof glues at our disposal.

Of course, the hammer and nail will never go out of style, and clamps allow us to perform tasks that would require many extra hands.

Hammer. A well-made hammer will last a lifetime and is less fatiguing to use than a budget tool since it absorbs shock more effectively. I have more than one size and select the one that's appropriate for the job.

Work tip: I once won the frame-nailing contest at the Massachusetts State Beekeepers Field Day. I chose the hammer with the smallest head because I knew it would be easier to use for starting small nails but was still heavy enough to drive them home quickly.

Screwdrivers. Not much to say here. Screwdrivers that fit the screw you are driving are essential. I use my cordless driver almost exclusively, with the exception of installing hinges and other small hardware. Many of the different screws available come with a bit to fit the screw heads right in the box.

Staple gun. I use this with an assortment of staple lengths for attaching the screen on screened bottom boards and inner covers, as well as for installing mouse guards on hives.

Clamps. Clamps have so many uses. I primarily use *bar* and *pipe clamps* for clamping pretty much everything that needs to be glued and screwed together. A 24" clamp should cover the biggest projects. Some smaller ones are handy for clamping across 8-frame and nuc boxes. *Spring clamps* have an endless variety of uses, such as clamping temporary stops. Clamps can hold pieces to the bench so you can safely drill or cut them. You'll find dozens of

other uses not listed here. *C-clamps* are also very strong, and I'm sure you'll find uses for them.

Drilling

Right off the bat I'll say, get yourself a variety of good drill bits. This is one area where the saying "you get what you pay for" really rings true. A good-quality cutter will stay on-center, drill a clean and accurate hole, not overheat under normal circumstances, and stay sharp for a long time. No matter how shiny and nice it may look, a cheap cutter will not be accurate or hold an edge and may even bend or break on first use. Buy good brand names. Besides your local lumberyard or home center, see if there is an industrial supply store in your area. They will have good-quality tools and a full range of bit sizes you may not find in the hardware store.

A set of drill bits. Different bits are useful for so many things. Good-quality brad-point bits are the ticket for wood. They won't walk when you start them, and they cut a clean hole. They also drill through aluminum flashing easily.

Forstner bits. Forstner bits cut around the perimeter of the hole first so they don't leave a ragged hole, due to tearout, when they break through the material. They can also be used to make two or more holes close together for roughing out slots.

Hole saws. Hole saws are used for larger-diameter holes, such as for making escape boards. They typically are used for rough work and can create significant tearout on the back side of the material, but you can prevent this by drilling partway through the material from one side, then completing the cut from the other side. The

hole made by the guide bit in the hole saw's center ensures the two cuts are aligned.

Spade bit. Like Forstner bits, spade bits are used for fairly large-diameter holes (over 1/2" or so) but aren't quite as clean-cutting. You have to watch for tearout with these; for a clean cut, drill from both sides of the material, as with a hole saw.

Work tip: The guide bits or points on Forstner bits, hole saws, and spade bits are there to keep the rest of the bit in place while it works against the material. You can start these bits in solid wood or small pilot holes, but if you try to start it in an existing hole that is larger in diameter than the guide bit or point, the drill bit (or hole saw) won't stay centered and will walk all over the place.

Center drill. A center drill is a metalworking bit used to create a guide hole for drilling through metal. First, punch the location of the hole, using a center punch, then drill a guide hole with the center drill. This ensures that the larger drill bit you'll use to make the final hole starts in the right location and, more importantly, that the hole comes out round.

Combination drill/countersink bit. You can buy these individually or in small sets of three sizes. They are great because they drill a pilot hole so that your screw won't split the wood, and they also countersink the hole for accepting the screw head, so the head finishes flush with or slightly recessed below the wood surface.

Depending on the type of screws you buy, you may not need to predrill the holes, but it helps.

Getting Help

If you're new to building projects and basic woodworking, take advantage of any expert advice you can find. Here are a few sources that have helped me:

- **Find a mentor**, if possible, who will show you the ropes and work with you on some projects. When I got started, I took a night course in woodworking at our local trade school. Before that, I didn't know that a 1×4 doesn't actually measure 1" by 4" (see *Lumber Dimensions*, **page 15**). If you belong to a beekeeping club, this book is a great opportunity to get together and build some equipment, and to share tools, resources, and ideas.
- **Read a good book** on power tools and woodworking. While a book won't replace a good mentor or hands-on experience, I can assure you that many of the skills I've learned came from reading a book about how to do something and then just going out and doing it. A couple of good ones that come to mind are *Woodworking Tools and Techniques: An Introduction to Basic Woodworking*, by Chris Marshall, and *Woodworking FAQ*, by Spike Carlsen (see Resources).
- **Support your local lumberyard.** I find that the quality of wood sold by many large chain stores usually doesn't compare to that of a smaller independent dealer. I still live in an area of fairly small towns and I'm lucky enough to have two family-owned lumberyards within five miles of my house.

Local dealers will get to know you and can answer your questions and give good advice. Become their patron and friend. If you take care of them, they'll take care of you (and you'll help them stay in business!).

Power Tools

Now on to the bigger stuff. Again, I didn't use a lot of different power tools, but those listed here are pretty much required to build your hives. Also keep in mind that often there are easier ways of performing many of the operations covered in this book. I'm showing the basic way you can do things using the simplest of tools.

I actually made just about every cut in the book using the single blade on my table saw. Normally I'd use my shaper if I were going to cut a lot of rabbets, but not everyone has one of those, or even a router table, for that matter. If you do, by all means use them and make your work as easy as possible.

Table saw. This is the workhorse of the group. A good saw with a cast-iron table is hard to beat. I have a Craftsman 10" saw that I bought secondhand in the mid-1970s, and it's still going strong. Mine is mounted on a heavy wooden table and has an induction motor with belt drive. It's not a Cadillac, but it gets the job done. I would avoid buying a new saw with light plastic housings and direct-drive motors, if possible. They are much noisier and vibrate more than heavier-duty saws, and often they don't have the capacity needed to cut larger pieces safely. If money is a big concern, shop for a better saw secondhand.

Drill and driver. While a drill press would be handy for many of the drilling operations in the book, I stuck to using a hand drill to be sure everything could be done that way. I did go cordless, though.

It's most handy to have a drill for drilling pilot holes (and other holes) and a driver for driving screws, so you don't have to keep changing bits between operations. But if you have only one tool, all drills and most drivers can be used for both drilling and driving. You can buy drill bit sets with hex shanks for use in impact drivers. One advantage to these is that it takes about 2 seconds to change bits, and there's no chuck key or loosening and tightening of drill chucks to deal with.

Work tip: I had never even considered a cordless drill until my son, Josh, showed up to work one day with a Makita cordless set that included a drill with a variable clutch and an impact driver, which has a hammer-like action for driving tough screws. After using them, I was convinced and bought a set myself. Today's models have a lot more power than earlier versions, and the batteries last longer between charges and also charge much faster. They're probably the most-used tools I own. I even used the impact driver to push the 2 1/2" hole saw through the plywood on the escape boards.

Miter saw. A powered miter saw is a real workhorse in the shop. When set up with an adjustable stop, it can't be beat for cutting multiple parts to length or for cutting accurate angles.

Circular saw. I occasionally use one for cutting plywood into more manageable sizes, or right to size with a guide board clamped to it. With a good guide, the circular saw can manage many of the cutting tasks generally relegated to the table saw.

Jigsaw. You'll use this for cutting holes, in place of hole saws or larger Forstner bits, and also for making slots.

Router. A router can cut rabbets and dadoes that you might otherwise cut on a table saw, and it can round over edges for a professional look. I used mine for making the winter cover and demonstration hive.

Electric brad nailer. While also not a necessity, a brad nailer sure is handy for attaching things like slats on the slatted racks, filler pieces on bottom boards, and wedges when assembling frames. I have an Arrow brand nailer that I love. It takes about 10 seconds to switch nail sizes. Be sure to wear eye and ear protection while using this tool. An assortment of wire nails and a hammer will also serve the purpose, so don't run right out and buy a nailer if you won't have other uses for it.

Extension cords. Always use extension cords that are heavy enough to carry the load you will put on them. This is indicated by the cord's amperage rating, which should be marked, and your power tools have nameplates that specify how much amperage they draw. If you are working outside, be sure to plug the cord into a GFCI (ground-fault circuit interrupter) outlet or use a GFCI-protected cord to reduce the risk of shock due to moisture and other fault situations.

Materials

Honey bees can and have been kept in almost anything imaginable, from clay pots to straw skeps and hollow logs (*bee gums*). However, in the United States, bees must be kept in a hive with removable frames so they can be inspected for disease. You can use all kinds of materials to build your bee equipment, from rough-sawn lumber to milled wood from the lumberyard, leftovers from a construction site, or a barrel cut in half and used for a top bar hive. There are even hives made out of Styrofoam.

For the projects in the book, I stuck with standard materials you can pick up at any well-stocked lumberyard. If you want to substitute with salvaged materials or extra supplies you have lying around, great. I do it all the time.

Wood

Almost every project in this book was made with pine, readily available at your local lumberyard, with a good amount of scrap wood salvaged from various places. Cedar, though more expensive, is a good choice for its natural resistance to rot.

Lumber Dimensions

If you're new to woodworking, it's important to know that usually there's a difference between the *nominal* size of a solid-lumber board (what it's called) and the *actual* size (what it actually measures to). The nominal comes from the board's original rough-sawn size, while the smooth milled piece you buy often is smaller. For example, the actual dimensions of a 1x3 are about $3/4"$ x $2\frac{1}{2}"$.

The actual size of a 2×4 is about 1½" × 3½". Most of the lumber in this book is "1-by," or about ¾" thick.

As far as the width goes, the differences between the nominal and actual dimensions are slightly more tricky. The actual width of a board is about ½" less than its nominal width — up through 7". For example, a 1×4 is actually 3½" wide, and a 1×6 is 5½" wide. However, starting at 8" in width, the actual dimension typically is ¾" less than the nominal: A 1×8 measures ¾" × 7¼"; a 1×12 measures ¾" × 11¼".

Finally, cedar and some other species may be available with rough-sawn surfaces, which often add to the wood's actual dimensions. For example, a rough-sawn cedar 1×4 might be 7⁄8" thick. The bottom line is that you have to measure the material before you buy it. This is the only way to ensure you'll have what you need. You can always make a wide board narrower, but trying to grow a board that's too narrow is a lot more difficult.

What this means to us as beekeepers is that a 1×10 measures ¾" × 9¼", not quite wide enough to make a deep super. You can either buy a 1×12, which gives you extra material to make handles and spacers, or you can glue boards together on-edge to get the width you need. I've found that both methods work fine. If I glue up boards, I tend to put the narrow section on the bottom. There is usually more stress on the top of the hive, where the edge is used for leverage to pry out frames.

If you encounter some cupping of the wood, which you probably will, plan so that when you clamp the board during assembly, you will be pulling the center down flat with the mating surface.

Dealing with Outdoor Exposure

Plywood that will be exposed to a lot of moisture should be exterior grade, although lauan (a.k.a. Philippine mahogany, a thin, inexpensive plywood) is fine for inner covers. *Don't build your hives using pressure-treated materials, due to the toxicity of chemicals used in the process.*

Finishing your project is your chance to get really creative. You'll want to apply some kind of finish to the outside parts of your hive to resist weathering. Some beekeepers use a linseed oil mixture for a natural wood look. The traditional finish for beehives is white paint on everything. One of my favorite parts about building hives is painting them a variety of colors.

I start with a good coat of exterior primer. Then the fun begins. You can buy mis-mixed paint from paint stores or the paint departments of larger hardware stores (even with computerized coloring equipment, paint mixtures often turn out wrong, leaving the store with gallons of unwanted paint). If you really want variety, go to a craft store where you'll find small containers of almost endless shades of colors. It's more expensive this way but widens your horizons.

I want my hives to be a joy to look at as well as work with, and if you have more than one hive, you'll be helping the bees as well: they will recognize the different colors or patterns and have an easier time finding their own hive entrance, which will cut down on drifting.

Hardware Cloth

I've talked to many beekeepers who say they can't find hardware cloth needed for beekeeping. Hardware cloth is square-grid metal mesh made with galvanized wire (or sometimes other materials). It's sold in rolls in various sizes, with the mesh size indicating the

distance from wire to wire. It can be expressed by that dimension or by the number of wires per inch. One of the most common sizes we use is #8 mesh, which means $\frac{1}{8}$ " from one wire to the next, or eight wires per inch. The actual space between the wires will be that distance minus the diameter of the wire. If you can't find the right hardware cloth at your local hardware store or home center, it's usually available from beekeeping supply houses.

Fasteners

The three primary fasteners we will use are screws, nails, and glue. The screws specified most commonly throughout the projects here are deck screws, which are coarse-thread wood screws designed for outdoor exposure.

Unless directed otherwise, always drill countersunk pilot holes for deck screws, to prevent splitting the wood and to create a clean, cone-shaped recess for the screw head to fit into. Screws with square-drive heads slip less than Phillips-head screws when installing. Star-head screws are great too, and I use them a lot.

Work tip: Screws get better all the time; my current favorites are Power-Pro star-drive screws. They have crosscut threads and need no predrilling. The head cuts its own countersink, and the star drive makes bit slippage virtually a thing of the past. They come in a variety of lengths for most any application.

The nails you use on the outside of your hives should be galvanized for rust resistance. In some cases, especially with the smaller wire

nails, it's hard to find galvanized, but nails used inside the hive don't need the same amount of protection against the elements.

Most wood glue manufacturers make a high-quality waterproof glue, which is essential when it comes to building beehives. Pick a brand that you like. Just make sure it's rated for outdoor exposure; most standard wood glues are not.

Special Techniques

Here are a few woodworking tips and tricks for working with — or without — a table saw.

Making Straight Cuts (without a Table Saw)

One area that has been a real boon for woodworking is accessories. You can find any number of saw guides that quickly clamp to a workpiece to guide your circular saw or jigsaw for cuts that are straight and square. Of course the tried and true method of using a square, two clamps, and a straight board as a guide works as well as ever.

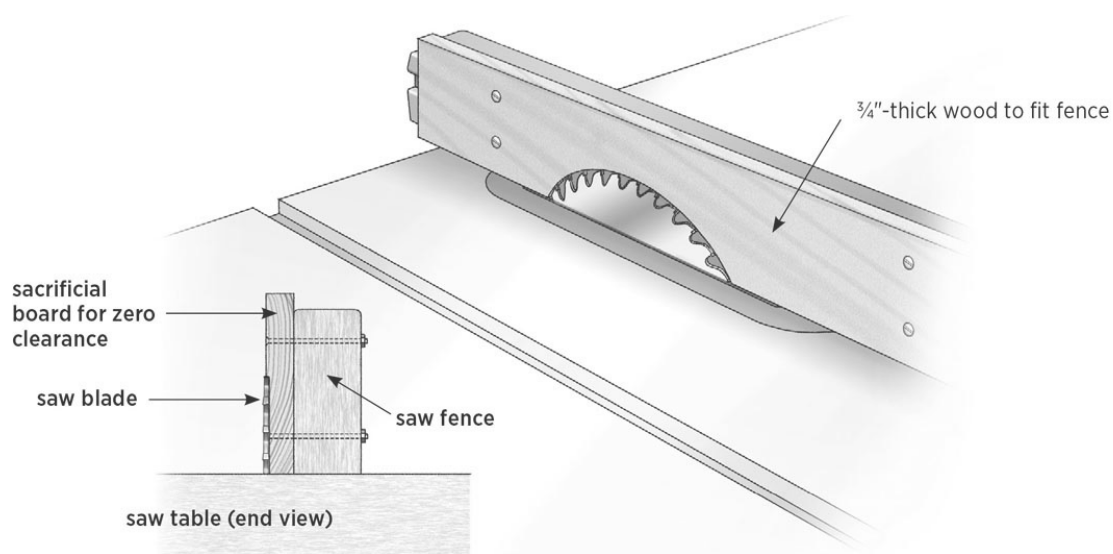
Whatever guide you decide to use, clamp it to a piece of scrap and make a cut with your saw. Measure the exact distance from the guide to the cut you just made, and write this dimension right on your tool. That way you'll know exactly how far you'll need to place your guide away from the line you intend to cut.

Zero-Clearance Fence

A zero-clearance fence is simply a sacrificial board attached to your regular table saw fence. The setup allows you to make a cut lengthwise on the very edge of a workpiece, such as when rabbeting the long edge of a board (for rabbeting short ends, you typically use a miter gauge).

To make a zero-clearance fence:

- 1.** Screw, bolt, or clamp a straight piece of wood to the face of your saw fence. Make sure that any clamps hold the board flat against the saw fence and don't obstruct the movement of your workpiece, your push stick, or any safety devices.
- 2.** Slide the fence over until the edge of the board just touches the blade. Lower the saw blade below table level, then nudge the fence over just a hair toward the blade and lock it into place.
- 3.** Turn on the saw and gradually raise the blade to the depth you will be cutting. It should just barely cut the wood of the zero-clearance fence.



ABOVE: *Zero-clearance fence.*

Cutting Dadoes and Rabbets with a Router

Making rabbet and dado cuts with a router is a viable alternative to using a table saw. A good router will have a quality adjustable guide (often sold as an accessory) that you can set to control the width of a rabbet or the distance of a dado from the edge of a board. You can also buy router bits with interchangeable bearings that roll along the edge of the work to control the width of a rabbet. A router mounted on a router table with a good fence and miter gauge will easily tackle all the rabbet and dado cuts in the book. (For examples of dadoes and rabbets, see pages **27–29**.)

No Dado Blade? No Problem

Don't worry if you don't own a dado blade for your table saw. For most of the projects in the book, I just used the regular blade on my table saw and made multiple passes.

- Set the blade height for the desired dado depth, and position the fence to cut the side (shoulder cut) nearest the fence.
- Make the shoulder cut, then move the fence away slightly and make another pass to clear out more of the dado.
- Continue moving the fence and cutting until your dado is the desired width.

Planning Your Project

The best way to plan for these projects is to read through each one completely before you start. Review the illustrations and get a sense of what cuts you'll be making, how each project will be assembled, and what the finished product will look like. Gather your tools and materials and get started.

I've tried to do most of the hard work and planning for you ahead of time. I started with commercially available frames, made lots of measurements, and built the hives from the inside out to fit them, striving to maintain proper bee space. The projects you will find here have spent practical time in the bee yards and are bee-approved.

Most boxes available for purchase don't exactly follow bee space. They're usually made bigger to allow for variations in frame sizes, swelling of wood, and propolizing. When setting up your hive, you typically keep the frames pushed tightly together, so that proper bee space is maintained between them. This whole group of frames is then centered side-to-side in the hive. Bees usually store honey in the outermost frames, taking advantage of any extra space there and drawing out those frames on the outer sides.

One place I've noticed a really big variation is with 8-frame hives. No one seems to have come up with anything close to a standard size. Some 8-frame boxes I've purchased easily hold 9 frames. The 8-frame equipment we will build is a little narrower than what's currently on the market — ours are actually made to fit 8 frames. Our 10-frame projects are interchangeable with commercially available products.

CHAPTER TWO

Starting at the Bottom

CHAPTER CONTENTS

Solid Bottom Board

Screened Bottom Board

Slatted Rack

Bottom boards — both solid and screened — and slatted racks make up the first components in your hive. Deciding which to use may be the hardest part. You can use all three together or any combination of them. Talk to other beekeepers in your area to see what works for them, then decide how you want to set up your hive.

Bottom Boards Defined

Solid bottom boards provide the base on which all other hive parts will rest. The bottom board must carry the full weight of the hive, which can be more than a few hundred pounds if you are running two deep boxes for brood and have several full honey supers on top. When a solid bottom board is used alone, it becomes the landing board for the bees as they fly off in search of nectar, pollen, propolis, and water, and return with their load of goods. For this reason, the bottom board is usually a few inches longer than the hive bodies themselves.

Screened bottom boards, commonly called varroa screens, are used as part of an *integrated pest management* (IPM) program to help reduce the number of varroa mites in the hive. The way they work is very simple. When varroa mites fall off the bees, either naturally or with the use of a control method such as powdered sugar dusting, they fall through the screen, below the hive, and are unable to attach themselves to another incoming bee.

They were initially developed to give bees more room, to prevent swarming. They also are thought to help encourage the queen to lay farther down on the bottom frames, which prevents chilled brood in the lower part of the hive. All of those reasons seem to make sense. I can't offer any scientific proof as to the value of a slatted rack, but I do use them.

PROJECT

Solid Bottom Board



The simple bottom board in this project will fit the hive bodies I show you how to build in chapter 3. Tongue-and-groove boards make for the strongest solid bottom board, but you can also use half-lap joints, or even straight sides, butted together and glued. What you use for these pieces may change your material list. The plan below is for using $\frac{3}{8}$ " half-lap joints. The parts consist of two sides (A), four platform boards (B-1 through B-4), and a filler strip (C), as shown in *Assembling the Solid Bottom Board*, on **page 21**.

Any sturdy solid wood will work as material, such as pine, spruce, cypress, or cedar. You may want to use a solid bottom board in conjunction with a screened bottom board (**page 22**), making it easy to slide a sticky board or tray underneath to check for mites.

Tools

Table saw

Drill with combination drill/countersink bit

Materials

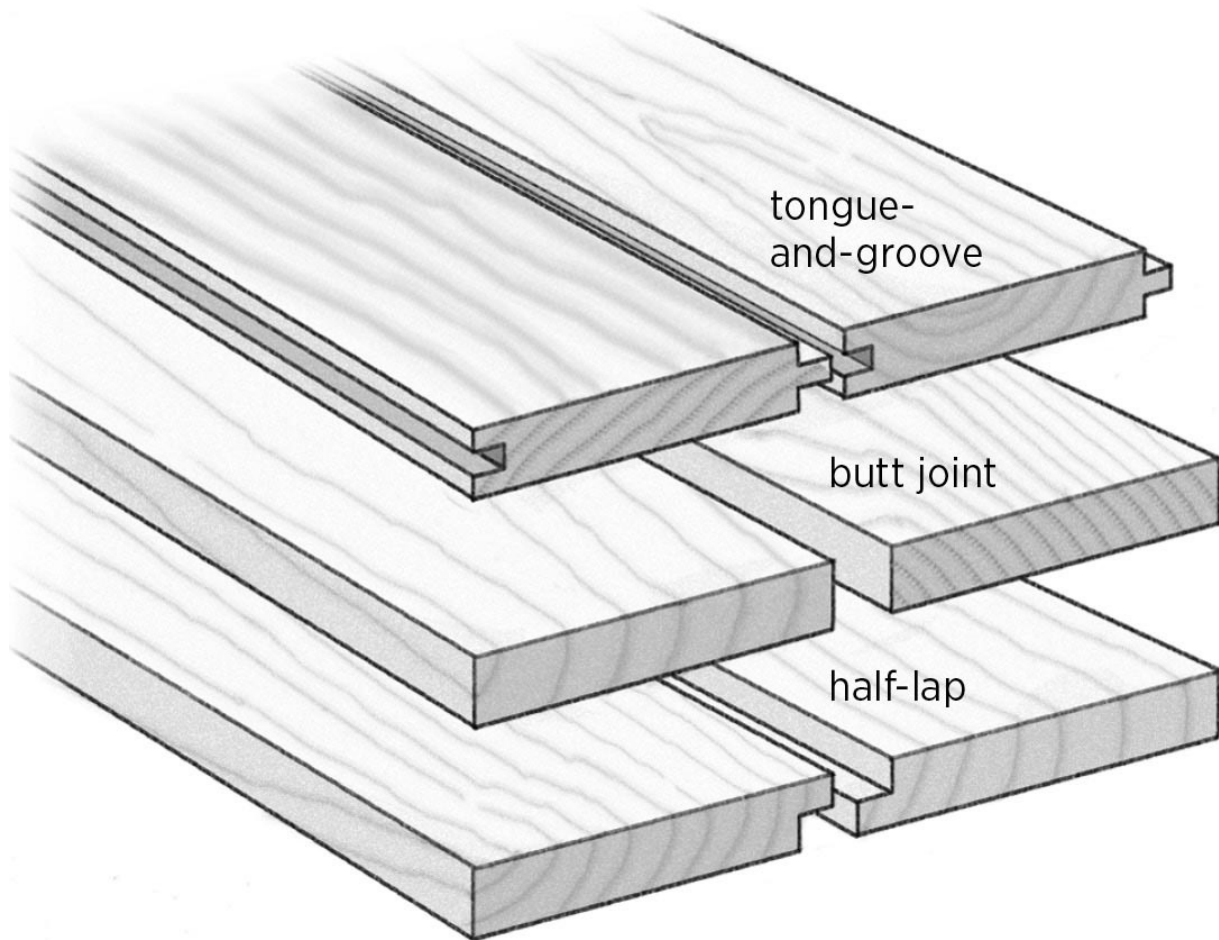
One 6-foot pine or cedar 1×6

One pine or cedar 1×8, 16" minimum

Waterproof glue

Twelve 1³/₄" deck screws

Four 1¹/₄" deck screws



ABOVE: *Joint options for bottom board.*

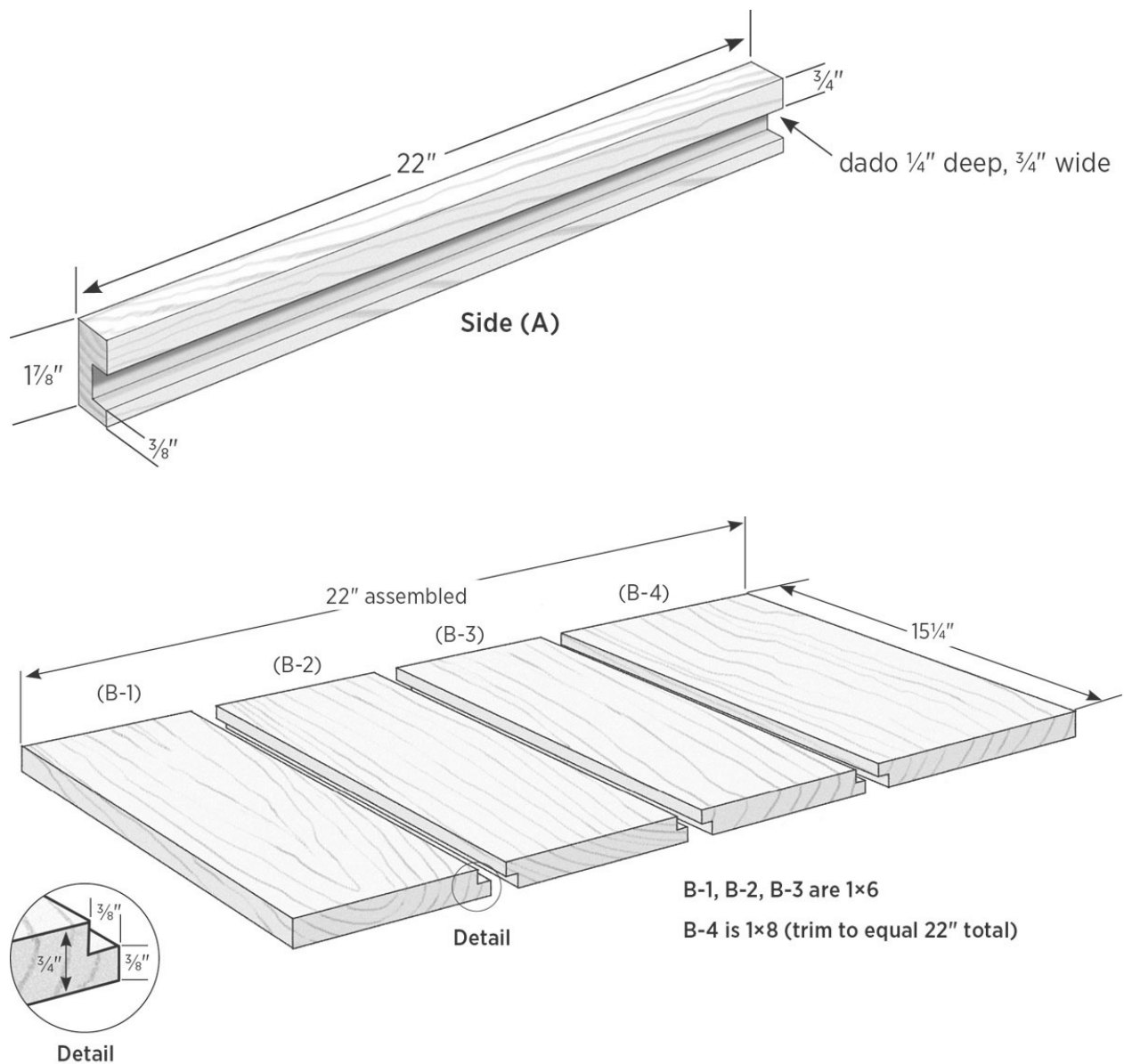
1. Make the sides.

Square off the 1×6 and cut one piece to length at 22" long and three pieces at 15¹/₄". Square off the piece of 1×8 and cut it to length at 15¹/₄". On a table saw, rip the 22" 1×6 into two pieces that are 1⁷/₈" wide for the sides (A). Save the cut-off piece and trim it to length at 14³/₄", then set it aside; this is the filler strip (C).

Set the saw fence at ³/₈" from the blade, and set the blade height at ¹/₄". Make a test cut using scrap, then cut a ³/₄"-wide dado in both

of the side pieces, moving the fence away a little at a time and testing the fit until the pine boards will slide in the slot. Don't make it too tight, because the boards may have some cupping. Using a combination square set to $\frac{3}{4}$ " , draw a screw guideline down each side piece centered over the dado.

Note: If you have a dado blade or router table, you can use them to speed up this step, but setting up sometimes takes as long as it does to cut with the single blade on the saw.



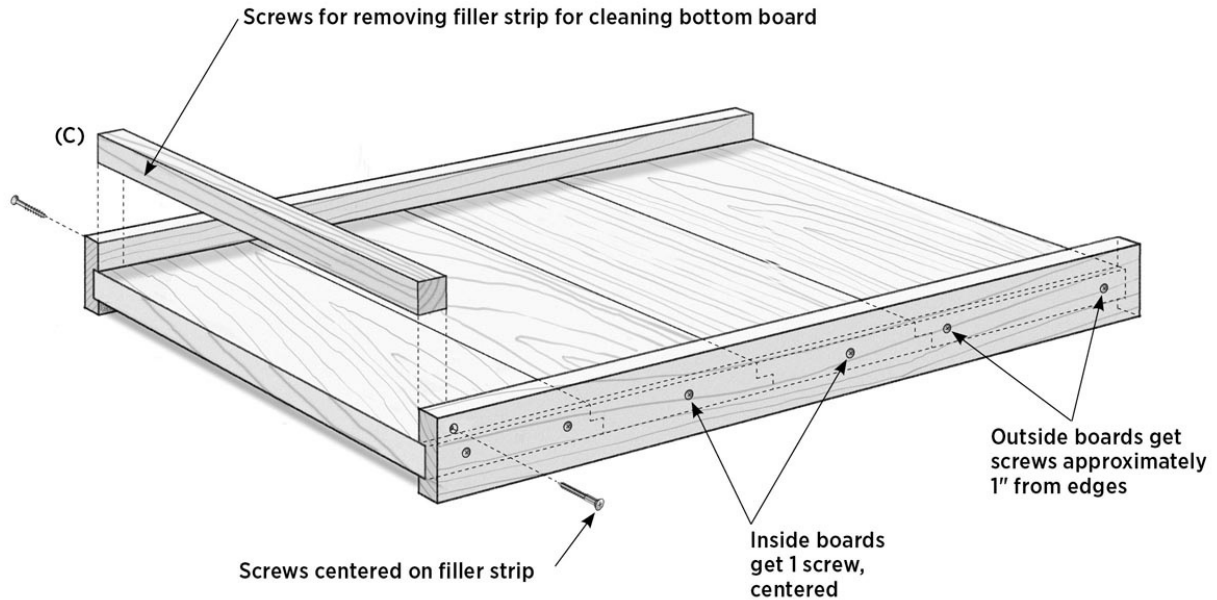
ABOVE: *Solid bottom board parts.*

2. Cut the half-lap joints.

Set a zero-clearance fence (see **page 16**) $\frac{3}{8}$ " to the far end of the blade. Set the blade height to $\frac{3}{8}$ ". Cut rabbets on the $15\frac{1}{4}$ " boards: Cut one rabbet on a bottom piece for each end (B-1 and B-4), and cut two rabbets on the two center bottom pieces (B-2 and B-3). Test-fit the boards together to make sure the surfaces are flush. When placed together, your platform boards should measure 22". If necessary, trim the 1×8 (B-4) to get the 22" dimension.

3. Assemble the bottom board.

Dry-fit all of the bottom board pieces. If everything fits right, generously glue the dadoes in the sides and the half-lap joints and reassemble the boards. Use two pipe or bar clamps to clamp the assembly. Check for squareness. Drill countersunk pilot holes for $1\frac{3}{4}$ " screws, and install the screws. I put two screws in the end boards (B-1 and B-4), about 1" from each edge, and one screw centered in the two center boards (B-2 and B-3). Let the glue cure as directed.



ABOVE: *Assembling the solid bottom board.*

4. Install the filler strip.

You can install the filler strip permanently by driving screws or nails through the sides, or make it removable for easier cleaning of the bottom board. To make it removable, drill through the sides into the filler with the drill/countersink bit. Remove the filler and open up the holes in the sides with a $\frac{3}{16}$ " drill bit. Replace the filler strip and drive two $1\frac{1}{4}$ " screws through the holes and into the filler.

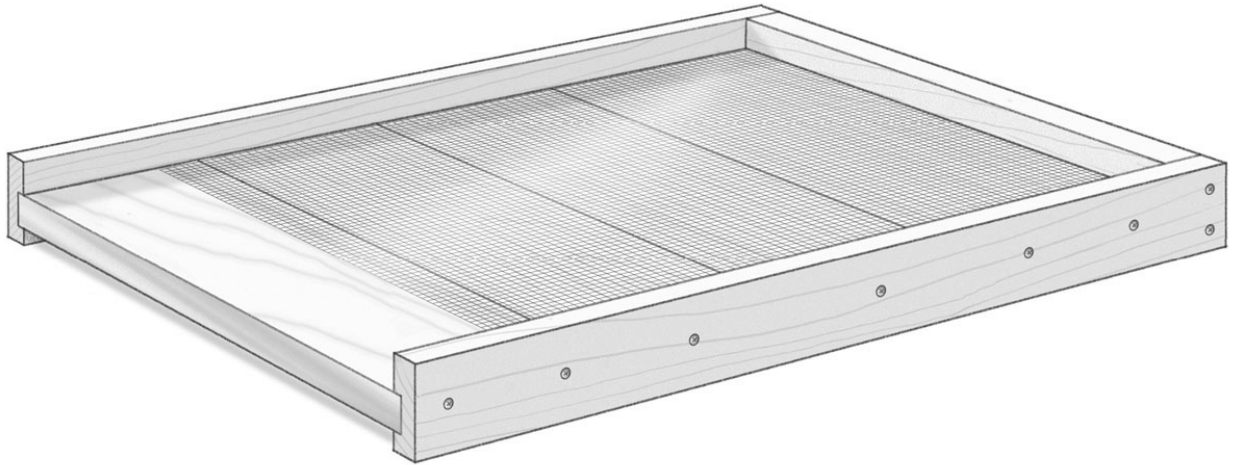
Next, looking from the back of the bottom board, drill pilot holes about 2" in from each end of the filler strip and drive two $1\frac{1}{4}$ " screws, leaving the screw shanks and heads sticking out enough to grab onto; these will act as pulls for removing the filler piece.

5. Finish the board.

Now your completed bottom board is ready for priming and painting. If you made your filler removable, take it off while painting so the parts don't stick together. You've done it! You've made the first part of your beehive. I hope you are as excited as I am for you.

PROJECT

Screened Bottom Board



Screened bottom boards were offered in the Dadant catalog (see Resources) beginning in 2002. Virtually all companies that sell beekeeping supplies now offer varroa screens in their catalogs. They were probably predated by the use of open mesh floors in the UK, referenced in a July 1990 article by Helmut Horn in *Bee Craft* magazine.

Varroa screens can also help with ventilation and the prevention of moisture buildup in the hive. If you use a screened bottom board on top of a solid one, the screened board becomes the landing board, so it's best to block off the space between the two to prevent bees from going under the screen.

Some beekeepers (even here in the cold Northeast) use the screened boards as stand-alone bottom boards, so the mites fall directly on the ground. One member of our club leaves them wide

open all year round with great success and low hive losses, but I'm too chicken to try it with our long and cold New England winters.

Tools

Table saw

Drill with combination drill/countersink bit

Tin snips

Brad nailer (optional)

24" clamps

2" spring or C-clamps

Staple gun

Materials

One pine 1×8, 22" minimum

One pine 1×6, 15 1/4" minimum

One piece #8 galvanized hardware cloth, 18" × 14 3/4" minimum

Waterproof glue

Six 2" deck screws

Ten 1 1/4" galvanized brads

1/2" or 5/8" staples

1. Cut the wood parts.

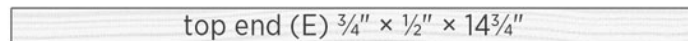
Cut the 1×8 to length at 22" and the 1×6 at 15 1/4". Set your table saw fence 3/4" from the blade and rip two strips from the 22" piece. Cut each of these to length at 16 1/4"; these are the filler strips (C).

Adjust the table saw fence to 1/2" from the blade and rip one strip from the 1×6, then cut it to length at 14 3/4"; this is the top end piece (E).

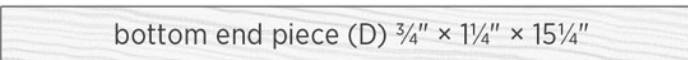
The remaining piece of 1×8 should be about 5 1/2" wide. This will become the two side pieces (A) and the bottom end piece (D). Mill a 3/4"-wide × 1/4"-deep dado on each side of one face of the board, starting 3/8" from each edge, using a table saw or a router table (see No Dado Blade? No Problem, on [page 17](#)). Test-fit the filler strips in the dados.

Set the fence for 1 7/8" and rip the two side strips from the dadoed 1×8. Cut the leftover piece to size at 1 1/4" wide × 15 1/4" long; this is the bottom end piece (D).

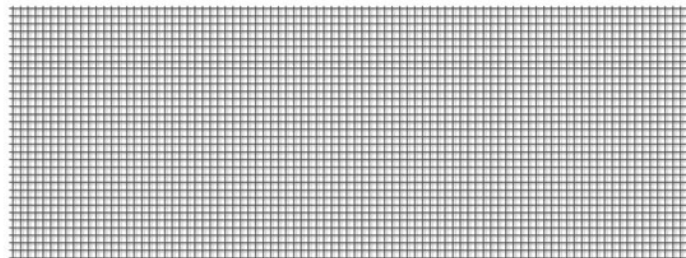
Rip the remaining piece from the 1×6 to 4 1/2" wide; this will be the landing board (B).

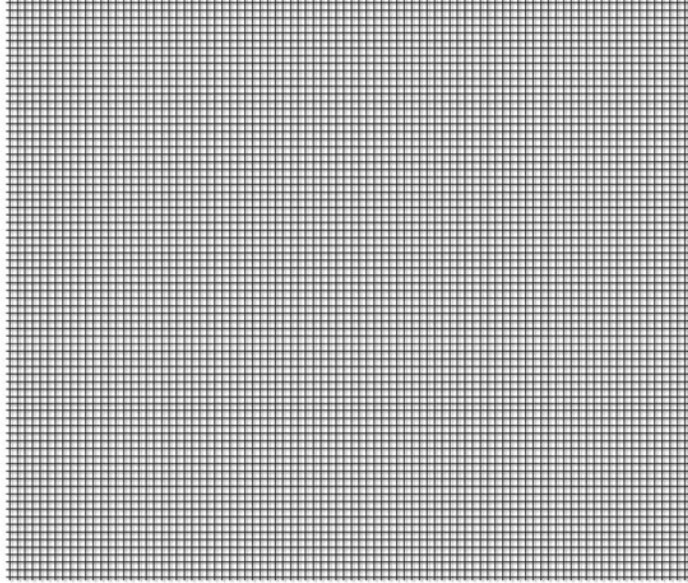


top end (E) 3/4" × 1/2" × 14 3/4"

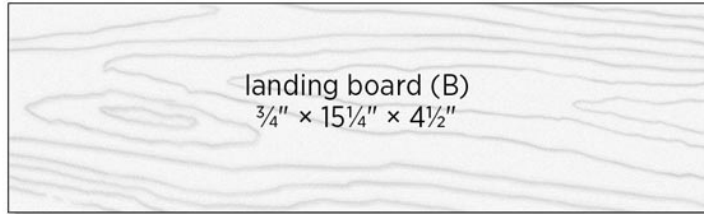


bottom end piece (D) 3/4" × 1 1/4" × 15 1/4"

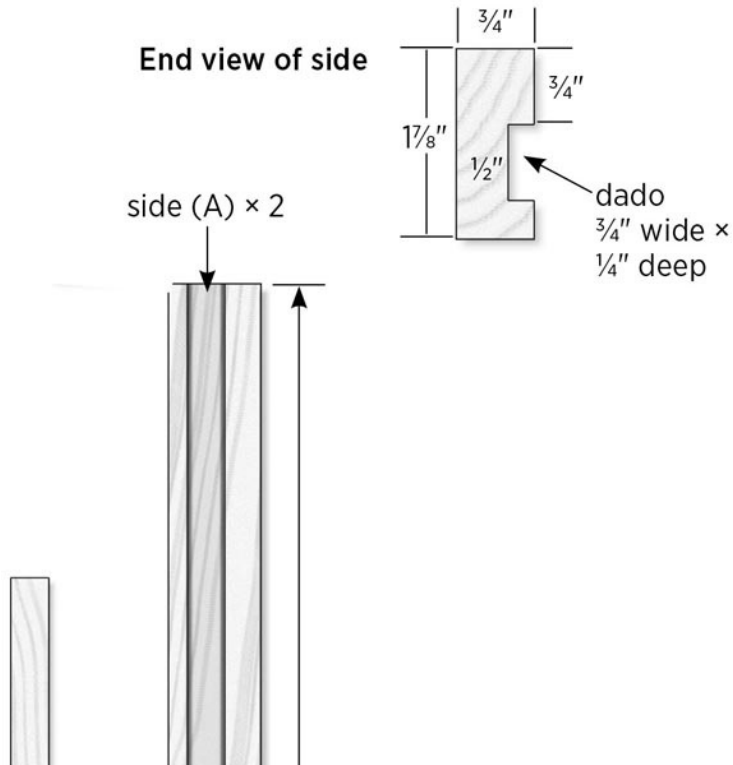


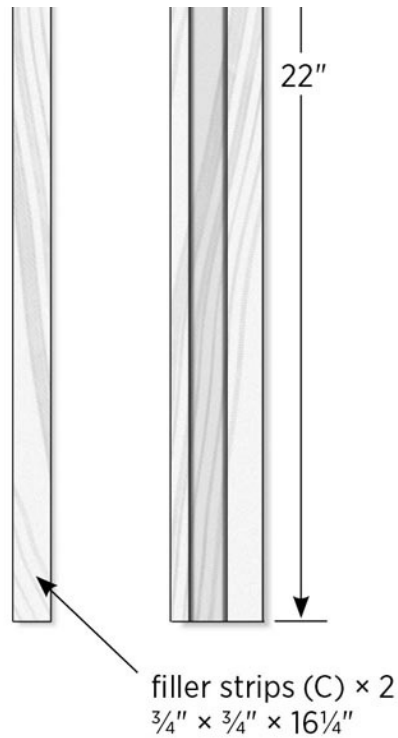


$\frac{1}{8}$ " mesh hardware cloth
 $14\frac{5}{8}$ " \times 18"



landing board (B)
 $\frac{3}{4}$ " \times $15\frac{1}{4}$ " \times $4\frac{1}{2}$ "





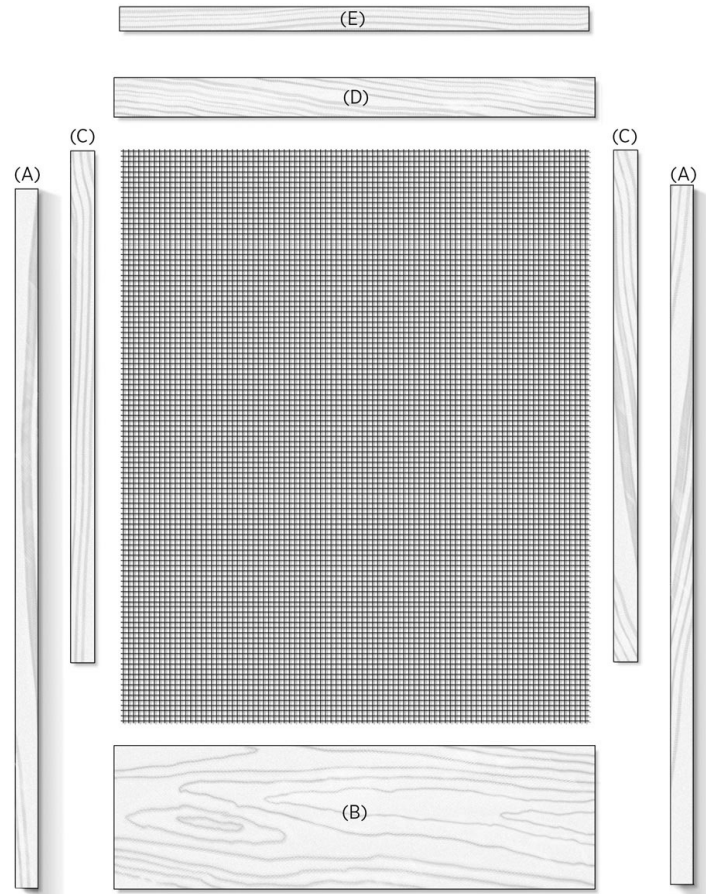
ABOVE: *Screened bottom board parts.*

2. Prepare for assembly.

Sand the edges of all the wood parts, then dry-assemble the project, as shown in *Assembling the screened bottom board* (facing page): Fit the landing board (B) into the dado slots of the side pieces (A) so it's flush with the front ends of the sides. Place the side fillers in the dado slots against the landing board, then slide the bottom end piece (D) into place. Confirm that everything fits well, then disassemble the parts.

Cut a piece of hardware cloth to size at $14\frac{5}{8}'' \times 18''$, using tin snips.

Drill three countersunk pilot holes in each side piece, as shown. Be sure to make one left-hand and one right-hand.



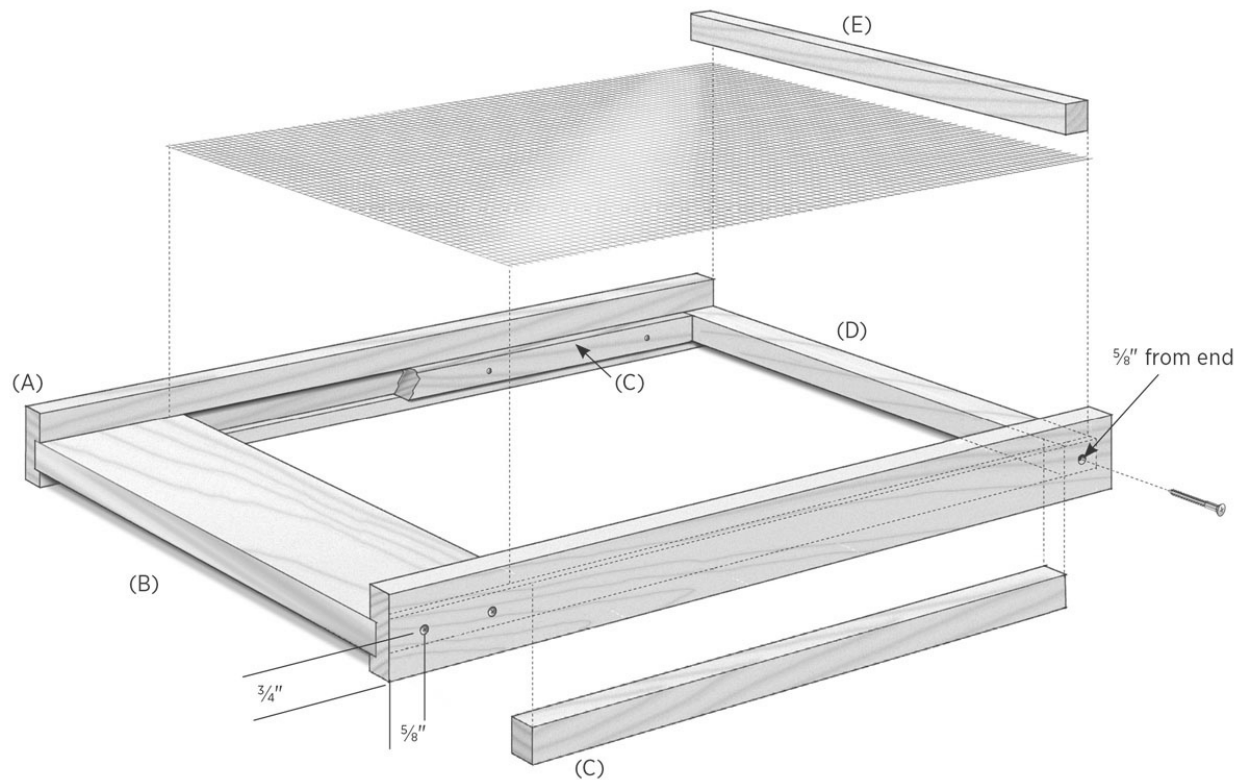
ABOVE: *Screened bottom board assembly layout.*

3. Assemble the project.

Apply glue to the dadoes of the side pieces and assemble the parts as before. Check the assembly for square, then tighten two pipe or bar clamps across the sides to hold everything in place. You can use C-clamps or spring clamps to hold the side fillers in place.

Drive 2" deck screws through the sides and into the landing board, and drive one screw into each side to hold the bottom end piece in place. Fasten the fillers with five 1 1/4" brads, spaced evenly and nailed from the outside. Remove the clamps.

Clamp the top end piece (E) in place for reference and staple hardware cloth along its edges using $\frac{1}{2}$ " or $\frac{5}{8}$ " staples. You have the option of attaching the top end piece or not, so it's removable for easy screen cleaning (that's what I prefer). If desired, you can drive in a couple of nails or screws partway, leaving them sticking out the end, to give you something to pull on for removal.



ABOVE: *Assembling the screened bottom board.*

PROJECT

Slatted Rack



I'm not sure when slatted racks were first developed. The first reference I found was in the June 1968 edition of *Gleanings in Bee Culture*, published by the A.I. Root Company. In early versions, the slats went from side to side, but with the advent of IPM, slats were reoriented to go from front to back and line up with the frames. This allows varroa mites to fall through a screened bottom board.

This slatted rack design consists of two identical ends, two identical sides, a shelf, and 10 slats. It's a good idea to read through all the instructions to familiarize yourself with the procedure before you get started. This project has a fair number of parts, and a brad nailer makes assembly a lot faster and easier.

Tools

Table saw

Drill and drill/countersink bit

Router table (optional)

Brad nailer (optional but recommended)

Materials

One pine 1×8, 32" minimum

One pine 1×6, 36" minimum

Waterproof glue

Thirteen 2" deck screws

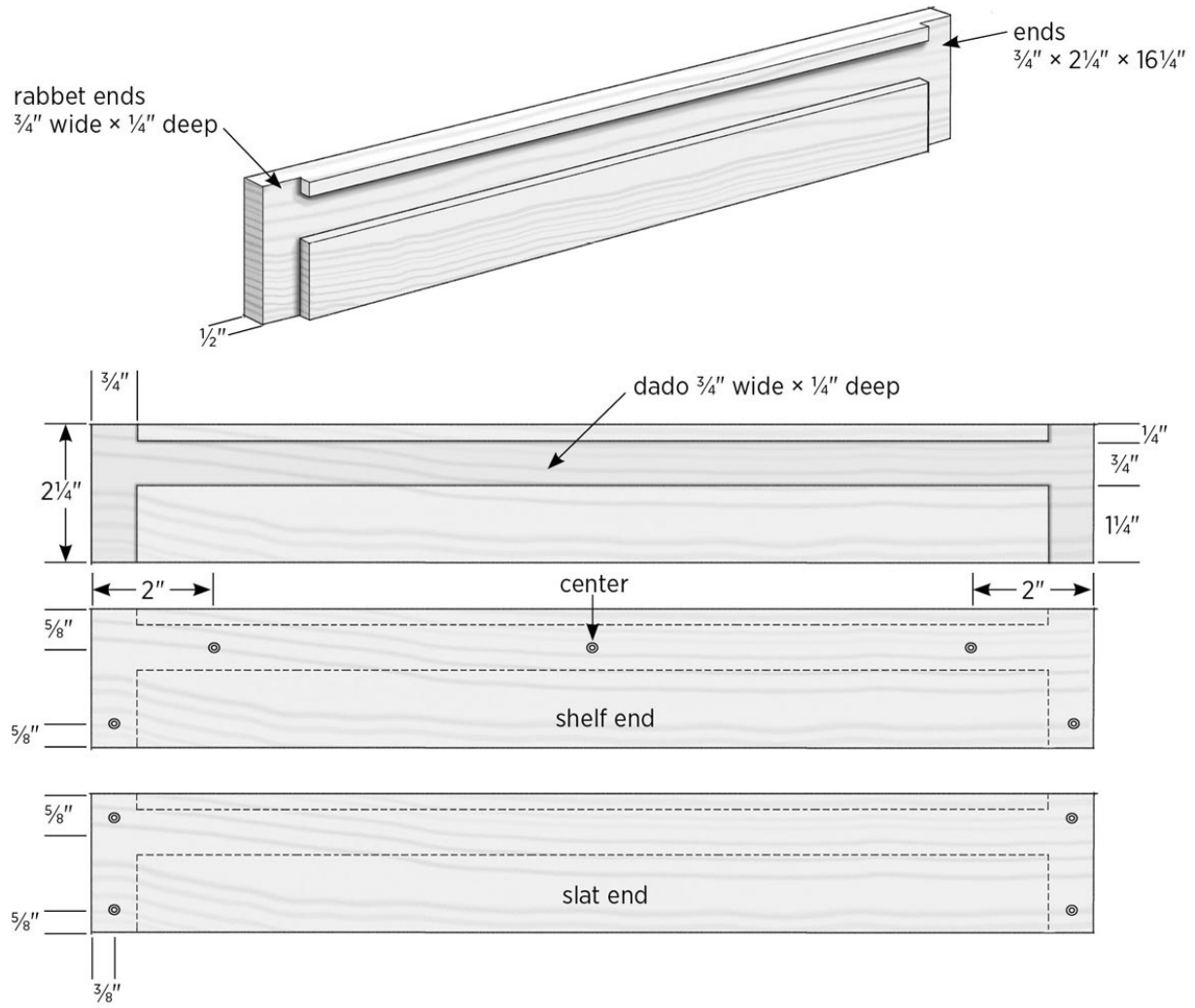
Twenty 1 1/4" brads (for brad nailer) or ten 4d galvanized box nails

Twenty 3/4" brads (for brad nailer) or 5/8" or 3/4" wire nails

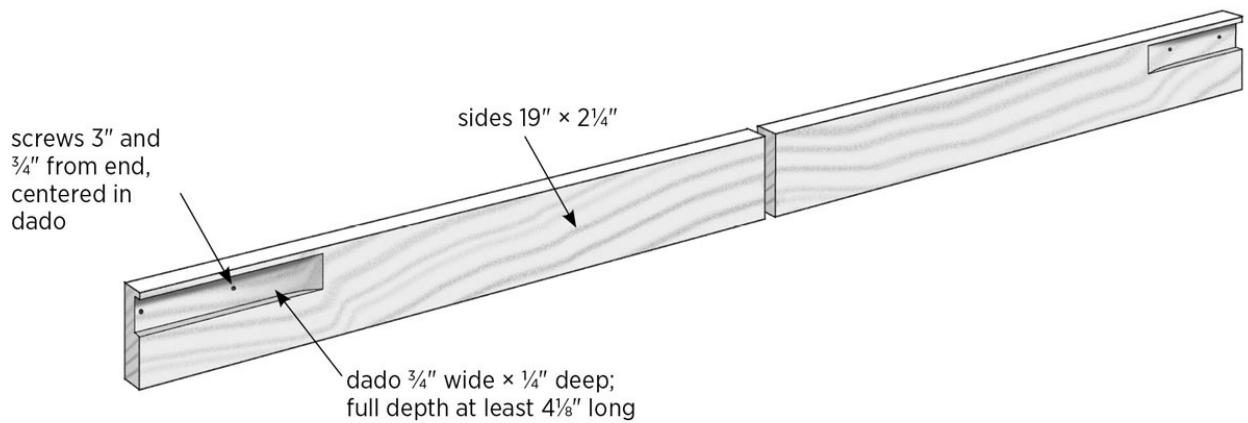
1. Cut the ends and sides.

Square the end of the 1×8, then cut two pieces to length at 15 1/4". Square the end of the 1×6 and cut one piece to length at 16 1/4" and one piece at 19".

Set your table saw fence to 2 1/4" and rip two pieces from the 16 1/4" board; these are the ends. Rip two pieces from the 19" board to create the sides.



ABOVE: *Slatted rack ends.*



ABOVE: *Slatted rack sides.*

2. Mill dados and rabbets into the ends.

Each end piece gets a full-length, $\frac{3}{4}$ "-wide \times $\frac{1}{4}$ "-deep dado, starting $\frac{1}{4}$ " from the top edge of the piece; these will accept the unmilled slat ends and the shelf. Each end piece also gets a rabbet at each end to accept the side pieces. The rabbets create strong corner joints and help to keep things square during assembly.

Make the dados using a table saw and standard blade or dado blade (see [No Dado Blade? No Problem](#), on [page 17](#)) or a router table. Test-fit a piece of the 1 \times 8 material (which will be used for the slats and shelf) in the dados, and make any necessary adjustments.

Keeping the blade height at $\frac{1}{4}$ ", set your fence so the distance to the far side of the blade is $\frac{3}{4}$ ". Make a test cut with a piece of scrap material, using the miter gauge. Test-fit the cut with a side piece, and make any necessary adjustments. Position each end piece with the dados facing down, and cut rabbets in both ends, using the miter gauge.

3. Dado the sides.

The side pieces also get $\frac{3}{4}$ " \times $\frac{1}{4}$ " dados, but these are *blind* dados and don't run the full length of the boards. Also note that there is a left side and a right side, and they're *not* interchangeable. This dado will hold the shelf, which is 4 $\frac{1}{8}$ " wide, so the full-depth portion of the side dado must be at least that long.

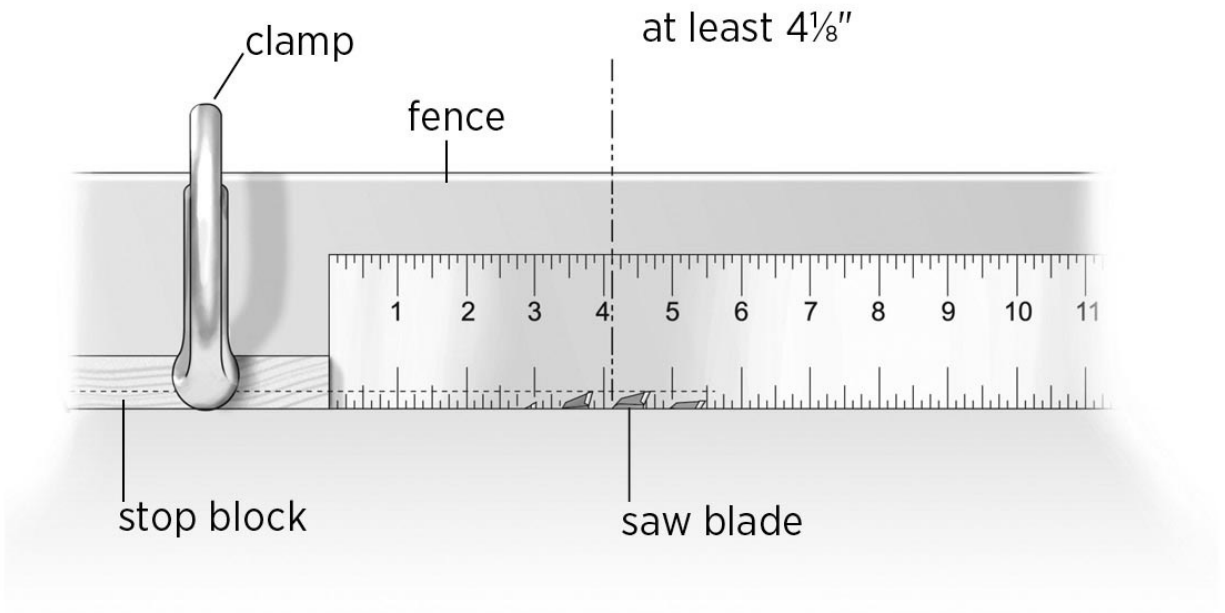
To cut the left dado on the table saw, with the blade height still set at $\frac{1}{4}$ ", measure from the high point on the blade 4 $\frac{1}{4}$ " toward the back of the table and clamp a stop to the fence. This ensures that the

full depth of cut is enough to accept the shelf. Once you are set up, the process is the same as cutting the dados in the sides.

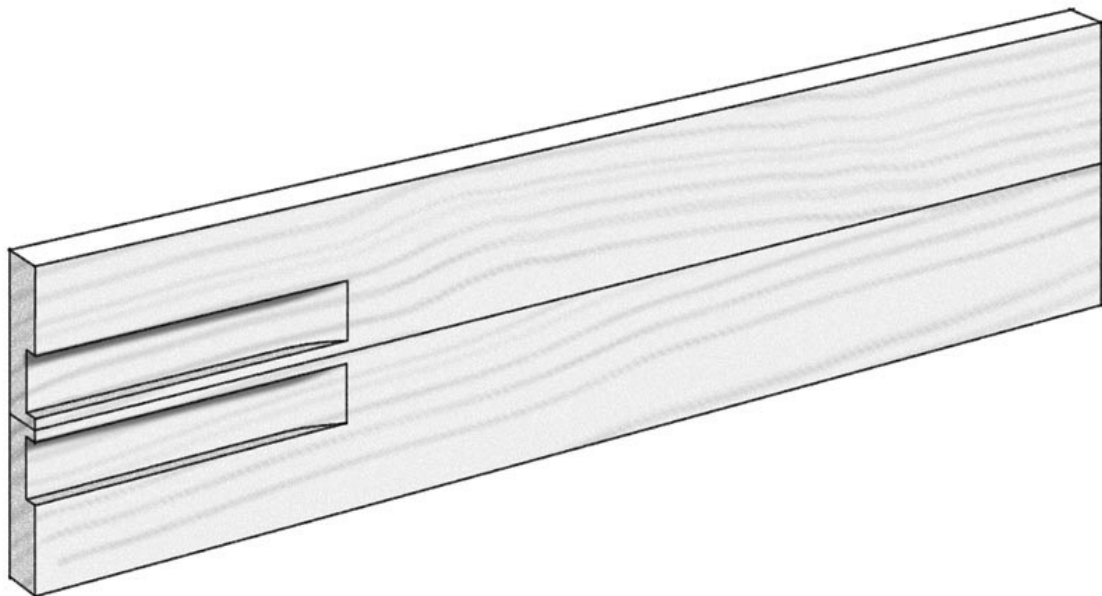
The right side piece is a mirror image of the left. Move the saw fence to the other side of the blade and repeat the same process to cut the dado.

Safety note: When cutting the blind dado, cut until your board hits the stop, then shut off the saw. Let the blade come to a complete stop before backing off your piece and moving the fence.

You can also make the blind dados with the router table, using the same technique of measuring to the center of the router bit and setting a stop. If you want a very tight fit, you could make the dado $4\frac{1}{8}$ " long and round over the shelf for a precise fit, or chisel the end of the slot square. But we're not building fine furniture here, and I really don't think the bees will notice the difference.



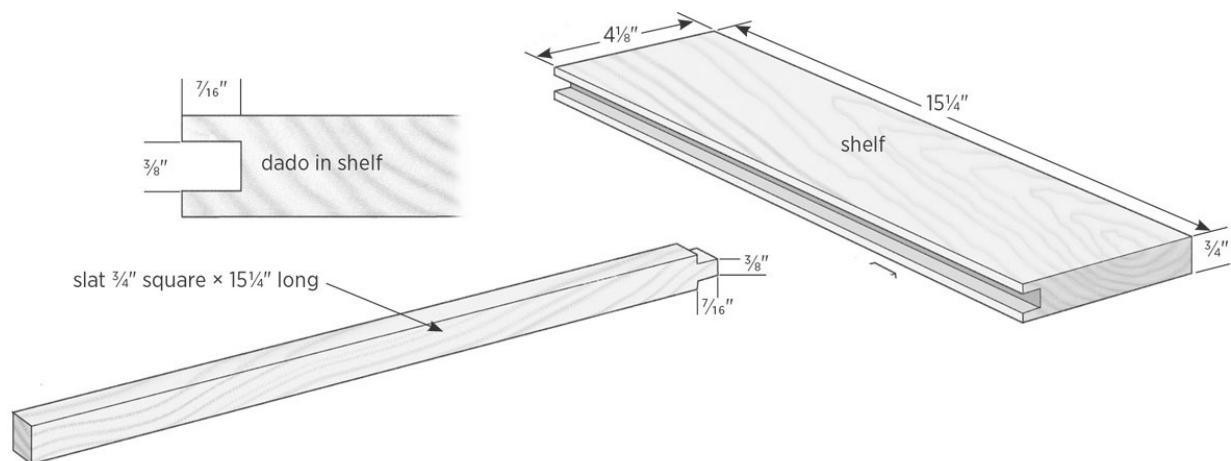
ABOVE: *Setting stop for blind dado in sides.*



ABOVE: *Completed dados.*

4. Cut and dado the shelf.

Cut the shelf piece from one of the 15 1/4"-long 1x8s. Set the table saw fence to 4 1/8" and rip one piece for the shelf. Save the leftover piece; you will use it for some slats. The shelf needs a 3/8"-wide x 7/16"-deep tenon slot centered along the length of one edge. Set the blade height to 7/16", and set the fence to 3/16". After making a test cut, cut one slot, then rotate the board and cut another slot. Move the fence and clean out the center to complete the slot.

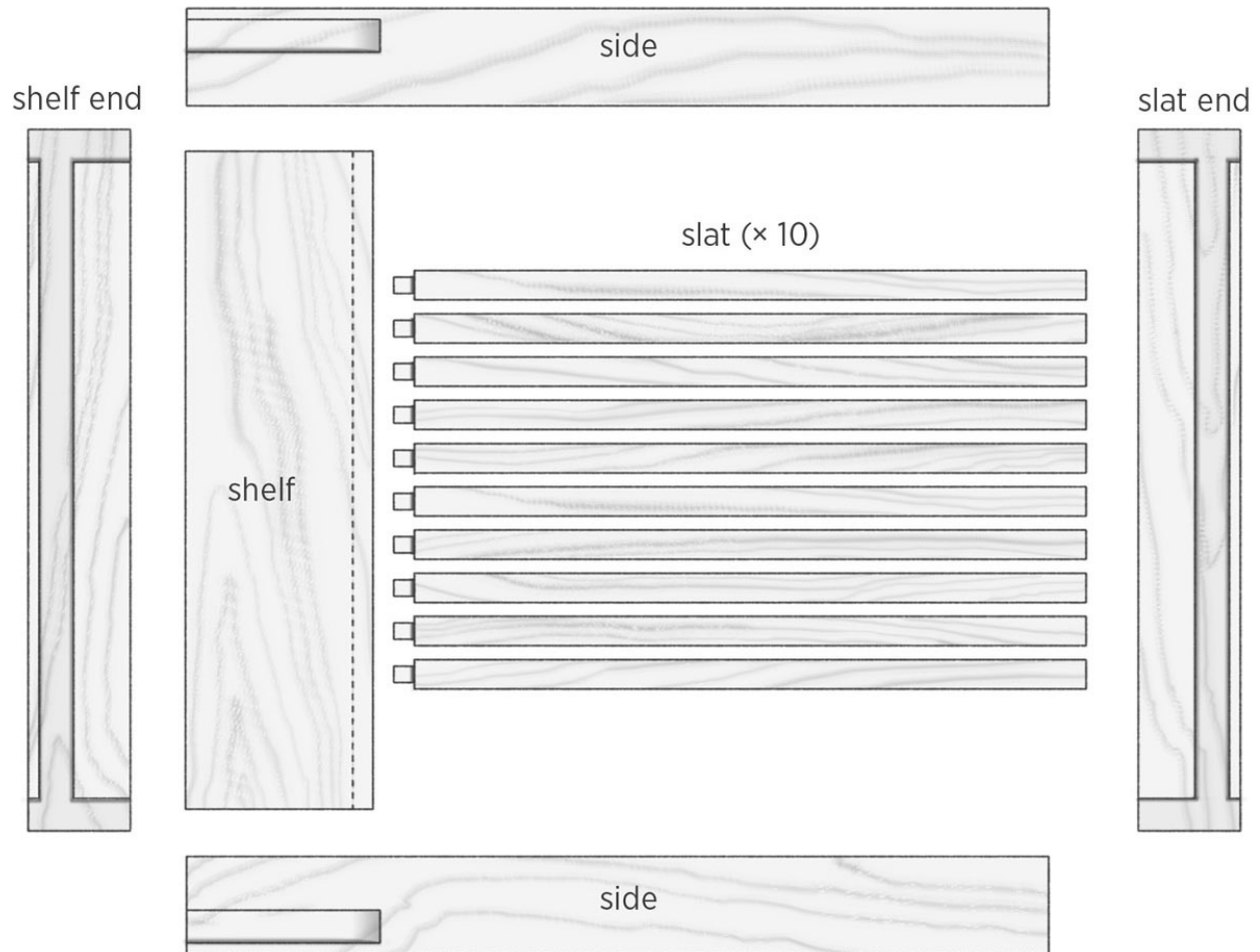


ABOVE: *Slatted rack shelf and slats.*

5. Make the slats.

Use the two remaining 15 1/4" pieces to make the 10 slats. There is enough material for a few extras. The slats get a tenon that fits into the dado of the shelf. Set the saw blade back to 3/16" high, and set the fence so that the distance to the far side of the blade is 7/16". After making a test cut, cut a rabbet in one end of each board that measures 7/16" wide x 3/16" deep. Flip the board and repeat to cut a

second rabbet, thus completing the tenon. Check the fit of the tenon in the shelf. Raise the blade and set the fence to $\frac{3}{4}$ ", then rip the slats.

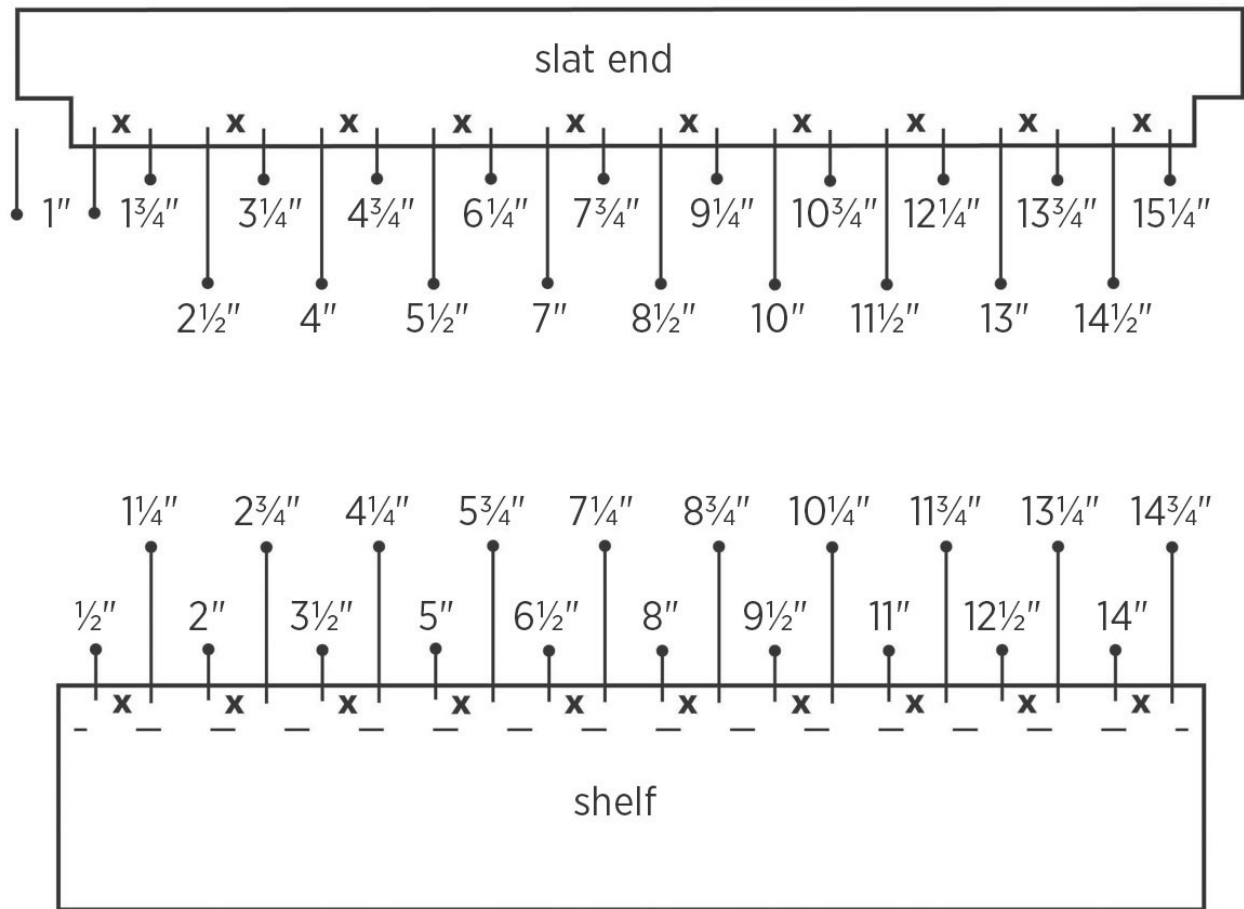


ABOVE: *Slatted rack parts layout.*

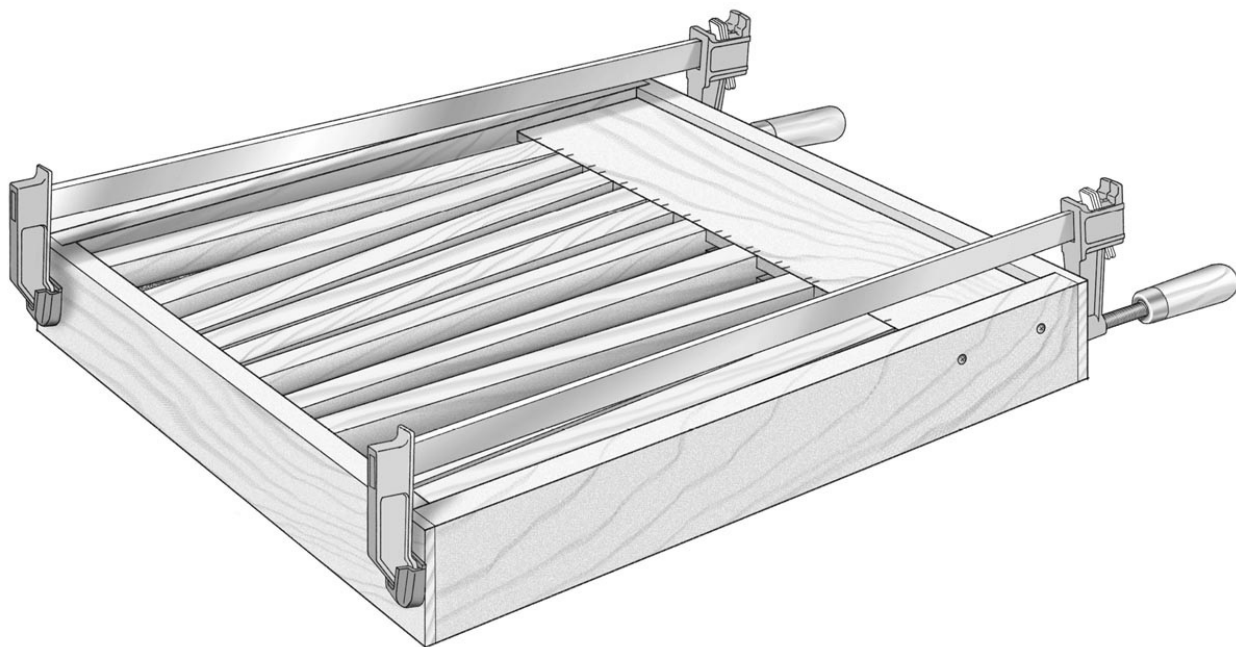
6. Begin the rack assembly.

Dry-fit the pieces of the frame, shelf, and a few slats as shown. Mark the locations of all screws and the slats. Disassemble the rack and apply glue to the dadoes of the side pieces and the end piece with the five screw holes only. **Note:** *Do not apply glue to the other end piece or the dadoes that the slats will fit into.*

Assemble the rack, making sure the slat markings face up. Install the slats into the slots, but for now don't worry about lining them up. Put a couple of clamps lengthwise on the frame and check it for square. Drill countersunk pilot holes at the screw marks on a side piece, and drive two 2" deck screws through the side and into the shelf. Turn the rack around and repeat for the other side.



ABOVE: *Slat locations on shelf and slat ends.*



ABOVE: *Square up the rack, clamp together, and attach the shelf using 2" screws (2 at each end).*

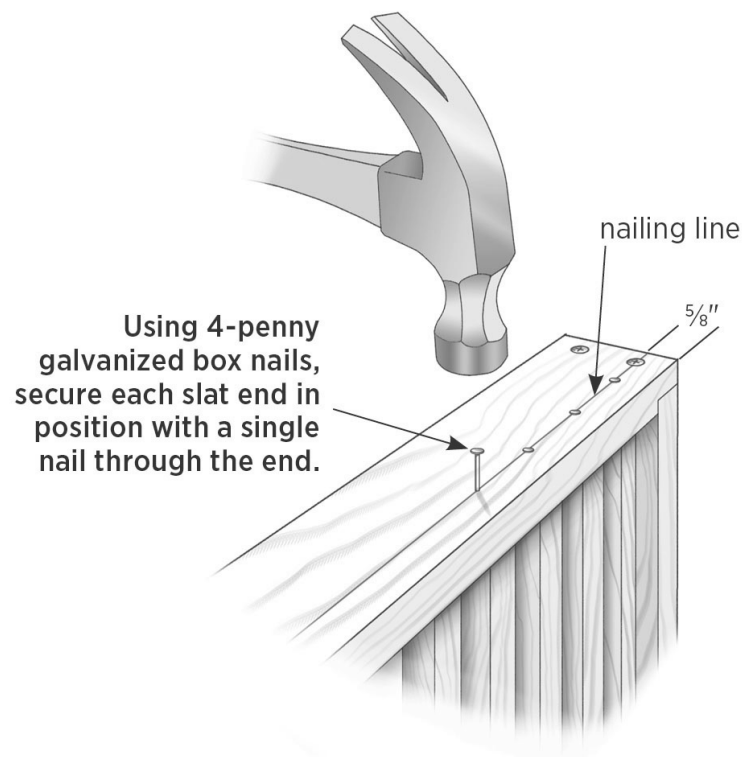
7. Install the ends.

To install the first end, drill pilot holes and drive five screws into the end piece, making sure everything stays straight and square. Three of these screws will go into the shelf and two will go into the sides. Install the second end using four screws, but don't tighten them all the way. Remove the bar clamps. The ends should be loose enough for you to get the slats lined up with their marks.

Once you have the slats pretty much lined up, fully tighten the four screws in the second end. You'll still be able to tweak them a little if needed.

8. Attach the slats to the end piece.

Draw a line across the end piece, $\frac{5}{8}$ " down from the top edge; this is the nailing line for your (non-tenoned) slat ends. Fasten each slat end with two $1\frac{1}{4}$ " brads if you have an electric brad nailer, or one 4d galvanized box nail if you're nailing by hand. Be sure to check the alignment of the slats as you go. It's a lot easier to get them in the right place the first time.

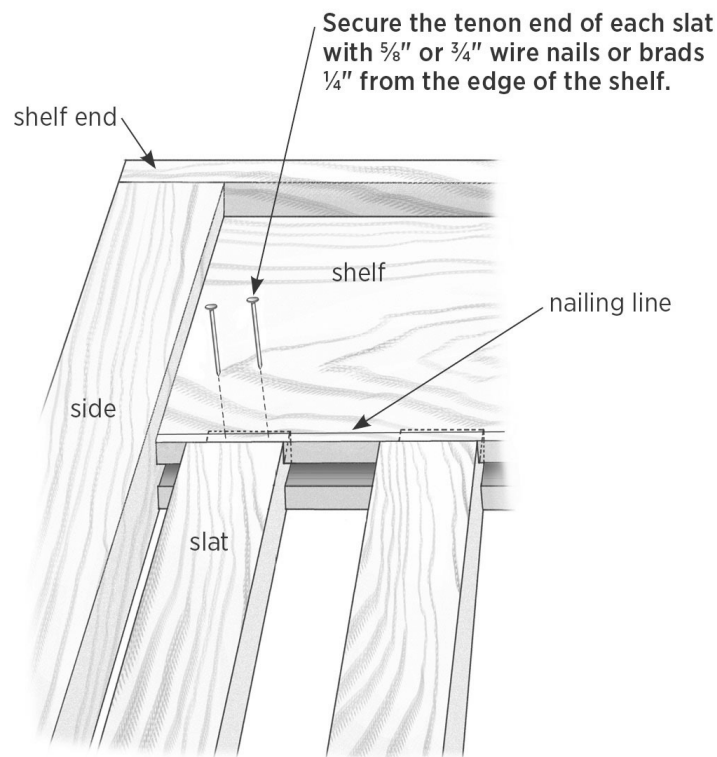


ABOVE: *Nailing slats to end piece.*

Work tip: If you have enough scrap pieces of pine, you can cut them to use as $\frac{3}{4}$ " spacers for lining up the slats. This will be helpful if you plan to build a lot of slatted racks, because you can use this first finished one as a template for building an assembly jig.

9. Fasten the tenoned slat ends.

Draw a nailing line across the shelf about $\frac{1}{4}$ " from the edge. If you didn't use spacers, readjust the tenon ends of your slats to line up with their marks. If you're using a brad nailer, switch to $\frac{3}{4}$ " brads. If you're nailing by hand, use $\frac{5}{8}$ " or $\frac{3}{4}$ " wire nails. Nail down through the shelf into each slat in two places.



ABOVE: *Nailing tenoned slat ends.*

CHAPTER THREE

Hive Bodies and Supers

CHAPTER CONTENTS

Hive Body with Butt Joints

Hive Body with Rabbet Joints

Medium and Shallow Supers

Making your bee boxes is pretty simple. It involves cutting parts to size and making rabbets that your store-bought bee frames will rest on. You'll have joint options for assembling the boxes. By attaching angled handholds to the outsides of the boxes, you'll create a slip-free grip, which is important when it comes to working the hive.

Hive Terminology

Some new beekeepers are confused by beekeeping lingo, and nowhere is there more confusion than with the terms *hive bodies*, *brood chambers*, and *supers*. They are all boxes of the same length and width. The only difference is the height, or "depth," as it's known. Many beekeepers refer to the deep boxes, or "deeps," which are about 9⁵/₈" high, as the brood chambers. They call medium and shallow boxes "supers" or "honey supers."

As a general rule, no matter what height the box is, if a beekeeper is using it for raising brood, it's referred to as a hive body; if it's used for collecting honey, it's called a honey super. In this book we call the deep boxes the *hive bodies* and the medium and shallow boxes *honey supers*.

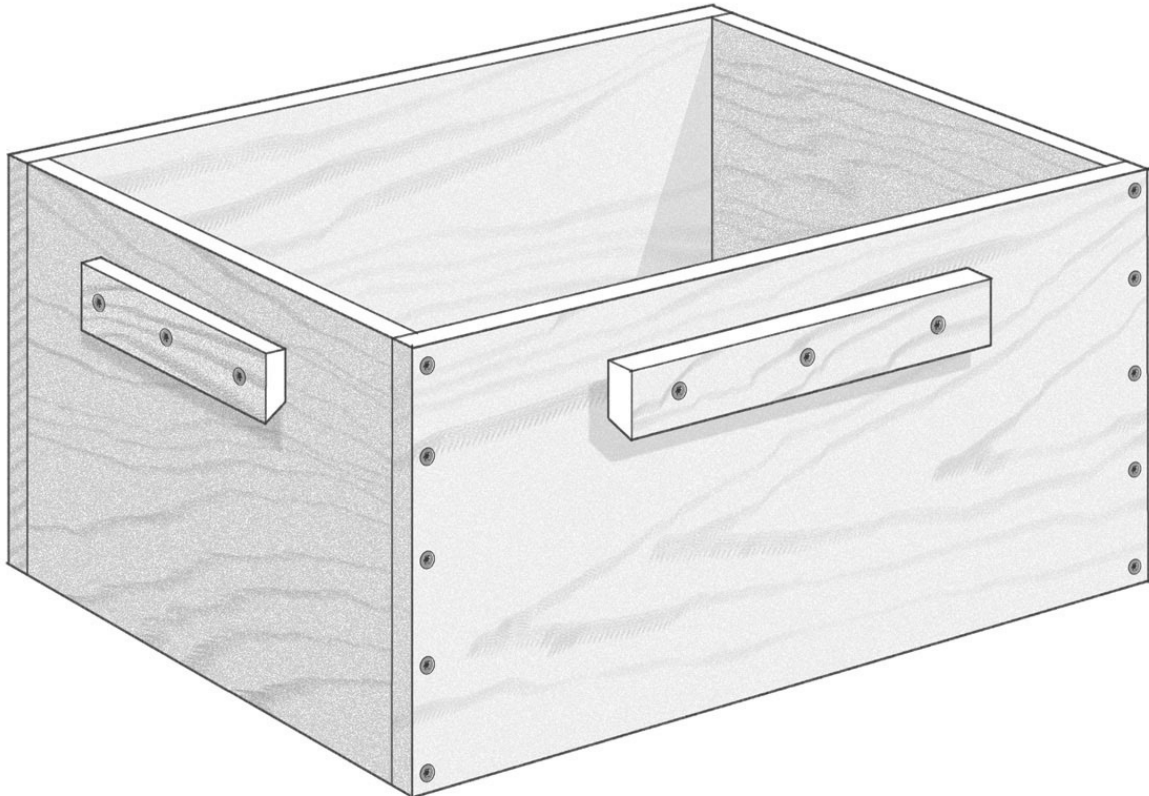
You can use any size of box for raising brood or storing honey. Personally, I've shifted toward having more room for brood. I've been leaving two 10-frame deeps and one medium on the hive year-round. These hives seem to do better. By leaving that extra super of honey on in the fall, there is less chance of the bees dying of starvation, and any honey not used gives them a good start in the spring as the queen kicks into gear. More room in the summer means more room for the queen to lay and less swarming. And more bees in the hive means more resiliency and better honey

production. (See 10-Frame vs. 8-Frame Boxes on **page 36** for more information.)

The thought of building your own hive boxes can be intimidating to some people. After all, the commercially made ones you see have those pretty, tight-fitting box joints and nicely cut, rounded handholds. For the most part, this is done on some very expensive, often computerized machinery. I watched a video of a machine that could make one end of a hive body in less than 10 seconds; the cost of the machine was a paltry \$80,000, plus tooling. It's going to take us a little longer to build our hive boxes, but the cost won't break the bank.

PROJECT

Hive Body with Butt Joints



With the modern glue and screws available today, we can make a perfectly strong and good-looking hive body using a simple butt joint. The project on **page 37** is virtually the same but uses rabbet joints for a slightly fancier treatment. So what are we waiting for? Let's get going. The hive body consists of two sides, two ends, and either two or four handholds.

Tools

Circular saw

Table saw

Combination square with protractor head (see step 3)

Drill with combination drill/countersink bit

Framing square

Pipe or bar clamps

Materials

One 6-foot pine 1×12 (you can also edge-glue narrower boards to get the width you need)

Twelve 1 1/4" deck screws

Twenty 2" deck screws

Waterproof glue

Sandpaper

1. Cut the side and end pieces.

Check the end of the 1×12 board with a square and trim it square, if necessary. Cut two pieces to length at 19^{7/8}". Cut two more pieces to length at 14^{3/4}". Set the fence on the table saw and rip all four pieces to 9^{5/8}". The longer pieces are the sides (A), and you're done with them. You'll use the leftover strips later for the handholds.

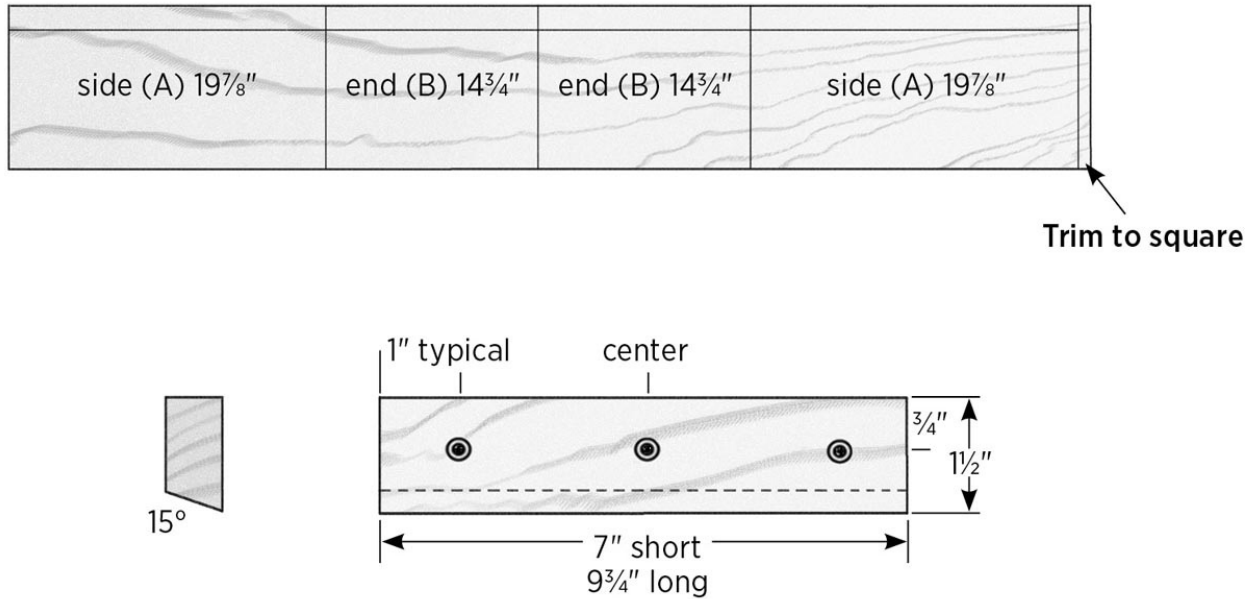
Work tip: For crosscutting the wide boards, a circular saw and an accurate crosscut guide will work. If you are using the table saw to cut the sides to length, it's best to cut the boards in half first. These shorter boards are easier and safer to handle, and you can get one side and one end from each piece.

2. Rabbet the end pieces.

The $14\frac{3}{4}" \times 9\frac{5}{8}"$ end pieces (B) each get a rabbet in their top inside edges to create rests for your store-bought frames. To cut the rabbets with a standard blade on a table saw, set up the saw with a zero-clearance fence (see [page 16](#)). Set the saw blade height to $\frac{3}{8}"$, and set the saw fence so it's $\frac{5}{8}"$ from the wood fence board to the far side of the saw blade.

Make a test cut in a piece of scrap, check the dimensions, and adjust as necessary. Make the shoulder cut (at $\frac{5}{8}"$) on both end pieces, then make the waste cuts by gradually moving your fence closer to the blade until the rabbet is finished.

Butt-joint hive body parts and cutting plan



ABOVE: *Predrill and counterbore $\frac{1}{4}$ " deep for $1\frac{1}{4}$ " deck screws.*

3. Create the handholds.

The leftover pieces from the ripped 1×12 are around 1¹/₂" wide, a good size for the handholds. First, set up the saw: Remove the zero-clearance fence. Using a combination square with a protractor head or whatever tool you have for measuring an angle, tilt your saw blade to approximately 15 degrees. Set the saw fence so that it's about 1¹/₄" to the nearest part of the saw blade.

Ideally, when you make the cut, there will be a small flat left on the top, as shown in Butt-Joint Hive Body Parts and Cutting Plan, on previous page. If you end up without a flat spot, just use some sandpaper to take off the sharp edge.

Make the beveled cut on enough material for four pieces at 7" long and four pieces at 9³/₄" long, then crosscut the pieces to length. (You can save the extras to use on your honey supers; see [page 39](#).)

ABOVE: *Butt-joint hive body assembly.*

4. Assemble the hive body box.

Mark each side piece for screws, as shown in Butt-Joint Hive Body Assembly, on **page 35**, and drill countersunk pilot holes at the marks, sizing the holes for 2" deck screws.

Apply a generous amount of glue on the ends of the end pieces, and clamp the box together, as shown. It's nice to have a helper for this step, or you can do one side at a time, if you wish. Tighten the clamps enough to hold things together, then check that all edges are flush and the box is square. It's also a good idea to make sure the frames you are using fit nicely with a little bit of play end-to-end.

Tighten the clamps. You should get some glue squeezed out. Confirm that the box is square and edges are still flush. Drill countersunk pilot holes on your marks and fasten the box with 2" deck screws. The hardest part about making the box with butt joints is dealing with warped boards; sometimes you have to start with one or two screws, then work the edge as you go, tapping the pieces one way or the other to keep them flush. Let the glue cure and remove the clamps.

Work tip: I used my table saw top to assemble my hive bodies. I lowered the blade and put a sheet of plastic down so the glue wouldn't stick or mar the surface. Also, the fence is perfect for use as a backstop when you line up and clamp everything together.

5. Install the handholds.

Use a combination square to draw layout lines for the handholds, 2" below the top of the box, near the center of each side. Then, mark the center of each side of the box on that line. Apply glue to the side of the handle that will go against the box. Position each handhold so its top edge is on the layout line and its center hole is over the center mark (the short handholds go on the end pieces). Fasten each handhold to the box with three 1 1/4" deck screws.

Congratulations. You have finished your first hive box. You must be dying to get some bees to put in it, but what's a house without a roof? We're not quite ready for bees yet. We still need to build inner and outer covers. See **page 40** to get started.

10-Frame vs. 8-Frame Boxes

Here in the Northeast, the tradition has been to use two deep, 10-frame boxes year-round for the bees, and add medium or shallow boxes for comb and extracted honey. But nowadays many new beekeepers, young and old, are leaning toward using all medium boxes, or using 8-frame hives (see **page 121**). Both are lighter to lift than the 10-frames, and there are other theories about the benefits of using 8-frame boxes:

- They are more similar to the shape and size of a hollow tree, where bees might nest if they were feral.
- The boxes are narrower, so as the bees naturally move up during the winter, they don't have to spread out as much to access the food supply. This can be a plus when the weather remains cold and the cluster is tighter.

Hive Body with Rabbet Joints

This deep hive body has the same overall dimensions as the butt-joint version (**page 33**), but it has rabbets on the end pieces (for joining the ends to the sides), as well as for the frame rests on the hive body. The different construction means the cutting list is somewhat different from that of the butt-joint body.

The advantages of a rabbet joint over a plain butt joint include a larger surface area for gluing and a solid surface to help line up the boards during assembly. When the sides are clamped together, any cupping is pulled in tight to the joint.

The tools and materials needed for this project are the same as for the butt-joint body, and the steps here follow many of the same techniques, so be sure to read that project first before starting this one.

Tools

Circular saw

Table saw

Combination square with protractor head (see step 3)

Drill with combination drill/countersink bit

Framing square

Pipe or bar clamps

Materials

One 6-foot pine 1×12 (you can also edge-glue narrower boards to get the width you need)

Twelve 1 1/4" deck screws

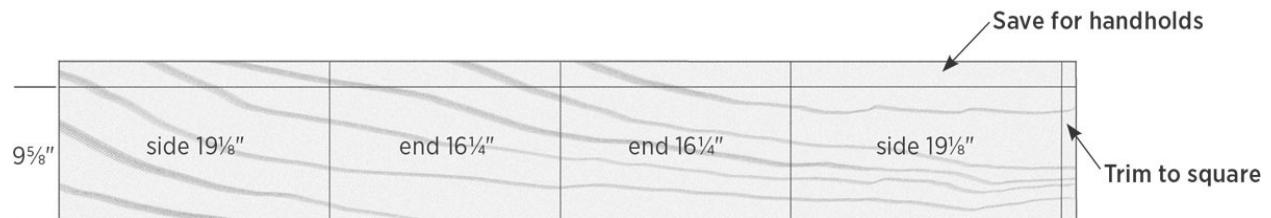
Twenty 2" deck screws

Waterproof glue

Sandpaper

1. Cut the box parts.

Cut the two end pieces to length at 16 1/4", and cut the two sides at 19 1/8". Rip all of the pieces to a width of 9 5/8", saving the cutoff strips for the box handholds.



ABOVE: *Cutting layout for deep hive body.*

2. Cut the rabbets.

Set up the table saw with a zero-clearance fence (see [page 16](#)), and set the table saw height at 3/8". Position the saw fence and cut a 5/8"-

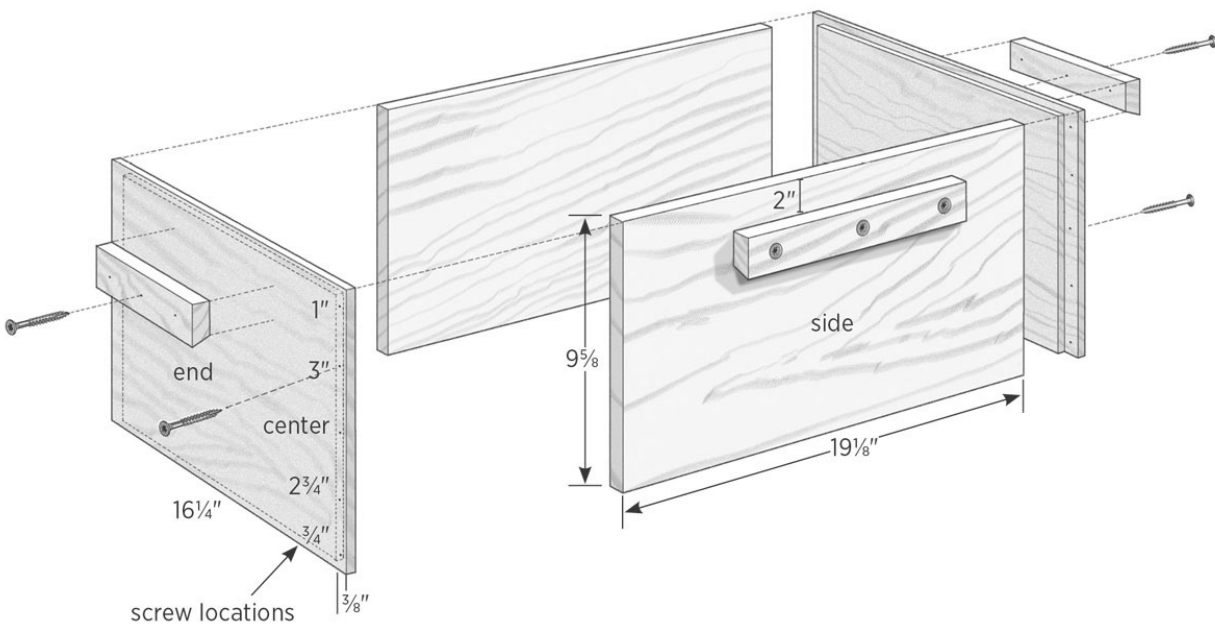
wide rabbet along *one long edge* of each end piece; these rabbets are the frame rests.

Reset the saw fence and cut a $\frac{3}{4}$ "-wide rabbet along *both short edges* of each end piece; these are for the joints with the side pieces, so the width must match the thickness of the side pieces. Touch up any rough edges with sandpaper.

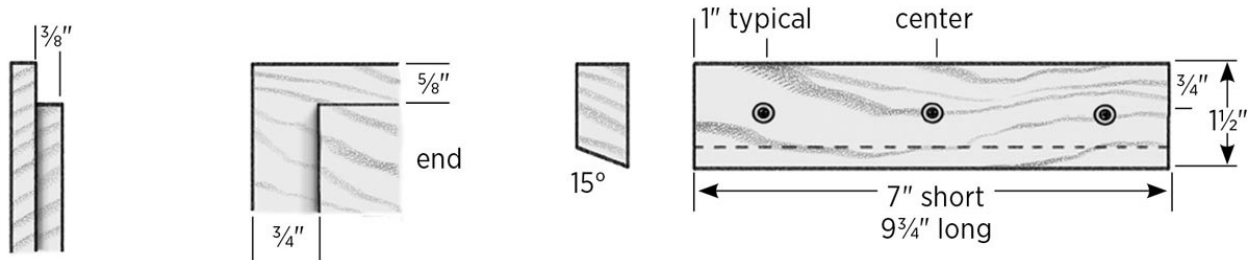
3. Assemble the hive box.

Dry-assemble the box with pipe or bar clamps to check the fit, then drill countersunk pilot holes, following the layout shown below.

Disassemble the box and apply glue to the rabbet joints. Clamp the box back together and drive 2" deck screws to complete the assembly. Let the glue dry as directed.



ABOVE: *Rabbet-joint hive body assembly.*



ABOVE: *Predrill and counterbore $\frac{1}{4}$ " deep for $1\frac{1}{4}$ " deck screws.*

4. Cut and install the handholds.

Create four handholds using the cutoffs from the side/end pieces, following step 3 on **page 35**. Install the handholds as described in step 5 on **page 36**.

Medium and Shallow Supers

Now that you've seen two methods for making hive bodies, you can use the same techniques to build your supers. It's nice to build one box each way so you get the hang of it. Once you've got it down, building more than one box at a time will really make things go faster. You can cut all of your boards and then set up just once for each operation, such as cutting the frame rests or making the rabbets for the sides.

Medium and shallow boxes are made exactly like the deep hive bodies described in the other projects in this chapter. The only differences lie in the heights of the boxes. The chart here shows cutting sizes for making supers with either butt-joint or rabbet-joint construction. The only additional wood you might need is for making the handholds. If you make short handholds

for the deep boxes, you may have enough leftover material for your supers. Another option is to start with a board one nominal size wider than you need, leaving plenty over for handholds and possibly a few other items. The medium and shallow supers call for 1×8 boards. The leftover strips from making shallow boxes will be enough for handholds.

Supers Cutting Chart

BUTT-JOINT BOXES	SIDES	ENDS
MEDIUMS 6 $\frac{5}{8}$ " HIGH	19 $\frac{7}{8}$ " LONG	14 $\frac{3}{4}$ " LONG
SHALLOWS 5 $\frac{1}{16}$ " HIGH	19 $\frac{7}{8}$ " LONG	14 $\frac{3}{4}$ " LONG
RABBET-JOINT BOXES	SIDES	ENDS
MEDIUMS 6 $\frac{5}{8}$ " HIGH	19 $\frac{7}{8}$ " LONG	16 $\frac{1}{4}$ " LONG
SHALLOWS 5 $\frac{1}{16}$ " HIGH	19 $\frac{7}{8}$ " LONG	16 $\frac{1}{4}$ " LONG

CHAPTER FOUR

Put a Lid on It

CHAPTER CONTENTS

Basic Inner Cover

Insulated Inner Cover for Winter

Screened Inner Cover

Telescoping Outer Cover

There are two covers typically used on a hive: an outer cover and an inner cover. The standard outer cover found here is used all year round. It's heavy and protects the hive from the elements. It extends over all four sides, can be made of solid wood or plywood, and has a metal top for long life.

Inner Cover Design

The inner cover, while being a simple piece of beekeeping equipment, can be made in many different ways to serve many purposes. First of all, it acts as the top of the brood chamber and defines the space in which the bees live and work. Bees don't usually build comb above it unless they are really cramped for space. It also creates an insulating air space between the top of the frames and the outer cover, which can get pretty hot in the afternoon sun.

Standard inner covers usually come with a center slot that is made to fit a bee escape. When it comes time to remove honey supers, a bee escape is placed in the slot. This contraption allows the bees to go back down into the hive through two channels that have flexible spring wire at the ends. The bees can go through the springs into the hive, but not in the other direction to get back up into the supers. While this type of bee escape is still available, and manufacturers still make slotted inner covers, many other methods have been devised for getting the bees out of the supers faster and more efficiently. For our purposes, this also gives us more flexibility with slots or holes in our inner covers. Inner covers can have several special features, including:

- Screening for ventilation

- Holes for feeding
- Insulation for keeping the hive warmer and drier in wintertime
- Built-in upper entrance — handy when there is snow piled up but the temperature is warm enough for a cleansing flight; also provides air circulation

PROJECT

Basic Inner Cover



Inner covers are very easy to make, and you'll get a sense of satisfaction when you assemble yours and feel how solid they are. You can build this cover with almost any type of wood. Some cover designs have a center board made of hardboard, but this material can sag under the weight of a feeder placed on top. I prefer to use plywood for the center board and regular pine for the frame. I usually save strips of wood from other projects and use them for the inner cover frames. Lauan plywood is fairly strong and inexpensive, and it works well for the center board.

Tools

Table saw

Drill with bits:

- Combination drill/countersink bit
 - 1 1/4" or 1/2" drill bit (see step 3)
-

Jigsaw

Materials

One 3-foot pine 1×4

One piece 1/4" lauan (or other) plywood, 17 7/8" × 14 1/4" minimum

Waterproof glue

Four 1 5/8" deck screws

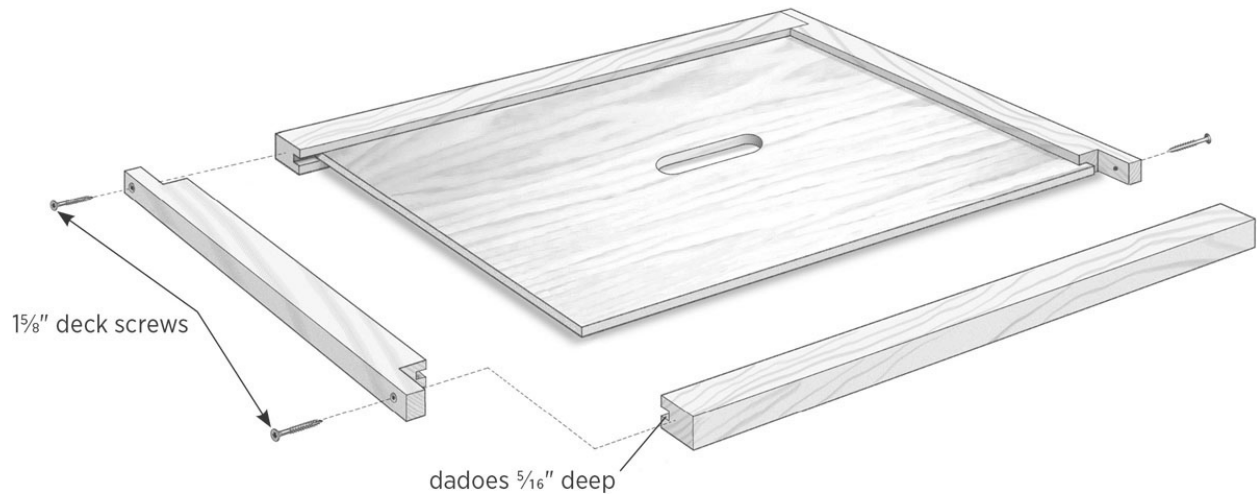
1. Dado and cut the side and end pieces.

The center board is captured in dados cut into the frame's end and side pieces, all of which are cut from the single piece of 1×4. First, you'll mill a dado on each long edge of the board, then you'll rip the side and end pieces to width.

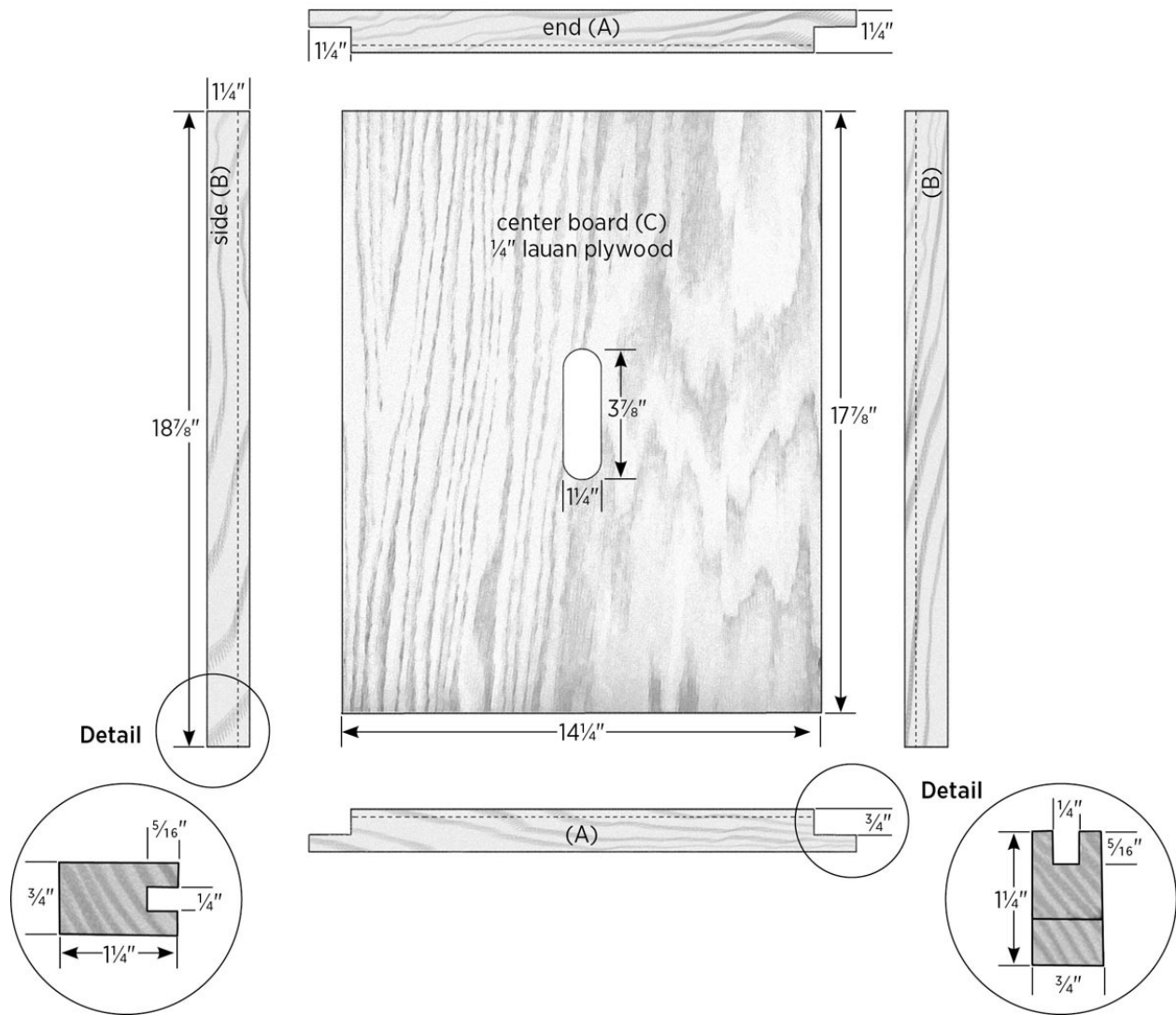
Set the blade height on the table saw to 5/16", and position the fence away from the blade a distance equal to one-half the thickness of the 1×4 minus one-half the thickness of the lauan plywood. Cut one side of the dado, then flip the board end-to-end and cut the other side. (If your blade's kerf — the width of its cut — is at least 1/8", you can complete the dado with these two passes; otherwise, you'll have to move the fence out a bit to clean up the middle of the dado.) Make

sure the plywood fits nicely into the dado, then repeat the process to dado the other long edge of the 1×4.

Set the saw fence to 1 1/4" and rip one strip from each side of the board. From each of these strips, cut one piece to length at 16 1/4" (the end pieces, A) and one piece at 18 7/8" (the side pieces, B).



ABOVE: *Basic inner cover parts.*



ABOVE: *Basic inner cover — exploded view.*

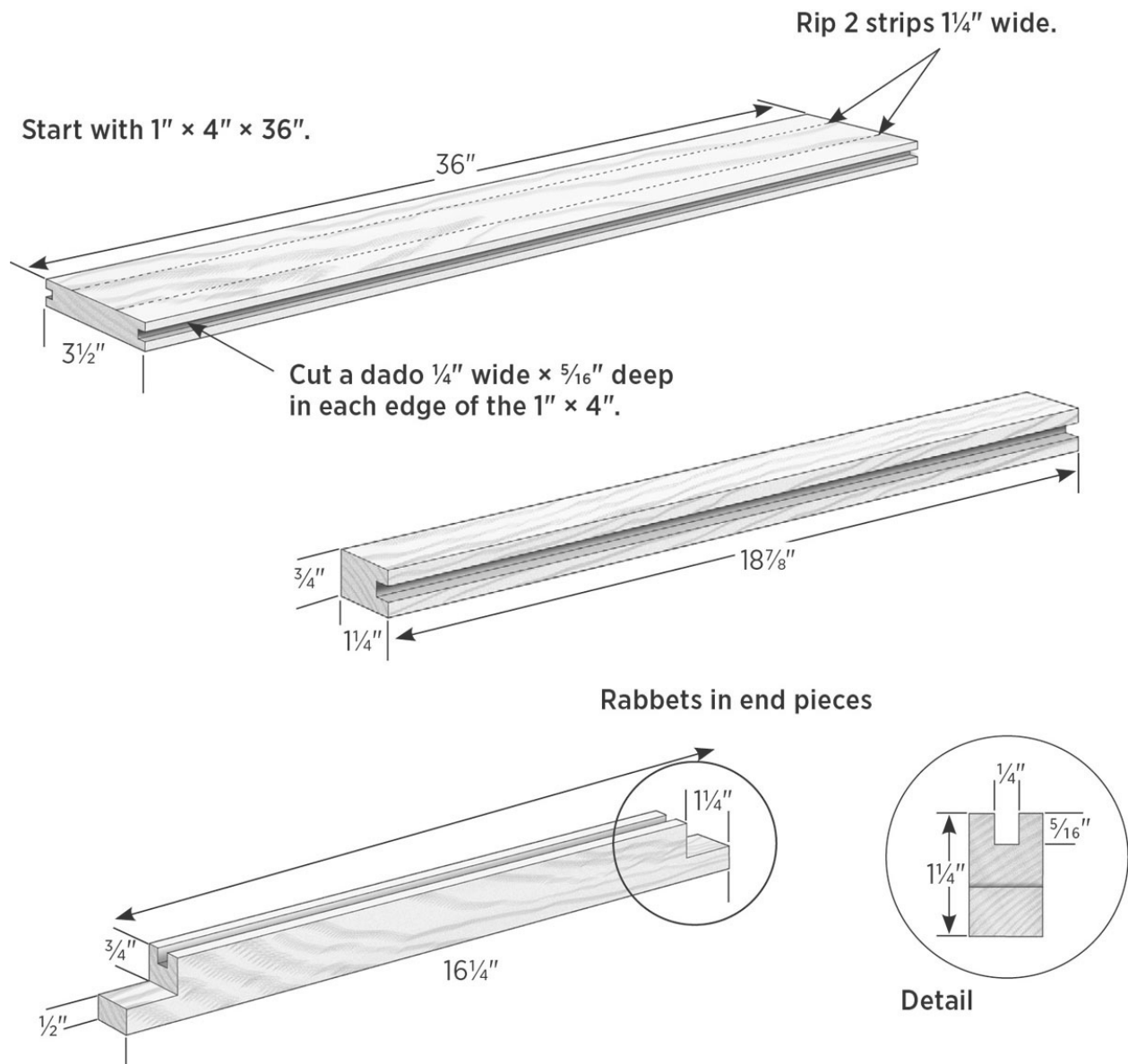
2. Rabbet the end pieces.

Each of the 16 $\frac{1}{4}$ " end pieces gets a $\frac{3}{4}$ "-deep \times 1 $\frac{1}{4}$ "-wide rabbet on both ends; these are on the same side as the dado for the center board. You can cut the rabbets with a router table, a radial arm saw, or a table saw (with a standard or dado blade). Here's the process for using a table saw with a standard blade: Set the blade height at $\frac{3}{4}$ ",

and set the fence so it measures $1\frac{1}{4}$ " from the fence to the far side of the blade.

Using the miter gauge, make a test cut in a piece of scrap and check your dimensions.

Cut each rabbet starting with the board's end against the fence, then gradually move your piece away from the fence with each successive pass, taking small cuts until your rabbet is complete.



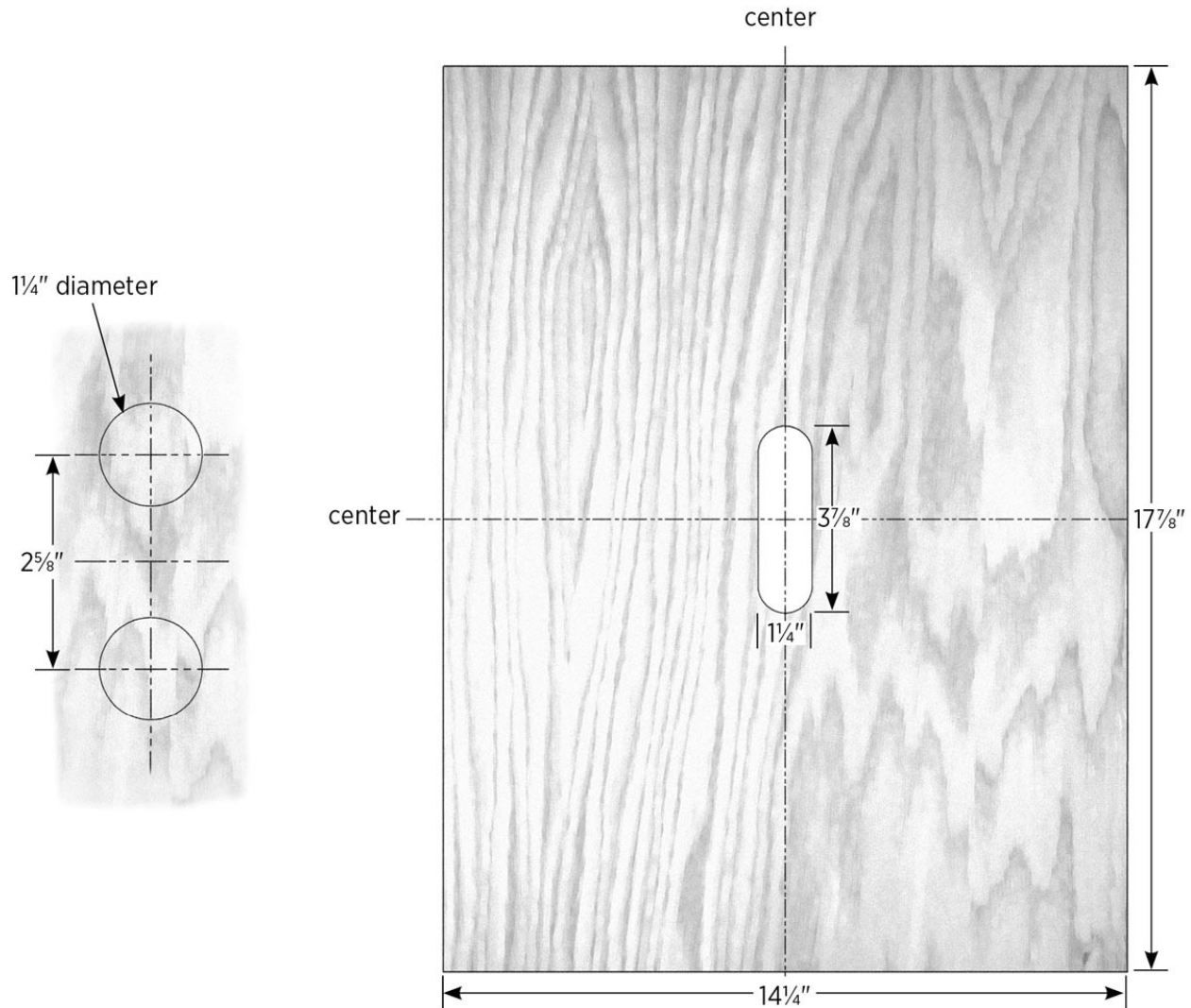
ABOVE: *Side and end pieces.*

3. Prepare the center board.

Cut the plywood to size at $17 \frac{7}{8}$ " long \times $14 \frac{1}{4}$ " wide. The standard size of slot in the center is $1 \frac{1}{4}$ " wide \times $3 \frac{7}{8}$ " long.

Work tip: These slot dimensions follow the traditional size for fitting "Porter-style" bee escapes, which are seldom used today. If you're planning to build an escape board, which is much more effective for getting supers off (see Escape Boards on **page 83**), the size of this slot isn't critical.

To make the slot, draw centerlines and layout marks on the plywood as shown. Drill two $1 \frac{1}{4}$ " holes, then use a jigsaw to cut straight lines between the outsides of the holes to complete the slot. Alternatively, you can drill a starter hole inside the marked slot area (using a bit that's bigger than your jigsaw blade; $\frac{1}{2}$ " works for most blades), then cut out the slot entirely with the jigsaw. To prevent excessive tearout (splintering caused by the bit exiting the backside of the plywood), clamp the center board to a sacrificial scrap of wood before drilling, especially if you're using the $1 \frac{1}{4}$ " bit.



ABOVE: *Slot layout in plywood.*

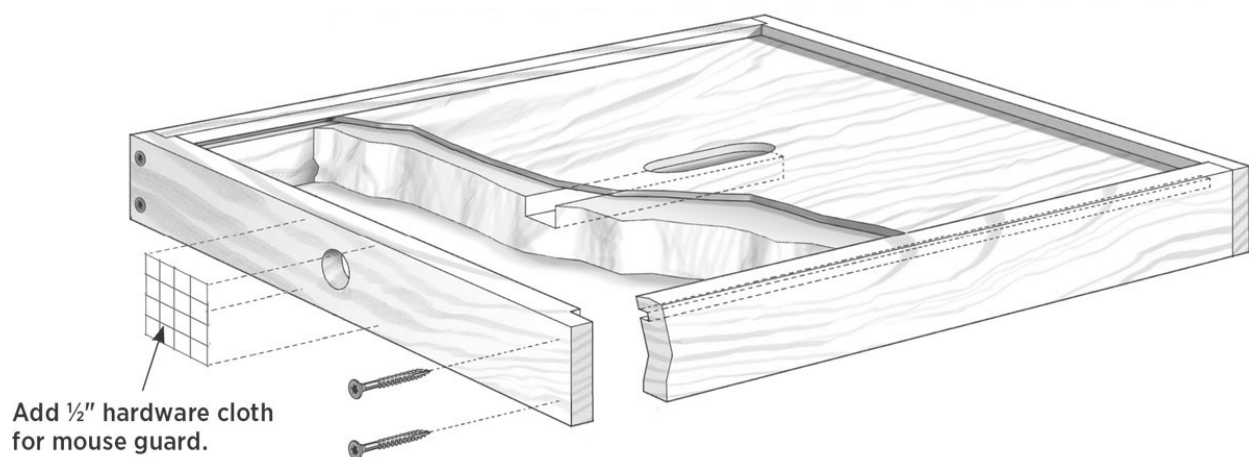
4. Assemble the cover.

Dry-assemble the project to make sure everything fits before the glue-up. Drill countersunk pilot holes in the end pieces as shown in Basic Inner Cover — Exploded View, on **page 42**. Disassemble the pieces, apply glue to the rabbet joints, reassemble the cover, clamp the assembly, and check that the frame is tight and square. The plywood does not get glued so it can “float” in the dadoes. Secure the

frame with 1⁵/₈" deck screws, and let the glue cure as directed. You're done. That was easy.

PROJECT

Insulated Inner Cover for Winter



ABOVE: *Note that this image is inverted to show cutaway detail:
install the cover in hive plywood-side down.*

Northeast winters bring lots of snow, extended periods of cold, and icy winds, and my area of western Massachusetts gets all of that. Houses here have thick layers of insulation, and heavy sweaters abound. While you can't knit sweaters for each of your bees, you can insulate their "attic." Besides preserving heat, the main reason for insulating a hive is to prevent moisture from condensing inside the hive and killing the bees.

If you live in a cold climate, you may want to build this insulated inner cover, which allows moist air to escape. It also provides an upper entrance that's handy on those occasional warm winter days

when the hives may be mostly buried in snow. This project includes a spacer that can be used for queen introduction, feeding, or medicating your hive (see chapter 6 for more information on using spacers).

Beekeeping advice: When I fell through the ice on the river by our house, my clothes were frozen almost solid by the time I got back indoors. As quickly as I could, I got out of the wet clothes and into a hot shower. If bees get cold and wet in the wintertime, they will die.

Tools

Table saw

Drill and 1" Forstner, brad point, or spade bit

Utility knife

Jigsaw

Router and straight bit with at least 1" cutting depth

Materials

One 6-foot pine 1×4

One piece 1/4" lauan plywood, 15" × 19" minimum

Waterproof glue

Twelve 1 ⁵/₈" deck screws

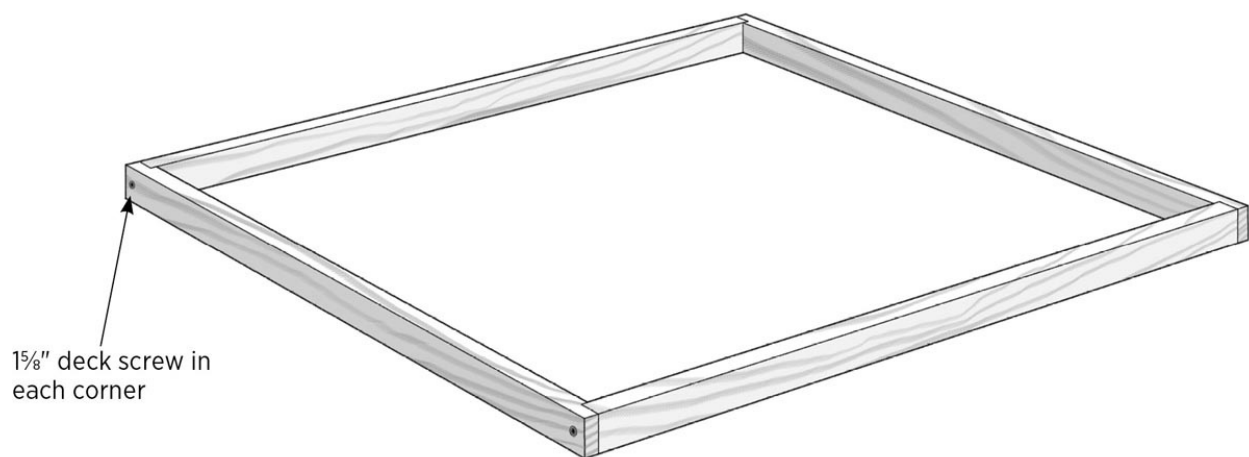
One piece 2"-thick rigid foam insulation board, 15" × 19" minimum (or two pieces of 1"-thick board; see step 7)

One piece 1/2" galvanized hardware cloth, 2" × 2" minimum

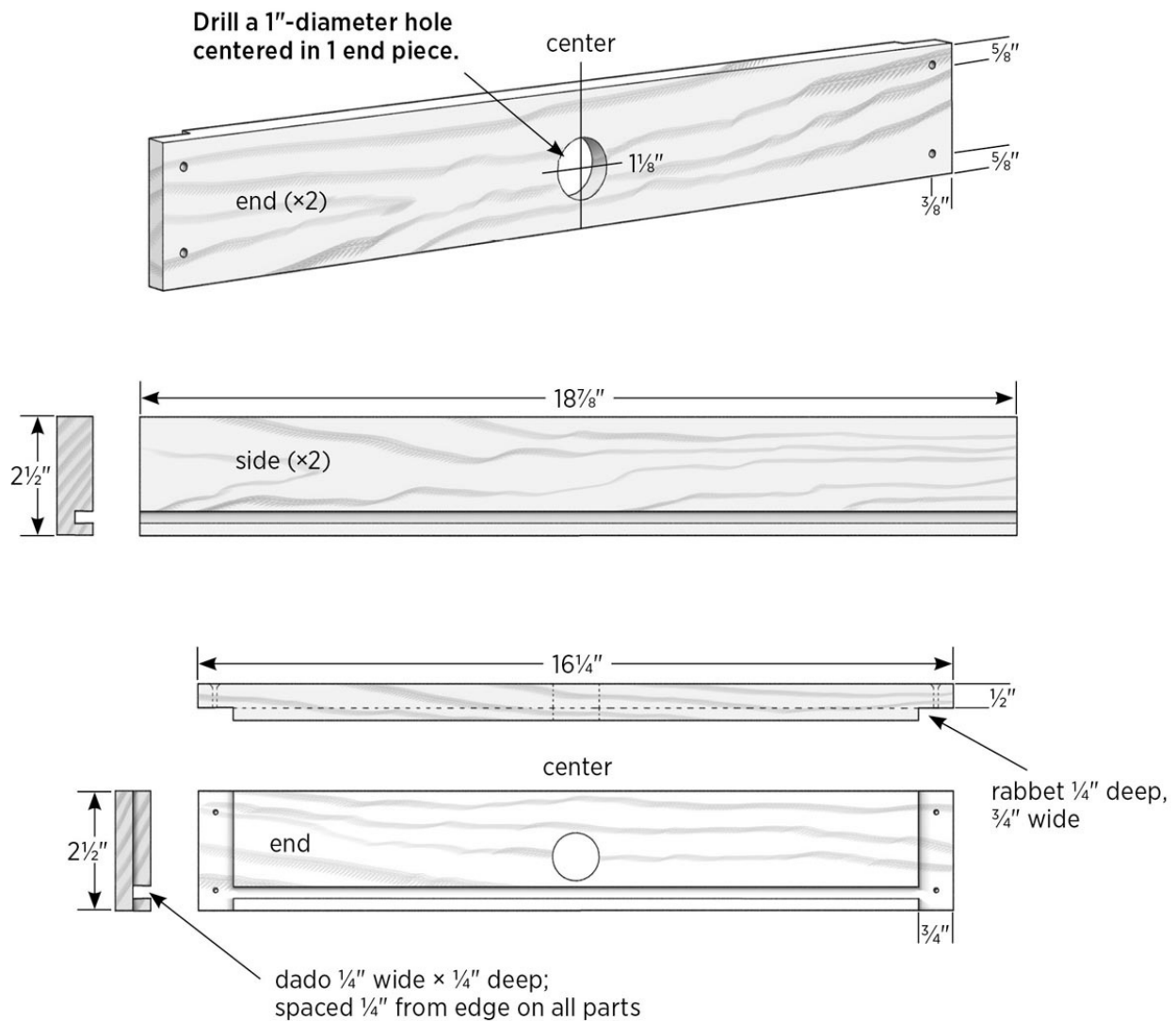
1. Cut and dado the frame sides and ends.

Cut two pieces of 1×4 to length at 16 ¹/₄" (for the ends) and two pieces at 18 ⁷/₈" (for the sides). Set the table saw fence and the blade height to ¹/₄" (as in previous projects, you can also use a dado blade or router table, but a standard blade on a table saw works fine). Cut a ¹/₄"-wide × ¹/₄"-deep dado into each piece, with the bottom of the dado ¹/₄" from the bottom edge of the piece, as shown in Insulated Cover Frame Parts, on facing page. Test-fit the plywood in the dadoes; a little bit of play is fine.

Insulated cover frame parts



ABOVE: *Hive spacer made from leftover wood.*



2. Rabbet the end pieces.

With the saw blade still set to $\frac{1}{4}$ ", reset the fence and cut a $\frac{3}{4}$ "-wide rabbet on each end of the two $16\frac{1}{4}$ " end pieces.

3. Rip the frame pieces to width.

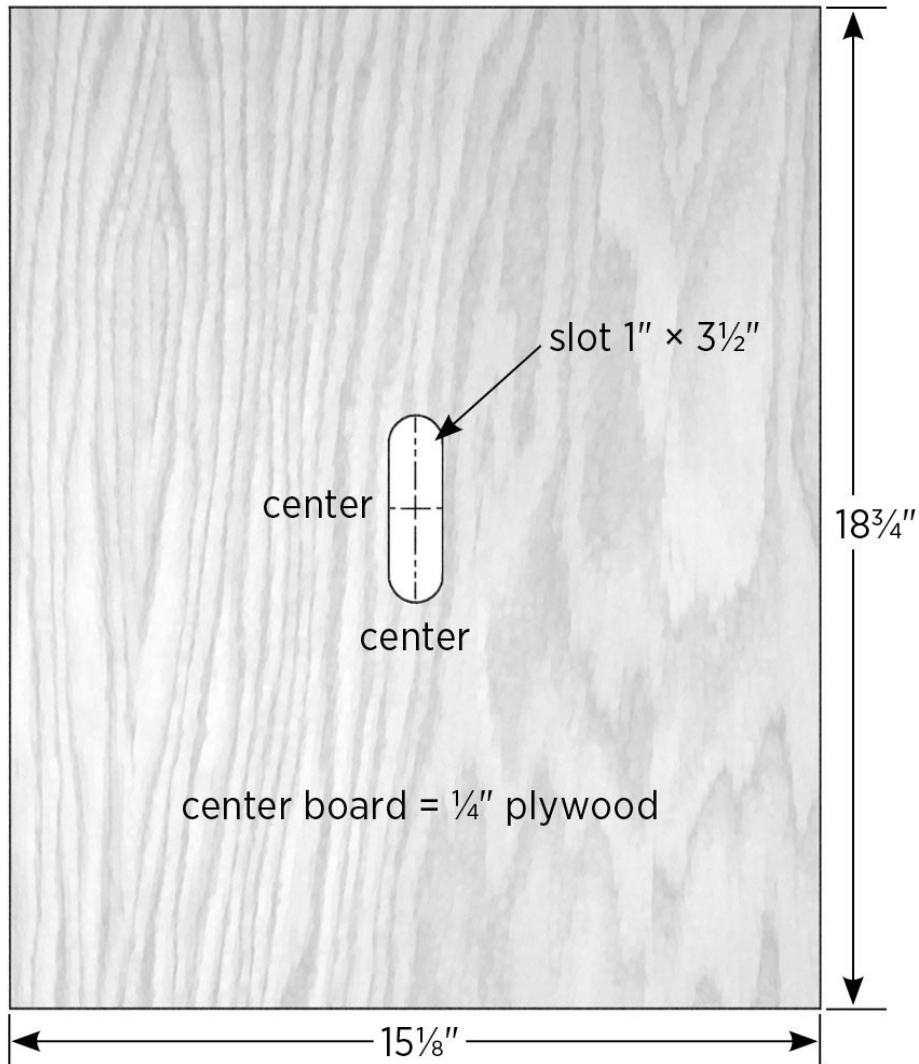
Set the saw fence at $2\frac{1}{2}$ ". Rip all four frame pieces to this width, making sure the dadoed edge is against the fence. Save the leftover pieces; you'll use them for making the hive spacer (step 9). On each end piece, mark $\frac{3}{8}$ " in from the ends and about $\frac{5}{8}$ " from the top and bottom edges for screw holes, then drill countersunk pilot holes.

4. Drill the upper entrance/vent hole.

Mark the location of the upper entrance/vent hole onto one of the end pieces by drawing a center line at $8\frac{1}{8}$ ", then measuring up $1\frac{1}{8}$ " from the bottom edge (closest to the dado) and marking a cross line (see Insulated Cover Frame Parts, facing page). Drill a 1" hole at the mark. You can use a Forstner, brad point, or spade bit. To prevent tearout with a spade bit, drill through from one side just until the tip of the bit comes through the other side, then flip the board over and finish the hole from the other side.

5. Cut and slot the center board.

Cut a piece of $\frac{1}{4}$ " lauan plywood to size at $18\frac{3}{4}$ " long \times $15\frac{1}{8}$ " wide. Mark the center of the width and length of the piece. Draw a centered line lengthwise and lay out a $1" \times 3\frac{1}{2}"$ slot, as shown. Drill 1" holes at each end of the slot layout, then connect the holes with a jigsaw to complete the slot.



ABOVE: *Plywood cutting diagram.*

6. Assemble the cover frame.

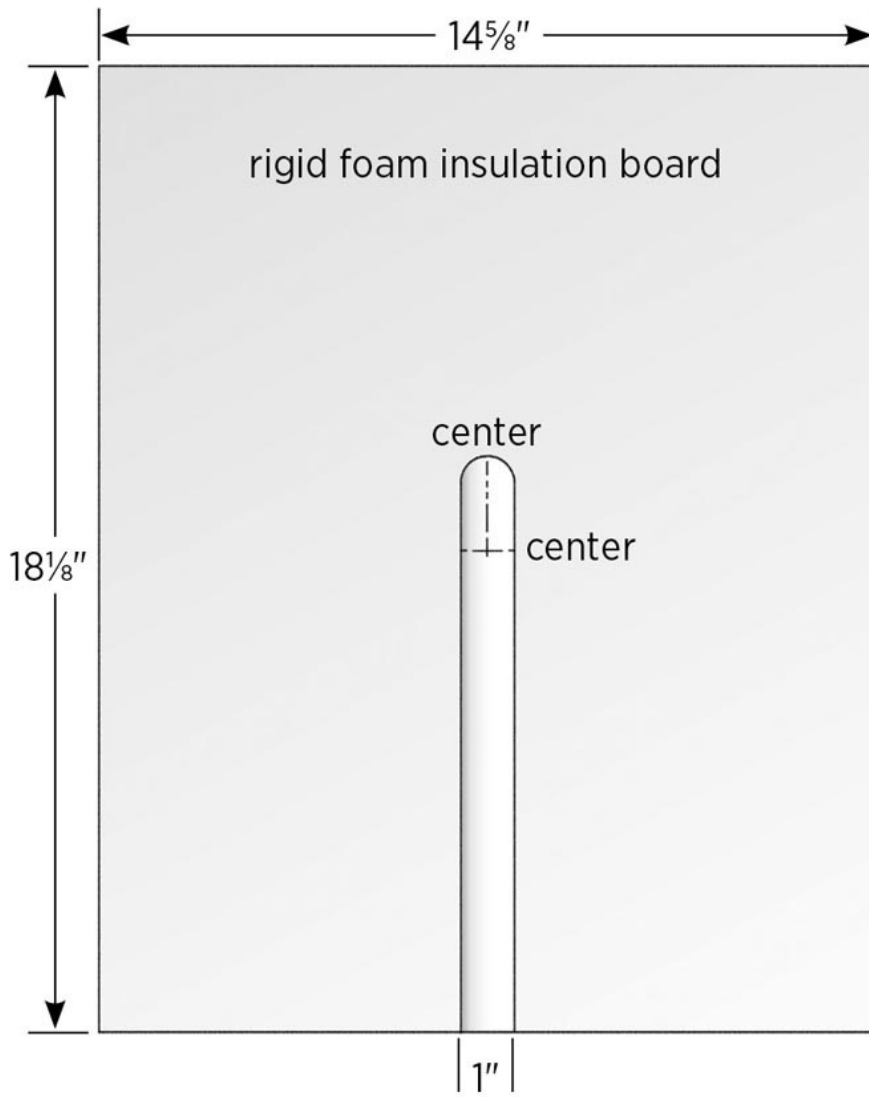
Dry-assemble the frame and center board to make sure all of the pieces fit well. Apply waterproof glue to the rabbets of the end pieces, and fasten the pieces with $1\frac{5}{8}"$ deck screws. There's no need glue the center board in place; it just floats in the dadoes. Let the glue dry as directed.

7. Add the insulation board.

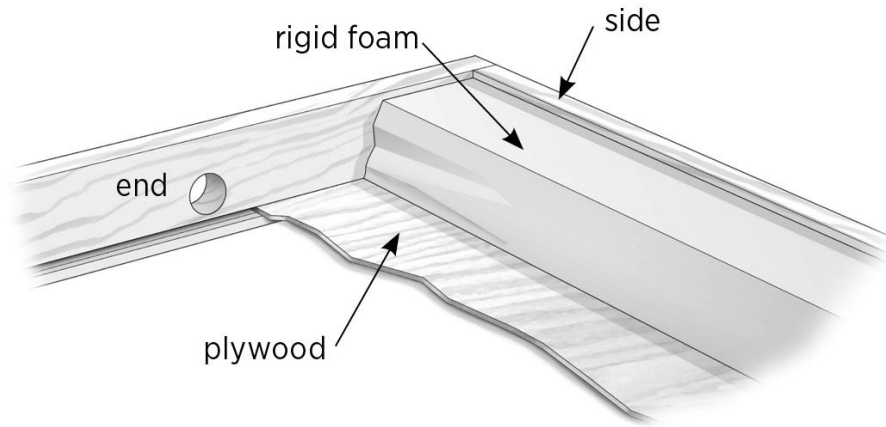
Cut a piece of 2" rigid foam insulation to size at $18\frac{1}{8}" \times 14\frac{5}{8}"$, using a utility knife (mark and cut from both sides of the board, then snap off the waste pieces). Set the cut foam into the assembled frame, and use a marker to trace around the slot in the center board and the hole in the end piece. Remove the foam and extend the slot lines all the way to the end-hole. Clamp a straightedge to the foam as a guide, and use a router to cut a 1"-deep channel along the marked slot lines (you might want to make this cut in two passes).

Alternatively, you can use two pieces of 1"-thick foam board: Cut the pieces to size, then set one piece into the frame and trace the slot, extend the lines, and cut out the slot with a utility knife. The nice thing about using 1" board is that you don't need a router to make the slot — a very messy process.

Place the rigid foam into the frame with the slot facing the center board. The foam board doesn't have to be tight-fitting and doesn't get glued down; it just sits in place.



Or use 2 pieces, each 1" thick.



ABOVE: *Cover frame — cutaway view.*

8. Install the screen and cover.

Cut a piece of $\frac{1}{2}$ " galvanized hardware cloth to size at about 2" square and staple it over the hole in the end piece of the frame. Position it so the bees have the most access. Its purpose is to keep those pesky mice from entering the hive and building a nice winter home.

Now that your cover is completed, you can install it on the hive. Remove the regular inner cover, and position your winter cover with the plywood side facing down. Set the outer cover back on and be sure to put your stone or other weight back on top to keep the outer cover from blowing off in the strong winter wind. Your bees will now be cozy and warm, plus they'll have ventilation, and an upper entrance if needed.

9. Build the spacer.

Clamp leftover pieces from step 3 together as shown in Insulated Cover Frame Parts, on **page 46**, and drill a countersunk pilot hole $\frac{3}{8}$ " from each end and centered over the board's thickness.

Reassemble the frame with glue and $1\frac{5}{8}$ " deck screws, and let the glue dry. You now have a handy spacer.

PROJECT

Screened Inner Cover

Someone once gave me a box of bees that had a screened inner cover, and it was screwed down for transportation. I don't remember exactly how it was made, but I think the screen was just sandwiched between the boards. I know I had planned on taking it off and replacing it with a regular inner cover, but the only time I thought of it was when I stopped to check the hives in that yard, and I never remembered to bring one. Well, late fall came and I found myself there again with no replacement, so the hive went through the winter with a screened inner cover, and came through with flying colors.

I'm not endorsing overwintering with a screen on the top of your hive, but screened covers do have their uses. For one, you can pop off the telescoping cover and see more of what's going on inside with a quick peek through the screen. It's easy to see how many frames the bees are working on without really disturbing them. And you can prop up the outer cover for ventilation and not worry about other bees getting into the honey stores and robbing the hive.

Following is my design for a screened cover. If you've already done some of the projects in this book, you'll be familiar with the steps required. I start with the same frame that I make for my Basic Inner Cover ([page 41](#)) and modify it to take the screen and slats that hold the screen in place.

Tools

Table saw

Drill and combination drill/countersink bit

Tin snips

Electric brad nailer (optional but helpful)

Materials

One 3-foot pine 1×4

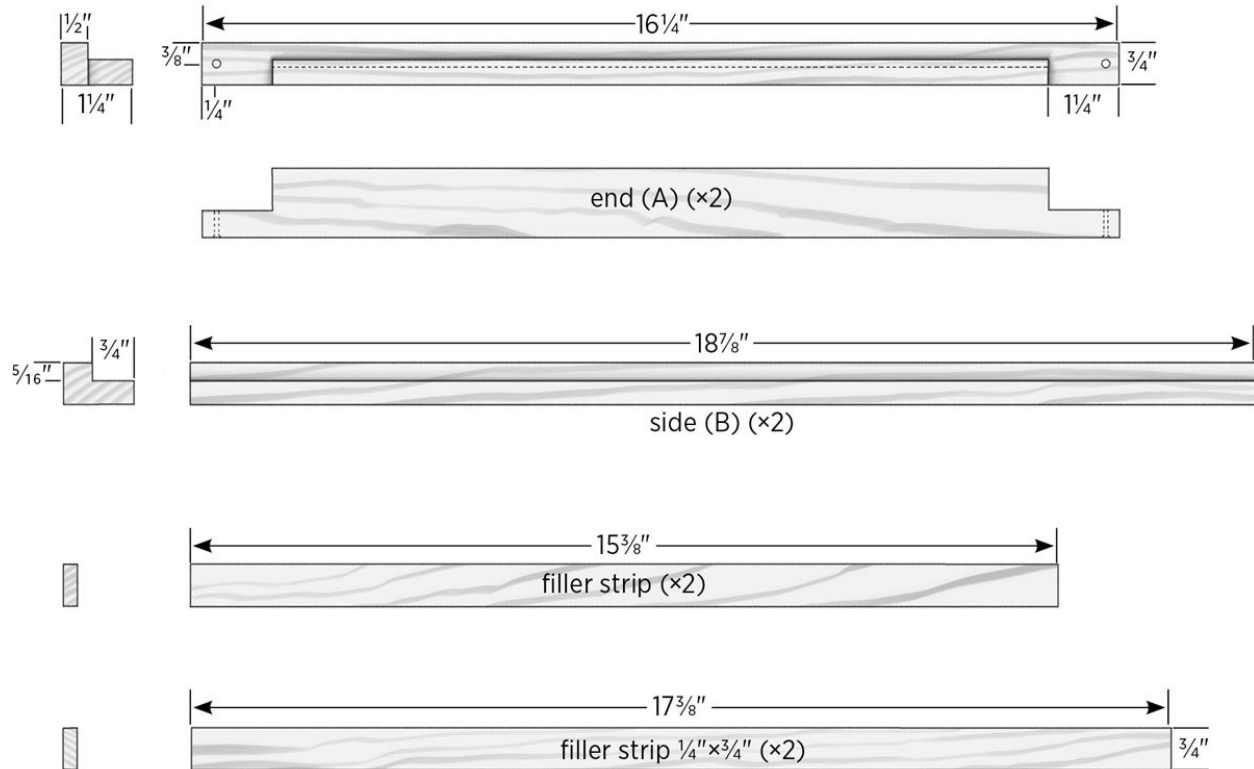
One piece #8 galvanized hardware cloth, 15" × 18^{3/4}" minimum

Waterproof glue

Four 1^{1/4}" deck screws

1" (or longer) brads or wire nails (see step 5)

Safety note: On my table saw, there is too much clearance between the blade and the removable insert plate to safely cut a 1/4"-wide strip between the fence and blade without the cut-off wood getting pulled down inside the table. One way around this is to cut a strip from the outside edge of a wider board. Instead, I created zero-clearance slot (not to be confused with the zero-clearance fence on **page 16**) around my blade as follows: I set the fence to 1/4" and lowered the blade, then clamped a piece of 1/4" lauan plywood to the table. I turned on the saw and slowly raised the blade to cut through the plywood until it was high enough to rip my 1/4" strips. After cutting, I shut off the saw, lowered the blade, and removed the plywood.



ABOVE: *Screened inner cover wood parts.*

1. Cut the frame rabbets.

Start by cutting two $\frac{5}{16}$ "-deep \times $\frac{3}{4}$ "-wide rabbets into one face of the 1 \times 4 board. Set up a zero-clearance fence on a table saw (see **page 16**), and position the wood fence at $\frac{3}{4}$ " to the far side of the saw blade. Set the blade height at $\frac{5}{16}$ ". Make the first cut, then turn the board end-for-end, with the same face down, and make the same cut. If you're using a standard blade, continue to move in the fence a little with each successive pass to complete both rabbets.

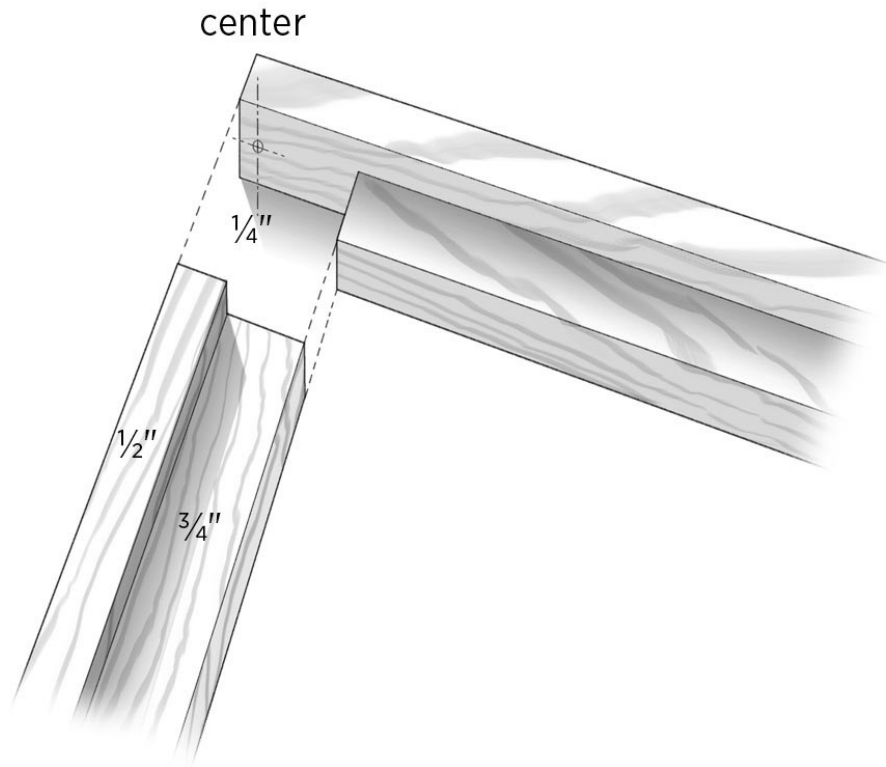
2. Rip the side and end pieces

Set the saw fence at $1\frac{1}{4}$ " and the blade height at 1". Rip both sides of the board. Save the scrap piece for the filler strips. From each of your two ripped pieces, cut one piece to length at $16\frac{1}{4}$ " (for the ends, A) and one at $18\frac{7}{8}$ " (for the sides, B).

3. Notch the end pieces.

The two end pieces are notched out to accept the side pieces. Set the saw blade height at $\frac{3}{4}$ " and set the fence at $1\frac{1}{4}$ " to the far side of the blade. Test-cut a scrap piece, using the miter gauge to guide the piece. Notch both ends of each end piece as shown in Screened Inner Cover Parts, above. When the sides and ends are fitted together they form a channel for the screen and filler pieces to rest in.

Test-fit the sides and ends to confirm a good fit as shown here, then drill countersunk pilot holes into the ends, $\frac{1}{4}$ " from each end and centered on the $\frac{3}{4}$ " thickness, as shown in Screened Inner Cover Parts.



ABOVE: *Test-fitting the end and side pieces.*

4. Cut the filler strips.

Set your saw fence at $\frac{1}{4}$ ", and carefully rip two strips from the leftover 1x4 material; the ripped pieces should measure $\frac{1}{4}$ " x $\frac{3}{4}$ ".

From the ripped strips, cut two pieces to length at $15\frac{3}{8}$ " and two at $17\frac{3}{8}$ ".

5. Assemble the cover.

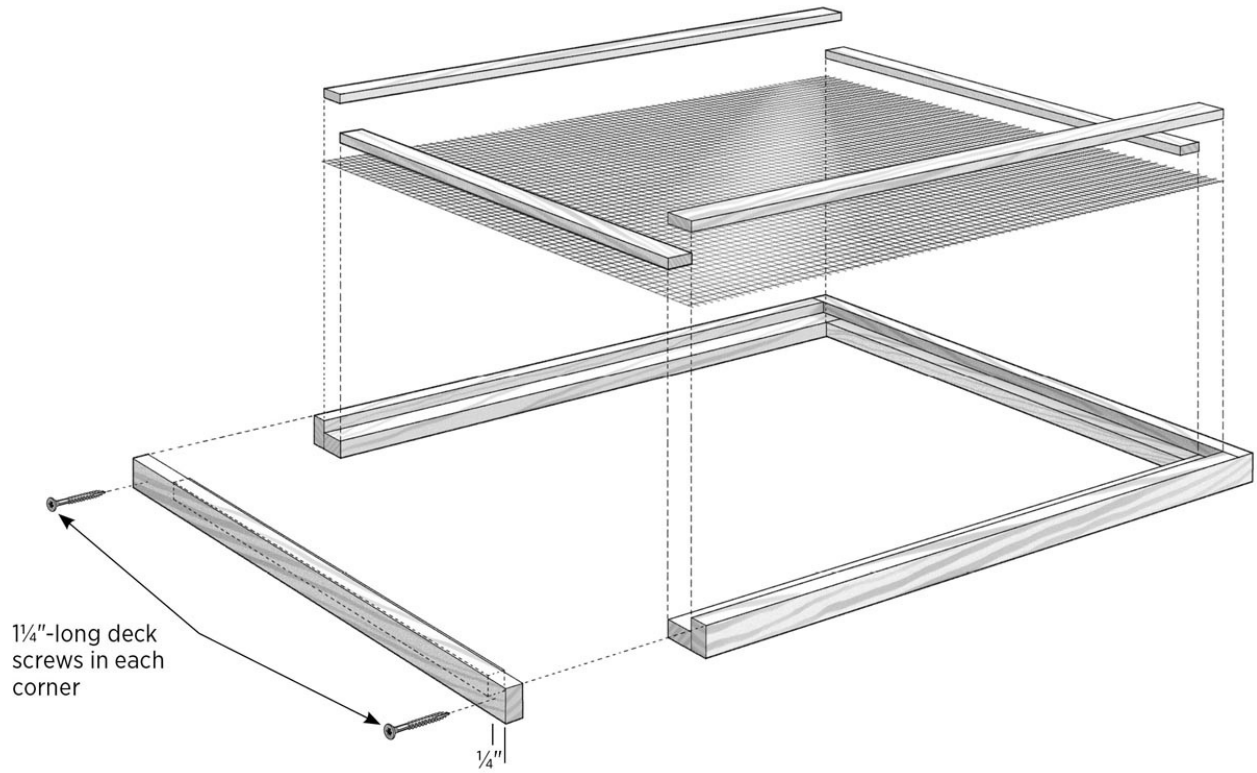
Cut a piece of #8 hardware cloth to size at $15\frac{1}{4}$ " wide x $18\frac{3}{4}$ " long. Dry-assemble the frame pieces and check the fit of the screen and filler strips in the frame recesses. Apply glue generously to one end of each side piece, position the mating end piece over the sides, and

fasten the pieces with 1¹/₄" deck screws, being careful not to overtighten the screws. Turn the frame around and repeat for the other end, making sure the frame remains flat and square.

Apply a good bead of glue on the bottom and sides of the recess. Put the screen in place and install one end filler strip. Fasten the strip with 1¹/₄" brads, spaced about every 3"; the brads will protrude through the back side of the frame, so set the assembly on a scrap piece of insulation board or other material before nailing. Place and nail off the remaining strips one at a time, keeping the screen flat as you go. When all pieces are nailed, flip the cover over and use a hammer to bend over the nails and pound them flat to cinch them down for a secure (and safe) connection.

If desired, drill a couple of countersunk holes on each side of the frame to give yourself the option of screwing it down on the hive body or super.

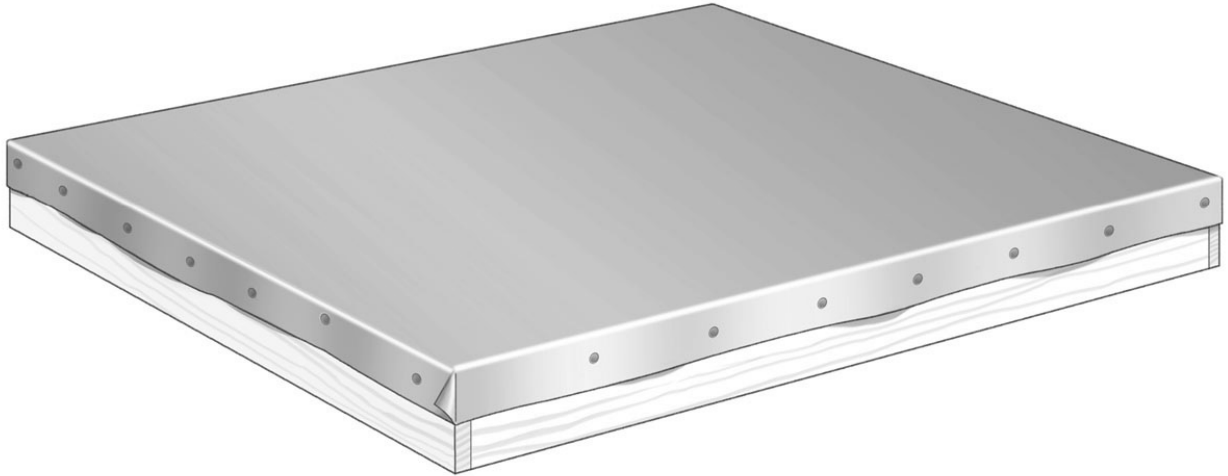
Assembled screened cover frame



ABOVE: *One option is to drill/countersink holes through the top of frames for screwing into hive body. This is helpful for moving hives.*

PROJECT

Telescoping Outer Cover



When I first heard the term “telescoping cover,” I envisioned something that could be adjusted to be big or small, like a telescoping tripod. Come to find out, this was not the case at all. It simply meant that the cover extends over the sides of the hive. I told you that beekeeping terms could be confusing.

The nice thing about telescoping covers, and this design in particular, is that there’s room for substitution of materials. The frame is made from 1-by pine lumber, but you can use plywood, tongue-and-groove boards, or solid boards for the top. You can cover it with aluminum coil stock, like that used for flashing and gutter making. If you come across some of the old newspaper plates that are thin aluminum, those also work.

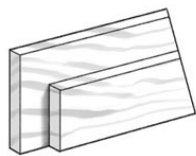
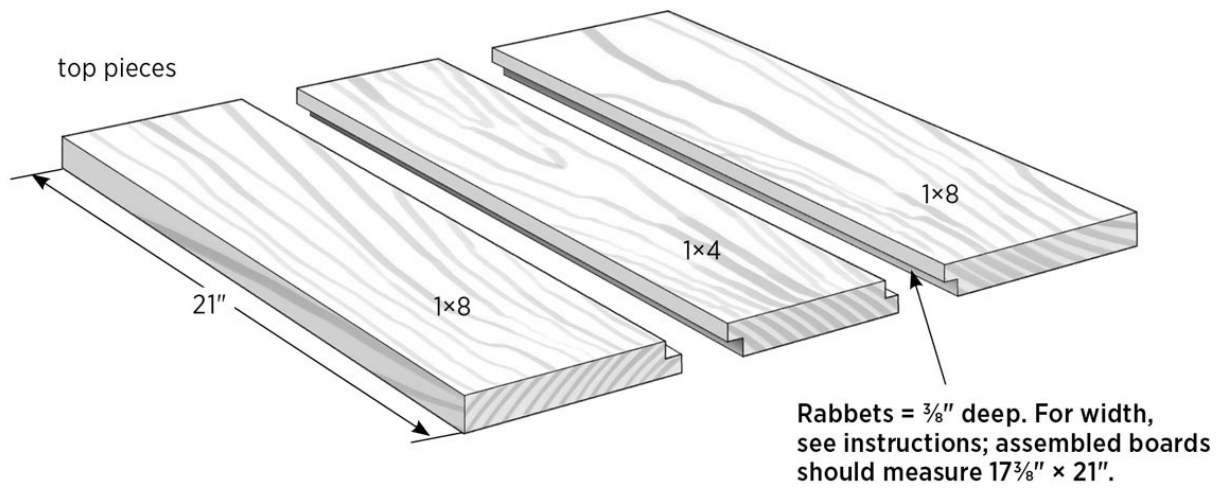
You can buy preformed pans from places like Betterbee or other supply houses, or even just caulk and paint. One time, in a pinch,

when I didn't have any metal and needed a cover for a swarm hive, I simply stapled a plastic garbage bag over a piece of plywood and nailed a couple of cleats on the ends to get by until I had time to make a proper cover.

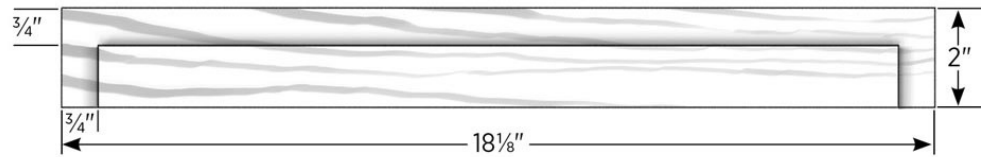
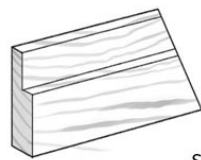
Telescoping covers typically are pretty heavy. They provide the outermost and uppermost protection for the hive. They have to stand up to all of the elements, such as snow, wind, and rain. Yet even with their weight, you still need to put a heavy rock or some other kind of weight on them to prevent their blowing away in high winds.

The dimensions of this outer cover fit the hive bodies we have been building in this book. The cover's frame also fits a preformed metal pan from Betterbee, allowing you to use the prefab pan rather than make a custom metal top (described in steps 6 through 8). The one thing I don't like about the prefab pans is their small lips; I prefer to have the metal extend over more of the telescoping cover frame, but as long as it keeps the top of the frame covered, paint will keep the sides of the frame dry.

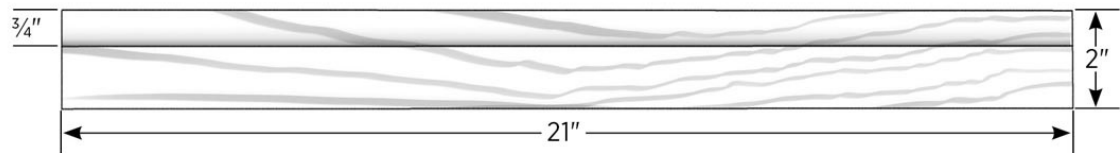
I used aluminum for the metal top of my cover, bending it by hand and with a rubber mallet, which works just fine. This project includes a simple setup for bending the metal top right to the completed cover, or you can use the Simple Bending Jig (**page 89**). You can find 24"-square pieces of aluminum at home centers and lumberyards; barring that, check with local roofers or siding contractors. Okay, let's get going and get a roof on our hive.



ends (A) (x 2)



sides (B) (x 2)



ABOVE: *Wood parts for telescoping cover.*

Tools

Table saw

Bar or pipe clamps (at least 24" long)

Drill and combination drill/countersink bit

Tin snips

Two scrap boards at least 22" long (see step 7)

Rubber mallet or hammer and wood block

Screwdriver with flat, wide blade

Materials

One 42"-long pine 1×5 (see step 1)

Material for 21" × 17 ³/₈" finished top (see step 4)

Twenty 1 ³/₄" deck screws

Waterproof glue

One 24" × 24" × 0.016" aluminum sheet (or use a preformed metal top)

Sandpaper

Twenty 3d galvanized box nails

1. Cut and rabbet the side and end pieces.

Cut two pieces to length from the 1×5 pine board, one at 18 ¹/₈" (for the ends, A) and one at 21" (for the sides, B). Each of these will be ripped into two pieces later. If you can't find 1×5 at your local lumber supplier, you can use 1×6; you'll just have a bit more waste.

Set up a zero-clearance fence on a table saw (see **page 16**), and set the blade height to $\frac{3}{8}$ ", or half the thickness of the frame boards. The wood of the zero-clearance fence should partially cover the blade so you can cut the very edge of your workpiece. Test-cut a piece of scrap wood, then make a cut on one face of each 1×5 board, running the full length. Turn each board end-for-end and make another cut on each board with the same side facing down. Move the fence away a little less than the thickness of the blade, cut again, and keep moving the fence until the width of your rabbet is $\frac{3}{4}$ ".

Work tip: If you're using a material other than 1-by pine for the top board(s), make the *width* of your rabbet match the *thickness* of your top.

2. Rabbet the ends for the corner joints.

The $18\frac{1}{8}$ " (A) piece gets a $\frac{3}{4}$ "-wide rabbet at each end to accept the side piece. The height of the saw blade remains the same at $\frac{3}{8}$ ". Set the fence at $\frac{3}{4}$ " to the far side of the blade (this is already done if you're using 1-by material for the top). Using the miter gauge, rabbet both ends of the piece, with the same side facing down. After making the shoulder cuts at $\frac{3}{4}$ ", gradually move the fence closer to the blade until your rabbet is complete.

3. Rip frame pieces and check the fit.

Raise the saw blade height to just over $\frac{3}{4}$ ", and set the fence at 2". Rip two pieces from each board, leaving the center as waste. Dry-

assemble the sides and ends, and temporarily clamp the frame together. They should form a box with outside dimensions of $18\frac{1}{8}$ " \times $21\frac{3}{4}$ ", with a recess that matches the thickness of the top material.

4. Cut the top pieces.

Note: If you're using plywood for the top, cut it to size at 21" long \times $17\frac{3}{8}$ " wide, and skip ahead to step 5. My top is made with two pieces of 1 \times 8 pine and one piece of 1 \times 4 pine, all joined with half-lap joints. The following is how I cut the top pieces.

Cut two pieces of 1 \times 8 and one piece of 1 \times 4 to length at 21". Set the boards edge-to-edge on a flat surface and measure the total distance across; it should be around 18". The finished width for the top is $17\frac{3}{8}$ ", so the assembly is $\frac{5}{8}$ " oversize. With three boards, there are two half-lap joints; dividing $\frac{5}{8}$ " by two gives you the width of each half-lap joint: $\frac{5}{16}$ ".

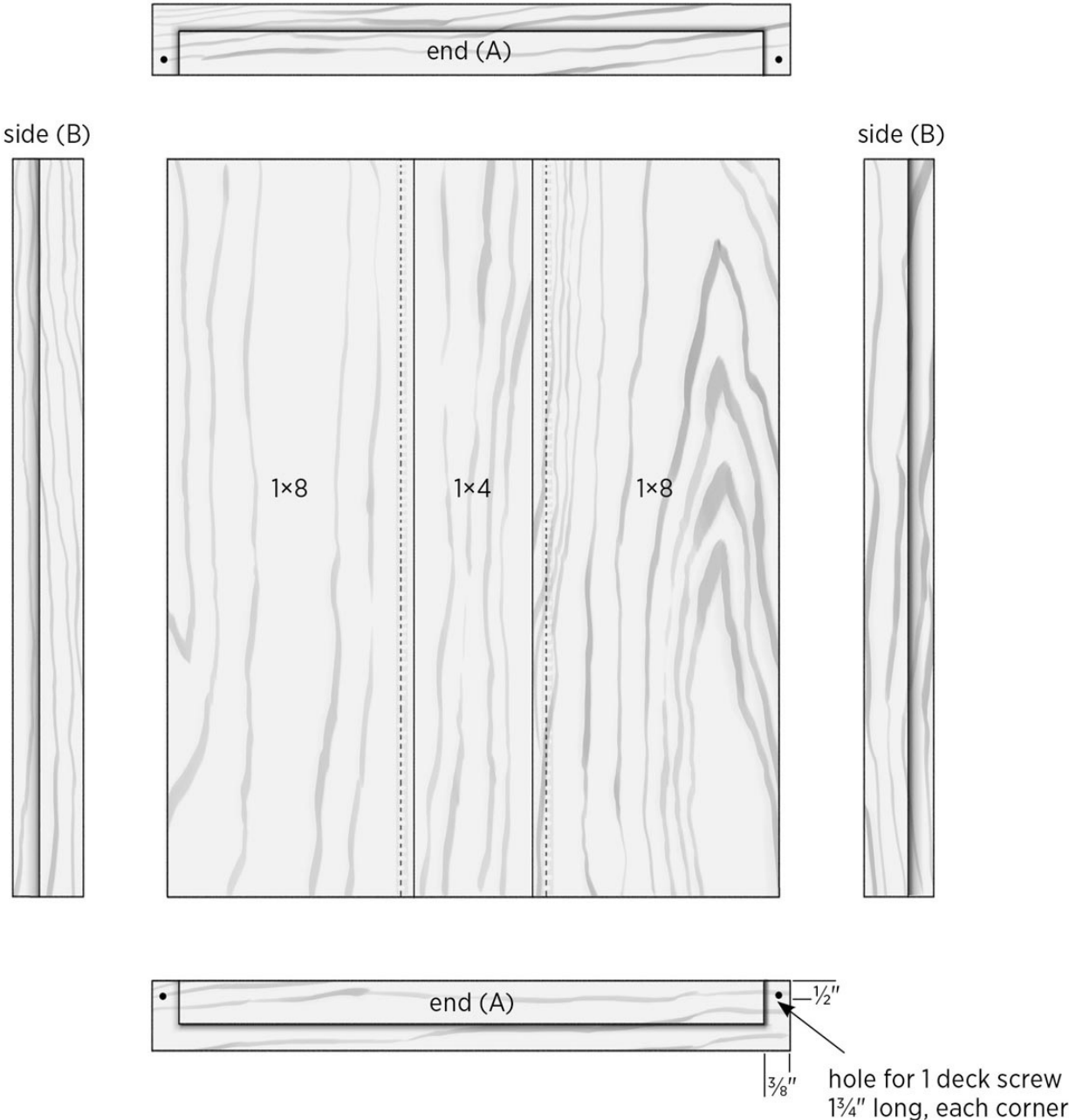
To cut the rabbets for the half-lap joints, set the saw blade height at $\frac{3}{8}$ " (one-half the board thickness). Use the zero-clearance fence set at $\frac{5}{16}$ " to the far side of the blade. Cut the rabbets as before, gradually moving the fence to complete the waste removal. Each 1 \times 8 gets one rabbet, and the 1 \times 4 gets two. Test-fit the three boards in the frame recess.

5. Assemble the wood parts.

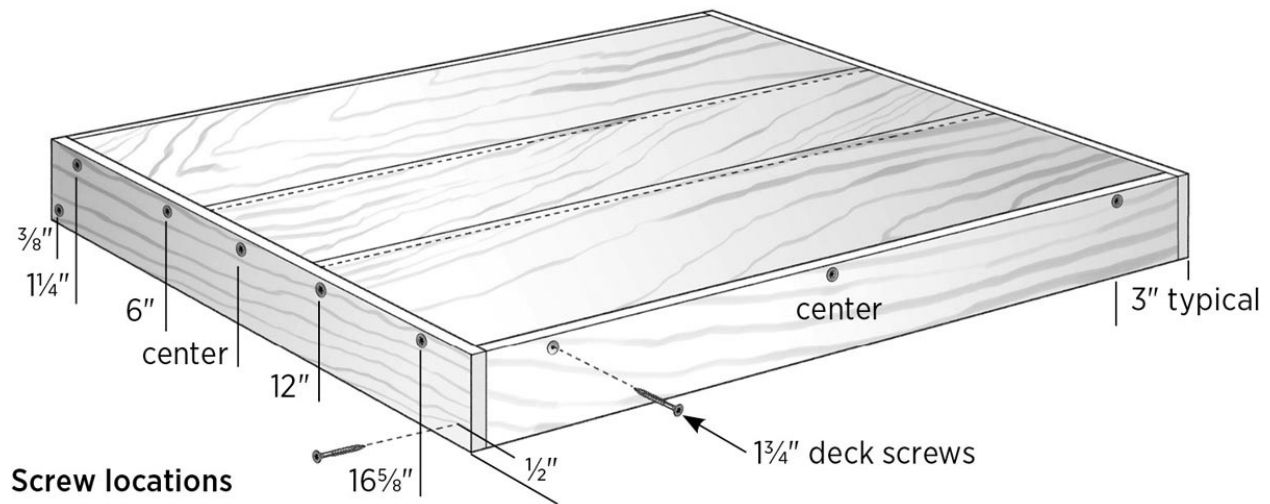
Drill countersunk pilot holes into the frame sides and ends as shown. Apply glue to the joints for the side and end pieces. Assemble and clamp the box frame, and check it for square. Drive one $1\frac{3}{4}$ " deck screw at each corner joint. Spread some glue on the half-lap joints, place the boards in the frame recess, and add screws. Once the glue

is dry, you can paint the outside rim of the cover before or after installing the metal top.

Wood parts ready for assembly



ABOVE: *If using plywood, add screws on the sides at 6 1/2" and 13 1/2".*



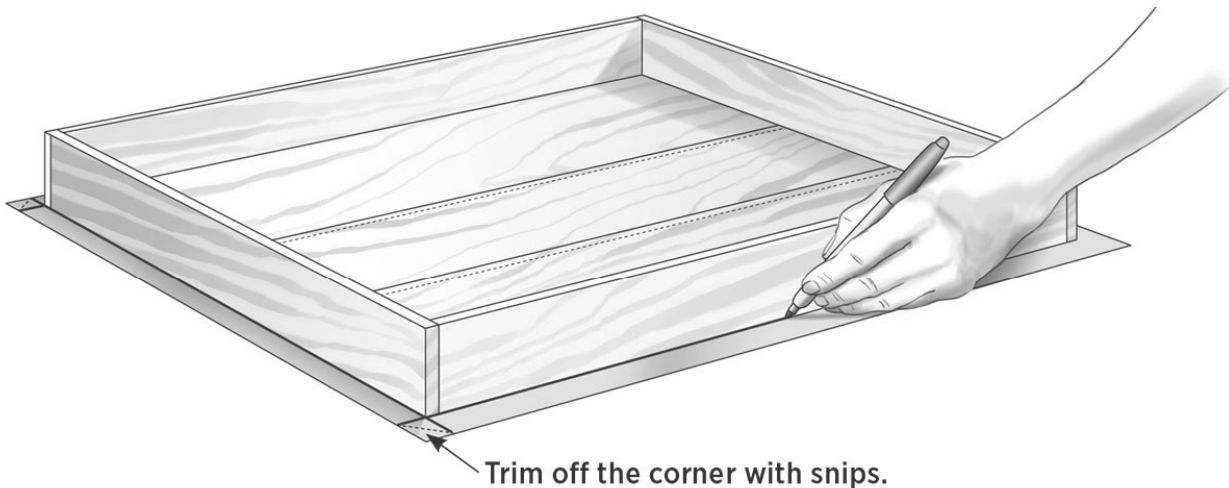
ABOVE: *Finished cover ready for metal top.*

6. Cut the metal top.

Note: If you're using a preformed pan for the metal top, attach it with 3d galvanized box nails, four or five to a side. You may have to predrill the metal. Otherwise, follow the remaining steps to make your own top.

Always wear gloves and safety glasses while handling sheet metal. Cut a piece of aluminum flashing to size at 20 1/4" wide x 24" long, using tin snips. This allows for about 1 1/8" of overhang on the sides. Carefully sand the edges lightly to remove burrs. Lay the metal sheet on a flat surface with the top side (the one you want to show) facing down. Center the cover frame top-down over the flashing and draw a line around the outside of the cover. Extend these lines to the

edges, and then trim off the corners at a 45-degree angle up to the ends of your lines, as shown.



ABOVE: *Marking the cover for trimming corners and bending.*

7. Bend and nail the first side of the metal top.

Place one scrap board underneath and one on top of the cover, lining up the edges, and clamp both ends with bar or pipe clamps (2×4s will work for the scrap boards, but something with a square edge is better for getting a sharp bend). Bend up the overhanging edge of aluminum a little at a time, going back and forth across the full length of the edge. You can use your gloved hands or press a block of wood on the metal and slide it back and forth. When you get close enough to 90 degrees, use a rubber mallet and tap along the very edge of the angle to bring the metal up tight to the cover.

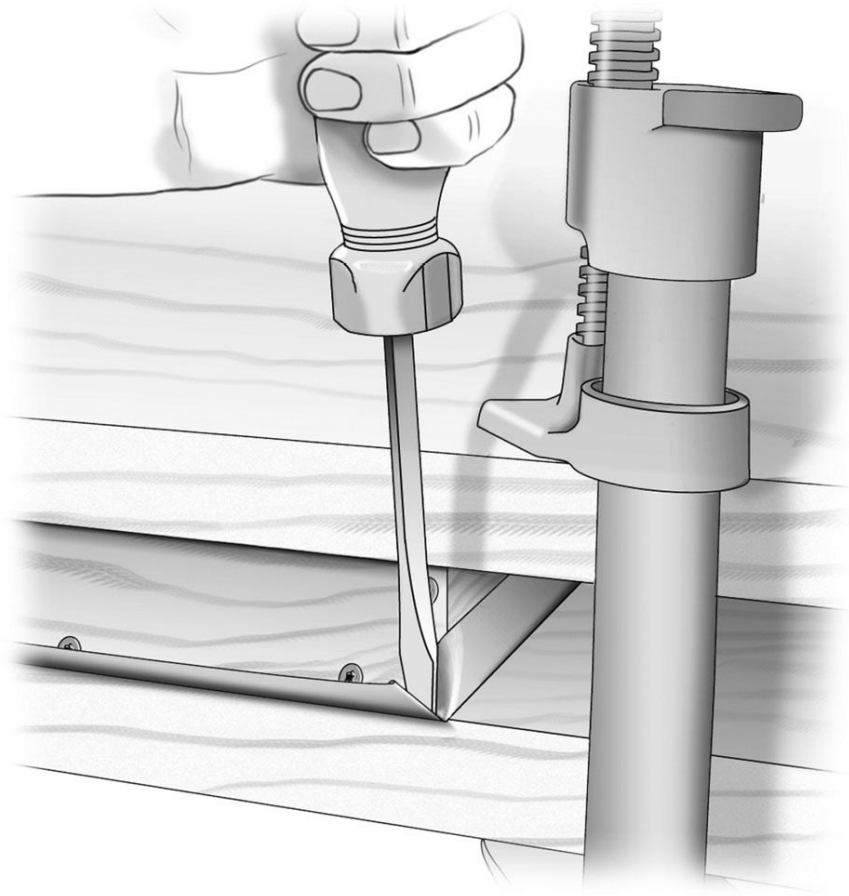
When the first side is bent, start from the center and nail toward the ends, using 3d galvanized box nails. Use five nails, spacing them evenly by eye and making sure they're going into the solid boards (or plywood panel) of the top.

8. Complete the cover.

Remove the clamps and rotate the setup 90 degrees. Repeat the bending and nailing on each side. To deal with the little dog-ear at the corners, use a wide-bladed flathead screwdriver to tuck the wrinkle into the corner. You can also use pliers to help squeeze and bend over the flap.

Try to keep the metal top fairly flat, but if your lines get off a little, don't worry. The top's purpose is to shed rain, and if the flaps are a little crooked, they'll work just as well.

With the last nails in place and the clamps removed, it's time for the crowning moment when you place the cover on your newly built hive. You're almost ready for some bees. If no one is around to give you a pat on the back, reach around and give yourself one. You deserve it.



ABOVE: *Tucking in the corner with a screwdriver.*

CHAPTER FIVE

Building Hive Stands

CHAPTER CONTENTS

A Very Basic Hive Stand

Hive Stand with Landing Boards

Doone's Double-Hive Stand

Hive stands are the least demanding part of your setup. They can be as simple or as fancy as you'd like. There are several benefits to using a stand for your beehive, some of which are: getting it off the dampness of the ground, putting it at an easier working level for lifting the boxes, and getting it up out of the reach of skunks that like to scratch on the front of the hive at night and eat the emerging bees.



ABOVE: *A top-bar hive on sawhorses.*

Hive Stand Design

Hive stands come in all sizes and can be made of anything and everything under the sun, from cinder blocks and tire rims, to timbers and old boards, to sawhorses. For the most part, anything that happens to be available and will get the hive off the ground a little can be used as a hive stand.

Beekeepers are an innovative lot. Many beekeepers will use a couple of old skids or wooden pallets to set their hives on. These do the job and can usually be had for free. Check your local newspaper ads or drive around to various businesses and you can usually find some. With the help of a flood control wall and some 2x10s, my friend Lloyd made a level place for some of his hives.

Design Considerations

Long stands that hold multiple hives do have their drawbacks. If there comes a time when you want to move one, it's heavy and awkward. Another disadvantage is that while you are working on one hive, the noise and vibrations are getting transferred to the other hives, which, depending on the temperament of the other hives, can make the bees at the end of the row pretty grouchy by the time you get to them.

I prefer individual hive stands for each hive or at least no more than two hives per stand. You can position them in a semicircle so that the entrances face slightly different directions, to minimize drifting.

If you plan on only having one or two hives in your backyard, perhaps you have the time and luxury to make a stand that will be nice to look at and also work well for you. This means getting them at a height that makes the hive easy to work on. One thing to

consider is the fact that in an average year, you may have several supers stacked on the hive and it can get tall fast. My advice is to get it up off the ground, but not too far off. Keep in mind, too, that at peak a hive with honey supers will weigh more than a couple of hundred pounds, so you want a stand that is strong and won't easily tip.

Beekeeping advice: I once started a 5-frame nuc set on a couple of sawhorses, intending to move it to another spot when it was ready to switch to 10 frames. Well, it didn't happen, and the next thing I knew I had two deeps and four medium supers piled on, and it got pretty high and interesting to work on. Sawhorses do work great for top-bar hives, though (see chapter 10). They raise hives to a good working level, and they are sturdy.

PROJECT

A Very Basic Hive Stand

Free is always the best price for materials. A hive measures only about 16" × 20", so it doesn't take much material to build a stand. If you know someone building a deck, set of steps, or other outdoor project, see if they have any usable leftovers. I often find wood for all kinds of little projects at our landfill, where wood is kept in a separate area.

Here's a simple base that will be adequate for supporting your hive or even a fancier hive stand. Since it will go directly on the ground and the bees won't really be crawling on it, this is one case where I recommend using pressure-treated wood, for rot resistance. You can give the top a coat of paint if you are concerned about chemical exposure.

Any size stand that the hive will fit on is fine, but it's nice to have some room on either side to set frames on when you are inspecting. Once you build this base stand, you can put your solid or screened bottom board right on top and continue setting up your hive. Or you can build the Hive Stand with Landing Boards (next project) to give your hive a little loft.

Tools

Handsaw or circular saw

Reciprocating saw (optional)

Drill or hammer

Materials

4-foot 4×4 or 6×6 timber

4-foot 2×6 or 2×8

Eight deck screws or nails, 3" to 4" long

2-by scrap material (optional; see step 3)

1. Cut the lumber.

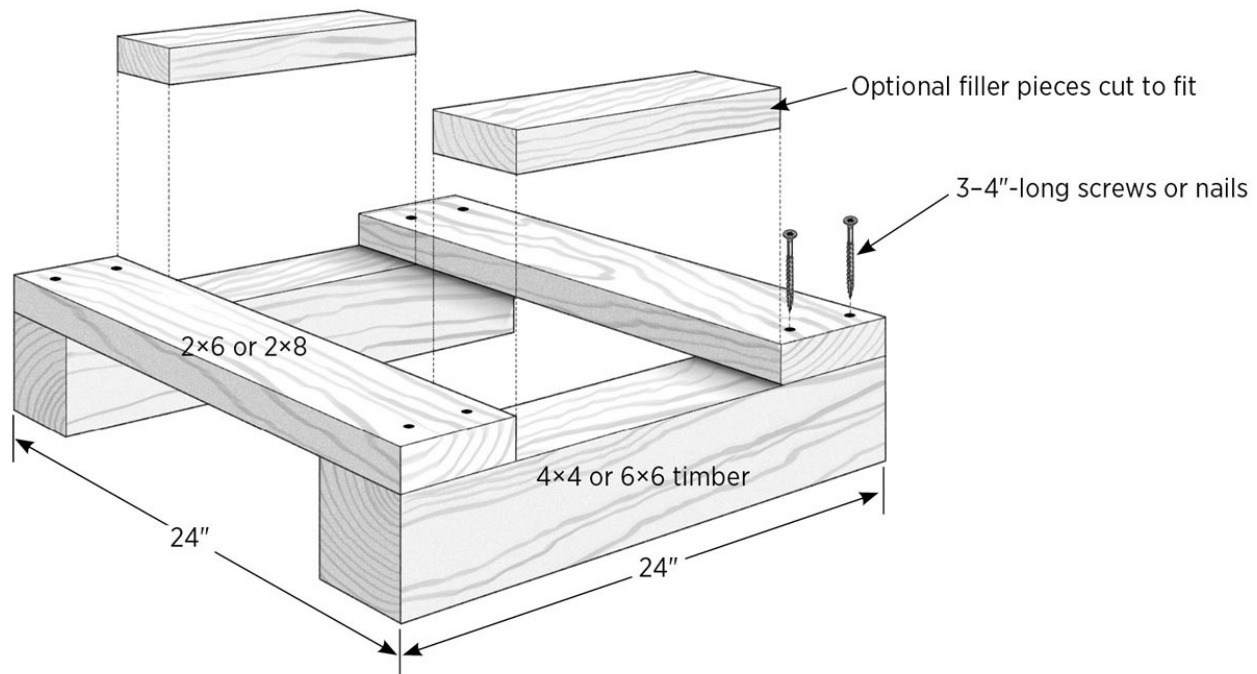
Cut the 4-foot timber and 2×6 or 2×8 in half, using a handsaw and/or a circular saw. A reciprocating saw is really handy for cutting through the full thickness of timbers in one pass.

2. Assemble the stand.

Place the two timbers 24" apart and set the 2-bys across them so all pieces are flush at the sides and ends. Check for square and drive two screws or nails through each end of the 2-bys and into the timber below.

3. Add fillers.

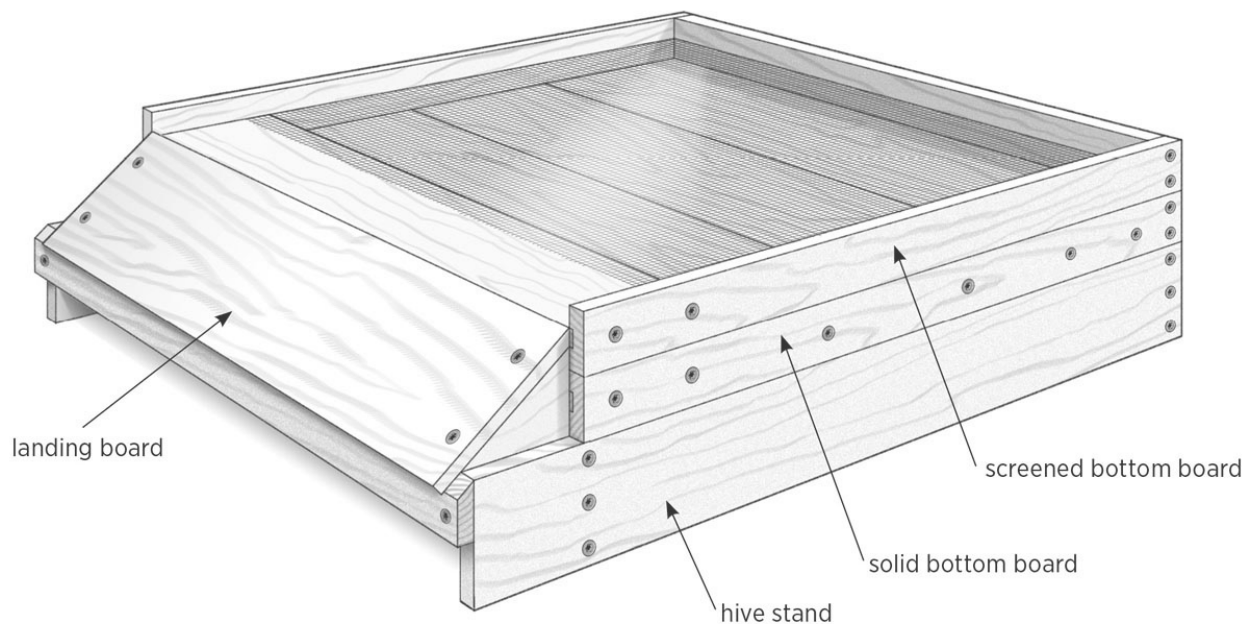
If desired, cut pieces of 2-by material to fit between the 24" 2-by crosspieces and fasten them to the timbers with screws or nails. Fillers are helpful for giving a little more support for the weight of the hive.



ABOVE: *Simple hive stand assembly.*

PROJECT

Hive Stand with Landing Boards



Here's a hive stand that you can set on top of the timber base ([page 59](#)) to get your hive higher off the ground. It could also be put directly on the ground, which should be solid and level. Cedar makes a great material for the stand, since it will be in contact with moisture more than other hive components, but don't worry if you don't have access to cedar or other decay-resistant wood. Pine with a coat of primer and topcoat of exterior paint will work fine.

This project includes steps for building both a tall, fixed landing board assembly and an adjustable landing board assembly. When I

first decided to try a screened bottom board, I noticed that the landing board on my hive stand was no longer useful because it was in a fixed position and my entrance was now higher. After years of using combinations of one and two bottom boards, I designed a handy adjustable landing board assembly that attaches to the end of the hive stand frame with two screws and can be adjusted to work with one or two bottom boards.

The adjustable board allows you to experiment with using a solid bottom board, an open screened bottom, or a combination of the two, while still using the same hive stand. The only disadvantage to the adjustable landing board assembly is that the landing board doesn't extend over the sides of the stand, but the trade-off is flexibility while you sort out your preferences.

Tools

Table saw

Drill and combination drill/countersink bit

Combination square with protractor head

24" bar or pipe clamps

Spring clamps

Materials

Two 6-foot 1×4s

One 3-foot 1×6

Waterproof glue

Twenty-four 1 ³/₄" deck screws

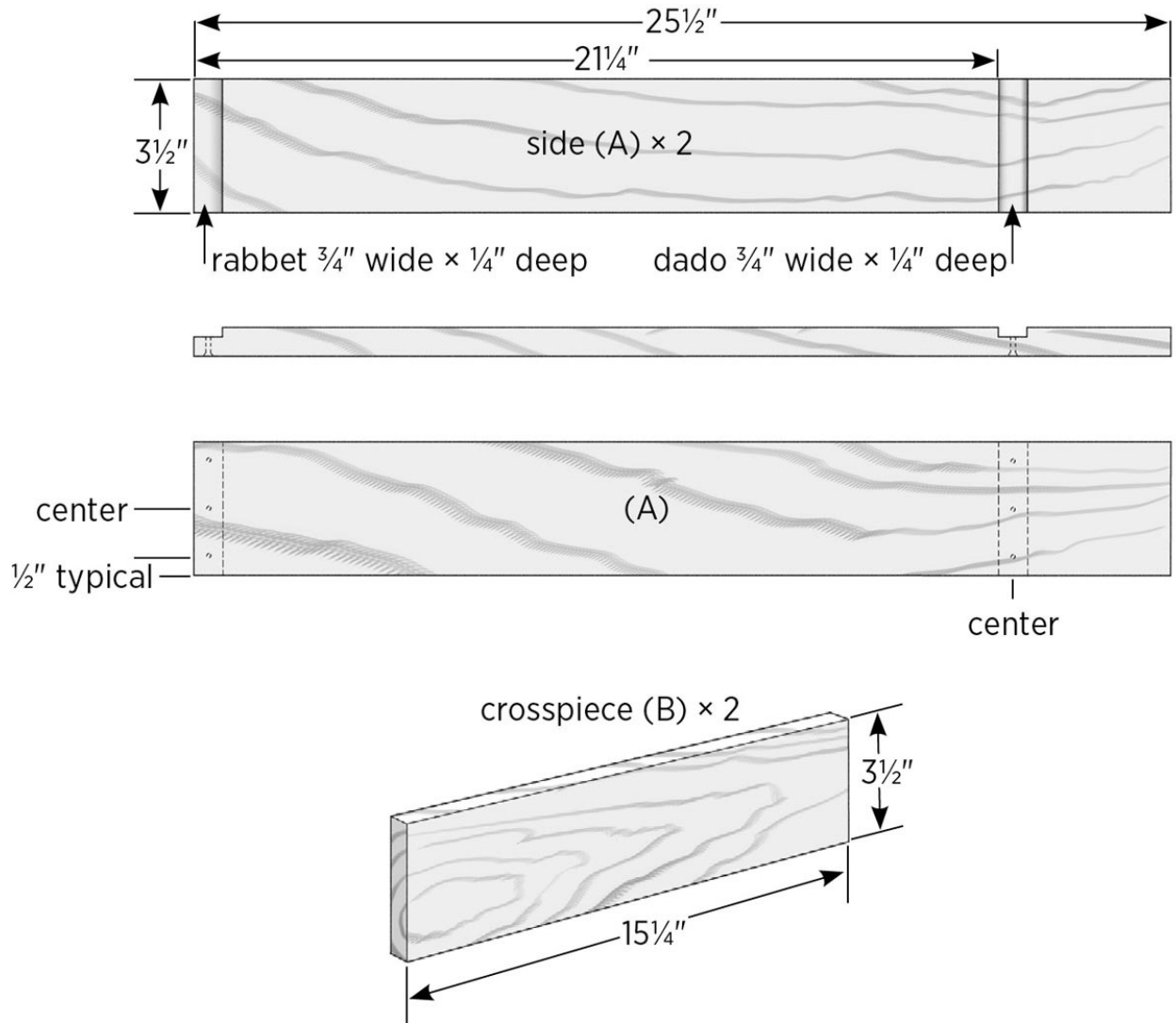
Two 1 ¹/₄" deck screws

1. Cut the side rabbets.

Cut two pieces of 1×4 to length at 25 ¹/₂"; these will become the sides (A). Each side gets a rabbet and a dado, both measuring ³/₄" wide × ¹/₄" deep, for accepting the crosspieces, as shown. To cut the rabbets using a standard blade on a table saw, set the blade height to ¹/₄" and set the fence ³/₄" to the *far side* of the blade. Using the miter gauge and a piece of scrap, make a test cut, then cut the rabbet in one end of each side, moving the workpiece slightly away from the blade for each pass.

2. Cut the side dados.

Reset the fence to 3 ¹/₂" from the *near side* of the saw blade and cut a ³/₄"-wide dado by gradually moving the fence away from the blade with successive cuts.



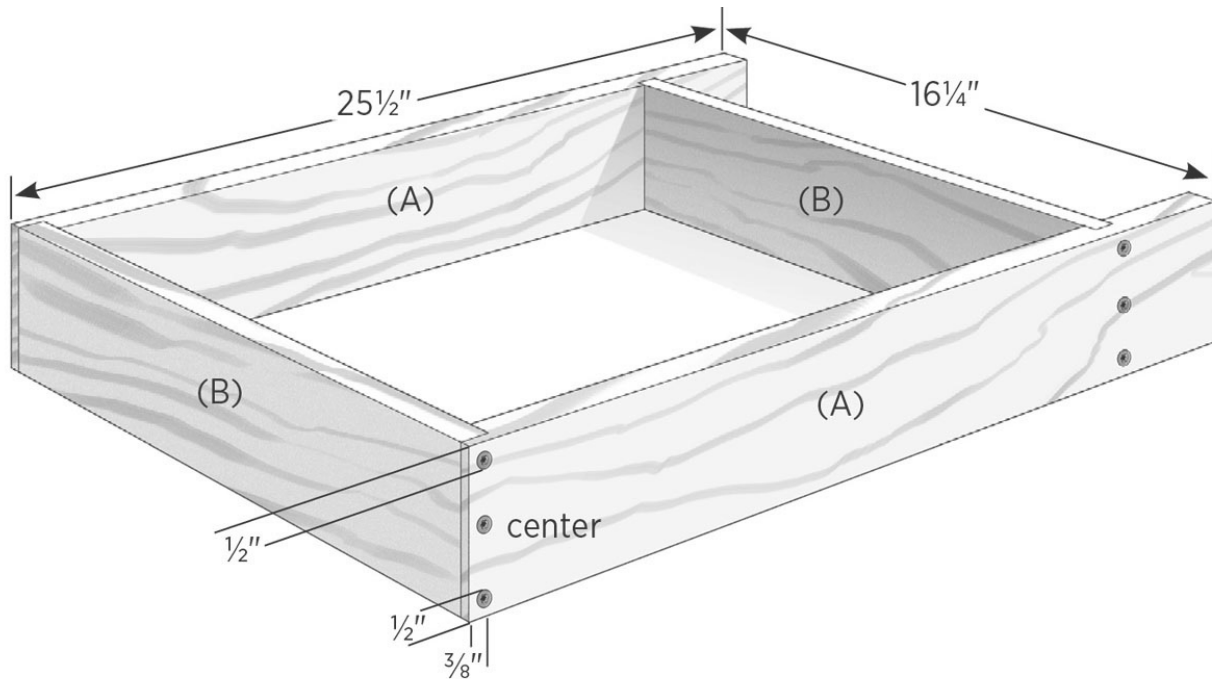
ABOVE: *Hive stand frame parts.*

3. Complete the frame.

On each side piece, draw guide lines for screws, centered on the rabbet and dado, as shown in Hive Stand Frame Parts, below. Mark three screw holes at $\frac{1}{2}$ " from each edge one in the center. Drill countersunk pilot holes at the marks.

Cut two pieces of 1x4 to length at $15\frac{1}{4}$ "; these are the crosspieces (B).

Dry-assemble the frame to make sure everything fits well. Apply glue to the rabbet and dado joints and clamp the sides and crosspieces together. Check the frame for square, then drive three $1\frac{3}{4}$ " deck screws at each joint. Let the glue dry as directed.



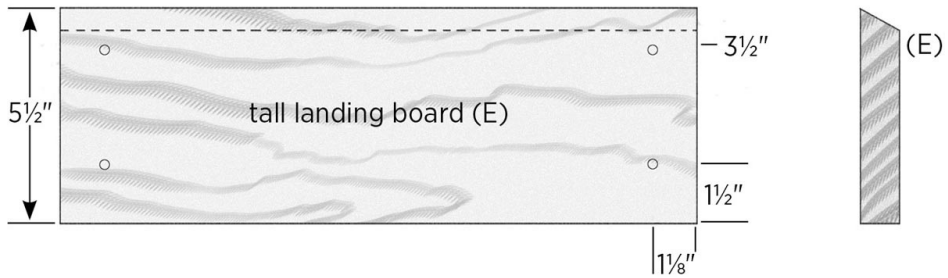
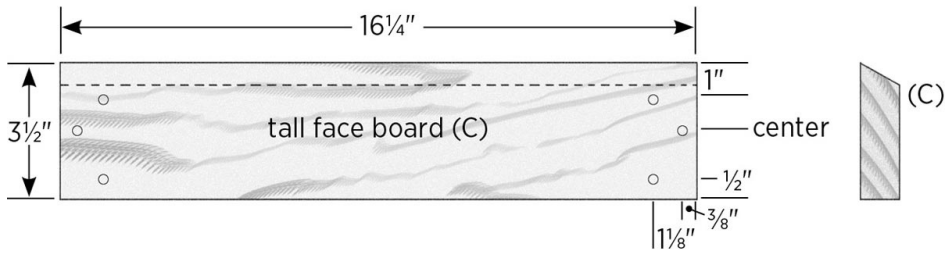
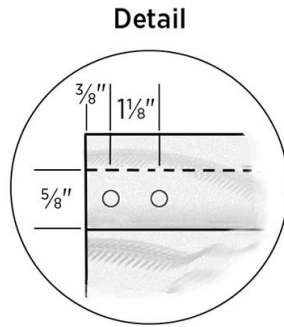
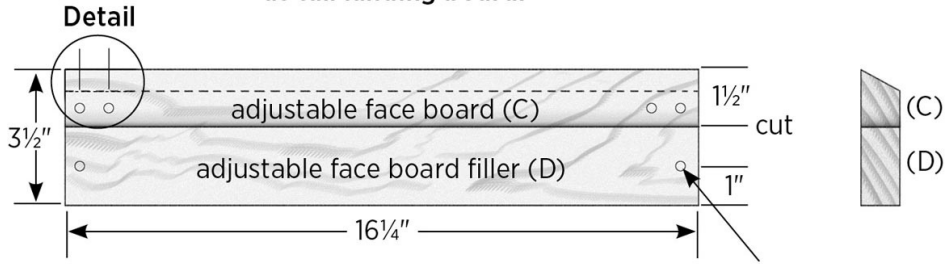
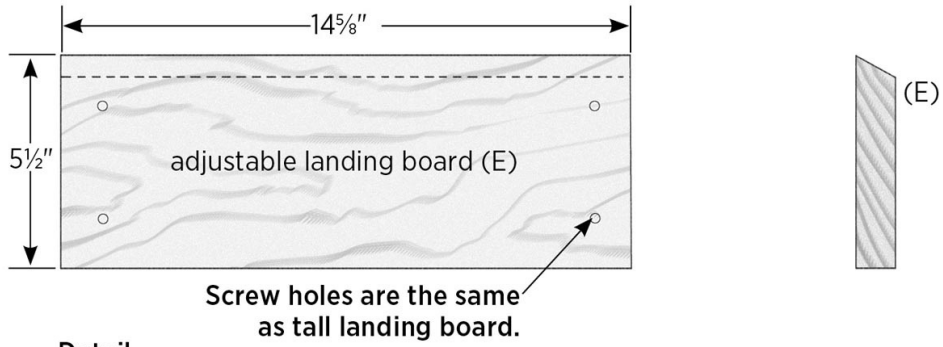
ABOVE: *Assembled landing board frame.*

4. Prepare the landing and face boards.

Cut one piece of 1×6 to length at $14\frac{5}{8}$ " (for the adjustable landing board) and one piece at $16\frac{1}{4}$ " (for the tall landing board). Cut two pieces of 1×4 to length at $16\frac{1}{4}$ "; these are the face boards for both the tall and adjustable landing boards.

All of these four boards get a 60-degree angle cut along one long edge. To cut the 1×6 landing boards, tilt the table saw blade to 30 degrees, and set the blade just high enough to cut through the 1-by

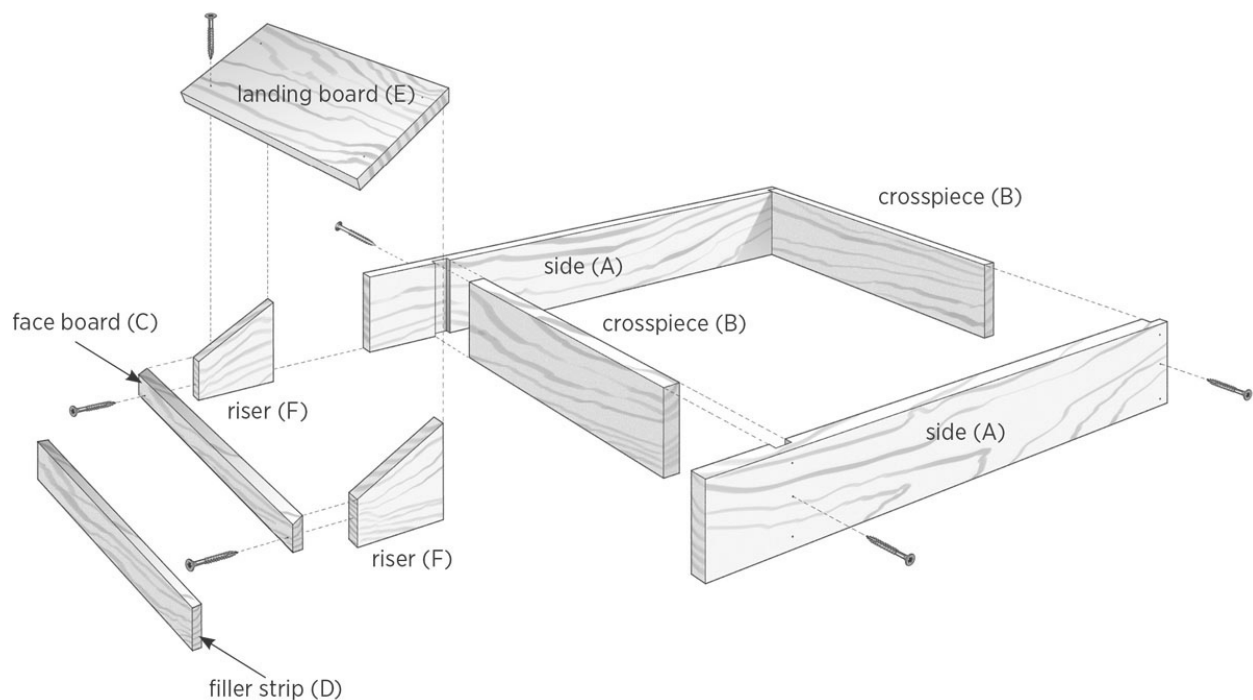
material. Set the fence so the blade just cuts the full edge of the 1×6 board. Cut one edge of each landing board. Drill two countersunk pilot holes on each end of the landing boards as shown.



ABOVE: *Landing boards and face boards.*

To cut the face boards, reset the fence and make the same angled cut on the edge of the two 1×4 face boards.

Return the saw blade to 90 degrees and check it with a square. Rip one of the face boards to 1½" wide; this is now the adjustable face board. The cut-off strip is the filler strip (D) and will be used when the adjustable landing board is in the upper position. Drill pilot holes in the face boards as shown.

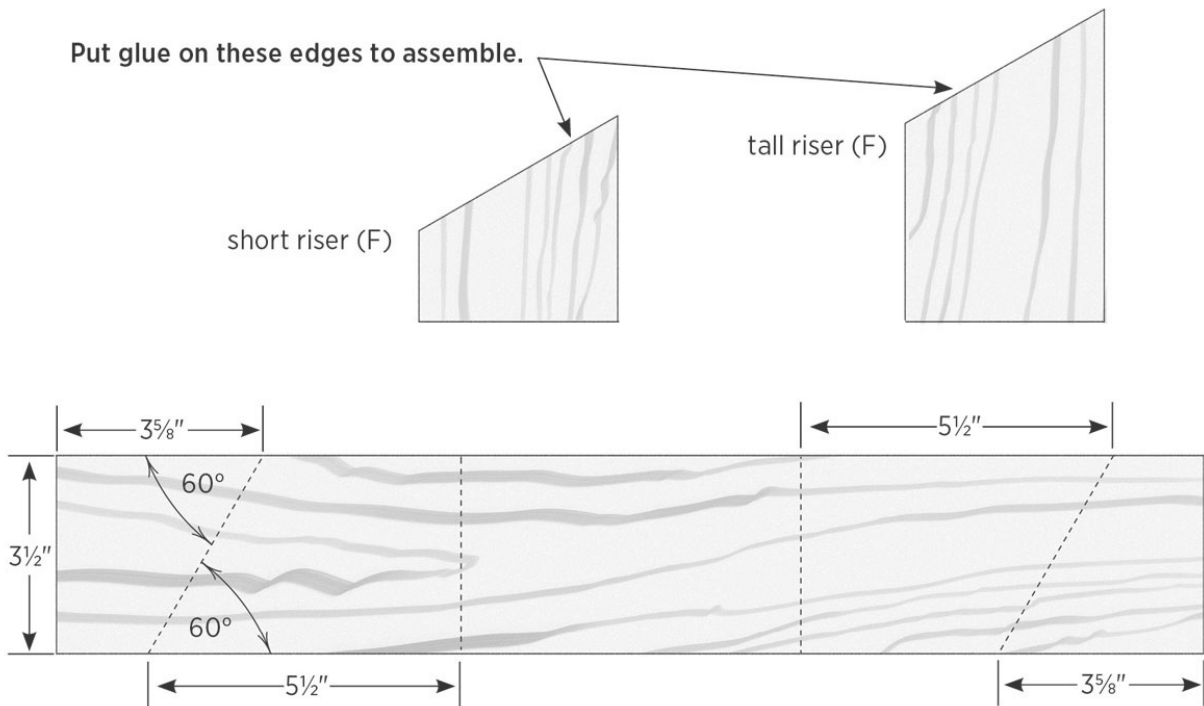


ABOVE: *Hive stand — exploded view.*

Safety note: Always use extra caution when cutting on a table saw with the blade tilted.

5. Cut the risers.

The risers are cut from 1×4 and have 60-degree angles cut along their faces (not their edges, as with the landing boards). Because the risers are short, it's best to cut them from the leftover piece of 1×4 that's about 21" long. Lay out the riser cuts as shown. Set the miter gauge on the table saw at 30 degrees and cut one riser from each end. This will leave a 60-degree angle on each end of the board. Return the miter gauge to zero and cut one long riser from each end of the board.



ABOVE: *Riser diagrams.*

6. Assemble the adjustable landing board.

Fold two sheets of standard 8 1/2" x 11" paper in half twice the short way; these will be used as spacers between the risers and insides of the frame. Spread glue on the angled edges of the short risers, set them inside the open ends of the frame using the paper spacers, and clamp them to the frame sides with spring clamps. Place the adjustable landing board on the risers, lining up the angled edge flush at the top of the risers. It will be centered side-to-side in the frame with about 1/16" clearance on either side. Fasten the landing board to the risers with 1 1/4" screws near the lower end of the risers and 1 3/4" screws near the upper end.

Spread glue on the front (exposed) edges of the risers. Center the adjustable face board (1 1/2") over the glued edges and attach with two 1 3/4" screws. Remove the assembly from the frame and wipe any glue from surfaces with a damp rag. Let the glue dry as directed.

Slide the adjustable landing board assembly back into the open end of the frame. Place the bottom board you intend to use (from chapter 2) on top of the hive stand. Position the landing board so it lines up with the top surface of your bottom board and drive the two remaining 1 3/4" screws through the face board and into the ends of the hive stand.

Work tip: Do not use glue on this part, or you won't be able to adjust it.

7. Assemble the tall landing board.

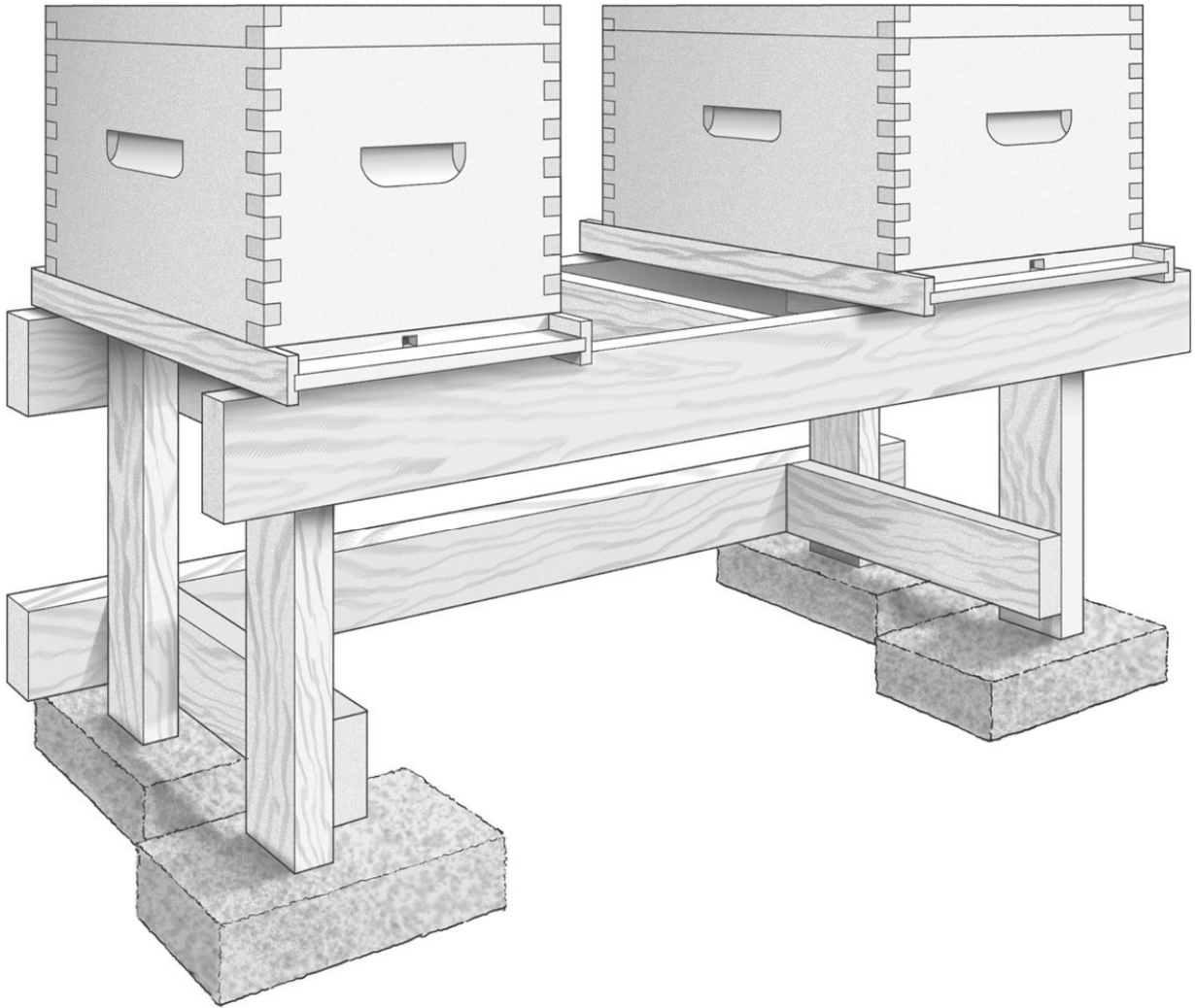
Clamp the tall risers inside the frame, as you did with the short adjustable landing board, using the paper spacers. Apply glue to the

angled edges of the risers. Line up the tall landing board flush with the high ends of the risers so it's centered on the sides of the frame. Drive two 1³/₄" screws in each end.

Line up the tall face board and drive two 1³/₄" screws at each end. Place the solid and screened bottom boards you made in chapter 2 on the stand. The edge of the landing board should line up with the top surface of the screened bottom board. Drive one screw through each end of the face board and into the frame. Your multipurpose hive stand is done. Next, you'll see how to make a sturdy two-hive stand using just a couple of 2×4s and some screws.

PROJECT

Doone's Double-Hive Stand



ABOVE: *Doone's finished double-hive stand set on concrete blocks.*

When my friend Doone Mackay decided to get some bees, she opted to go with two 8-frame hives. Before I knew it, she had a nice little stand set up. She's quite good with numbers and doesn't like to waste material, and this stand is proof of that. By happy accident, it also turned out to be a perfect stand for a top-bar hive. The entire project is made with three 8-foot 2×4s and uses every bit of wood.

Tools

Circular saw or handsaw

Drill and combination drill/countersink bit

Clamps (must open at least 3")

24" bar or pipe clamps

Materials

Three 8-foot 2×4s

Twelve 4" deck screws

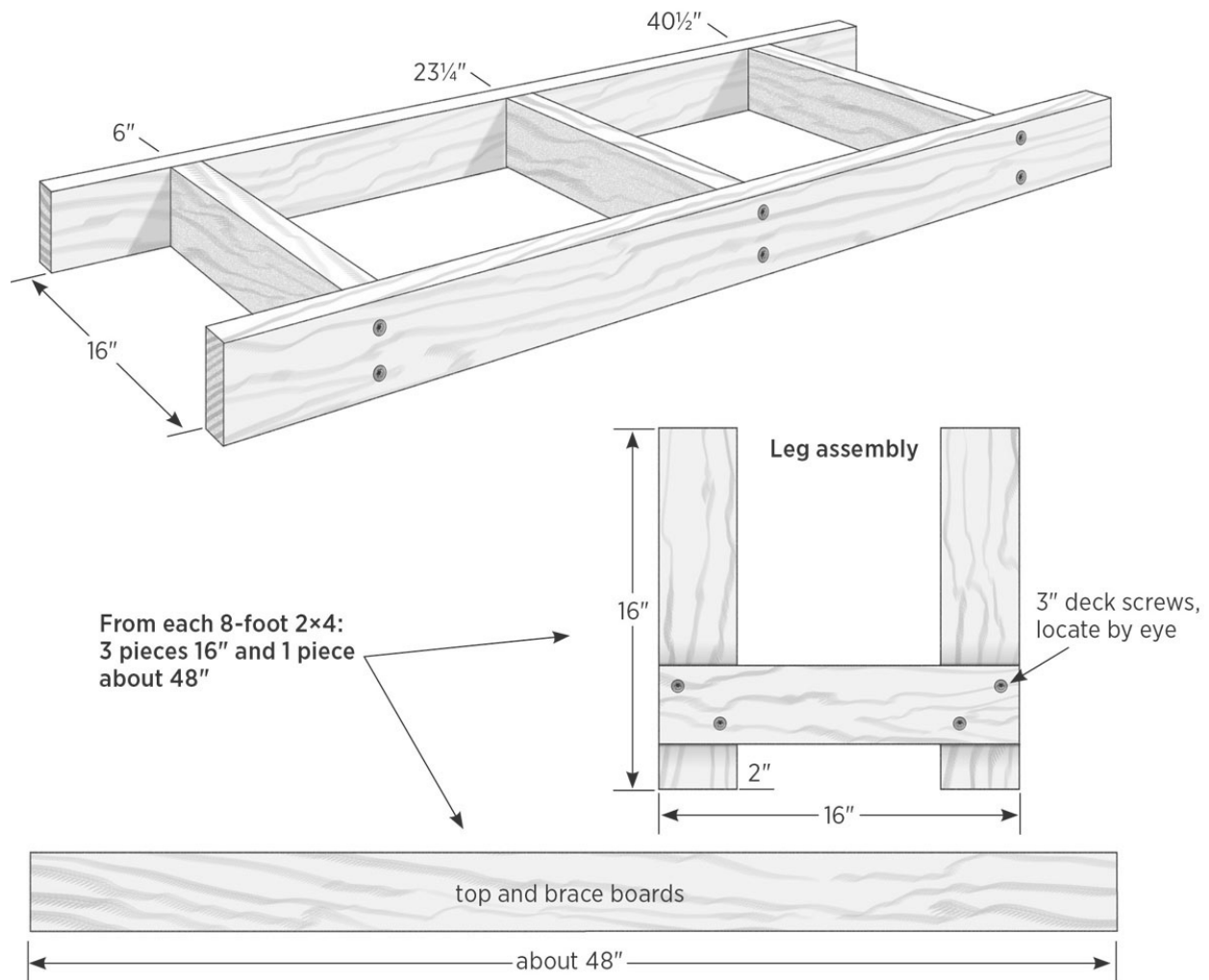
Twenty 3" deck screws

1. Cut the parts.

Cut three 16" pieces from each of the three 2×4s, for a total of nine pieces. This leaves three pieces at about 48" long for top section and long brace; it's okay if the lengths vary a little.

2. Assemble the top section.

Set two of the 4-foot 2×4s together on a flat surface, with both pieces flush at one end. Use a tape measure and square to mark the faces of the boards at 6", 23 1/4", and 40 1/2". Line up three 16" crosspieces on these lines, as shown in Double-Hive Stand Parts, below, and clamp the assembly with bar clamps. Drill countersunk pilot holes as shown, and drive two 4" deck screws through the long boards and into the ends of the crosspieces, making sure the frame is square as you go.



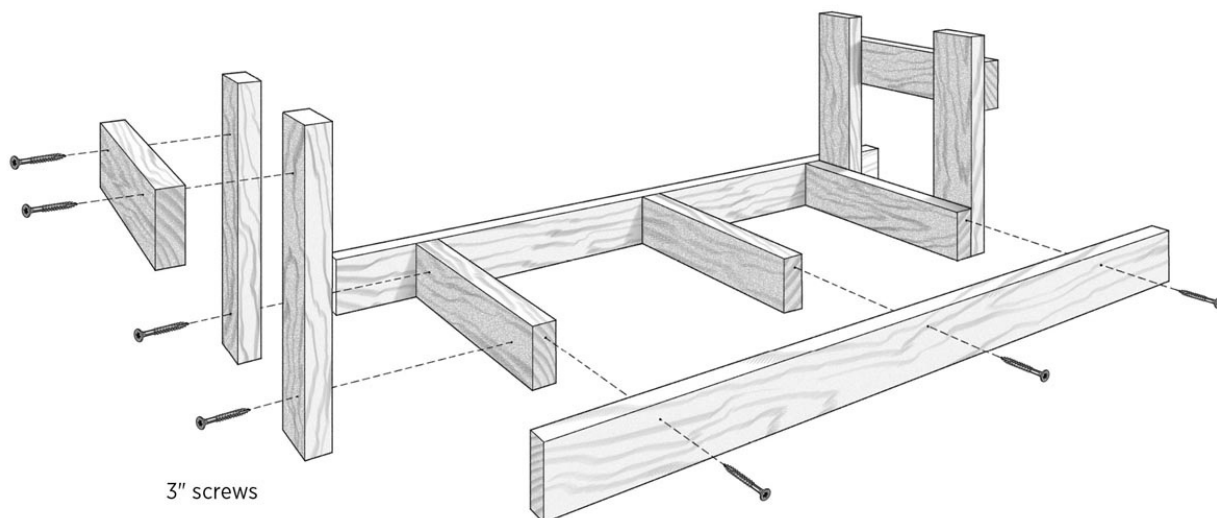
ABOVE: *Double-hive stand parts.*

3. Assemble and install the legs.

Construct two leg assemblies with three 16" 2×4s for each and 3" deck screws, following Double-Hive Stand Parts, facing page. Be sure to maintain the 16" dimension across the top.

The easiest way to attach the legs is upside down: Set each leg assembly, with the braced end up, into one end of the top section and fasten it with four 3" screws driven into the outer crosspiece. Repeat with the other leg set.

Double-hive stand — exploded view



ABOVE: *It's easiest to assemble this upside down, as shown here.*

4. Add the long brace.

Position the stand on its side, line up the last 2×4 with the leg braces, and fasten the pieces with two 4" screws at each end.

Beekeeping advice: You can take this basic plan and modify it to fit your needs. For example, you can make the top smaller to use with just one hive, or use it as a handy stand to set boxes on during inspection. As you can see, when it comes to hive stands, your imagination is your only limitation. You can shoot for form or function, or combine the two. I'm sure you'll be dreaming up the perfect hive stand before you know it. You can make the sides higher and combine a stand/bottom board/varroa screen.

CHAPTER SIX

It's All in the Details

CHAPTER CONTENTS

Hive Spacer

Entrance Reducer

Paint Can Feeder

Bucket Feeder with Screened Plug Insert

Traditional Boardman-Style Entrance Feeder

Escape Boards

Now that you have your hive and stand built, there are a few other items that I would consider necessities. Some you should have right away, and others can wait a while. If you live in bear country, you'll want to have your electric fence set up before your bees arrive. A hive spacer, entrance reducer, and feeder are useful if you're getting package bees. Escape boards won't be needed until it's time to harvest honey.

Electric Fences

I'll never forget my introduction to our local beekeeping club. It was my first meeting, and when I arrived there was a bunch of guys sitting in rows of chairs and two guys up front at a table. I assumed they were the club leaders. I took a seat toward the back. The meeting hadn't officially started yet. The old guy sitting in front of me turned around, and I expected him to introduce himself, but instead the first words out of his mouth were, "You got bees?" I said, "No, but I'm getting some. I have them ordered." Then he asked, "You got an electric fence?" I said, "No, I don't." His reply was, "Well, you might as well get up and go home, 'cause you ain't gonna have no bees."

I was a little overwhelmed by the "warm friendly welcome" I was receiving. If I hadn't been brought to the meeting by a beekeeping friend, I probably would have gotten up and left. It took just a couple of meetings to realize that that was just old Charlie's way, and I soon learned to take everything he said with a grain of salt. And looking back, there was much truth to what he was saying.

I live in the hills of Berkshire County, Massachusetts, and this is black bear country. Even if you live in town, there are occasional

bears that wander unexpectedly into the neighborhoods, and with changes in the hunting laws, the bear population has steadily increased over the years. Everyone knows that Winnie-the-Pooh loves honey, but black bears are more interested in the brood as a great source of protein. If you haven't seen a hive that has been damaged by a bear, it can look like something that has come through a tornado, with broken boxes and frames all over the place, not to mention some very angry bees.

I had one hive get hit by bears. It was on the farm where my son lives. It was springtime and I had just reversed the boxes. A mother and two cubs pulled the top deep box off and dragged it out into the field, and did some chewing on the frames. Luckily, the bees were all in the bottom box that they left behind. My son scared the bears away, and I put up a proper fence that day. Bears have very good memory and will return to a good source of food. I must have done something right with that new and improved fence, because the bears have been spotted in the field by the hives many times in the last few years, but the electric fence has kept them at bay.

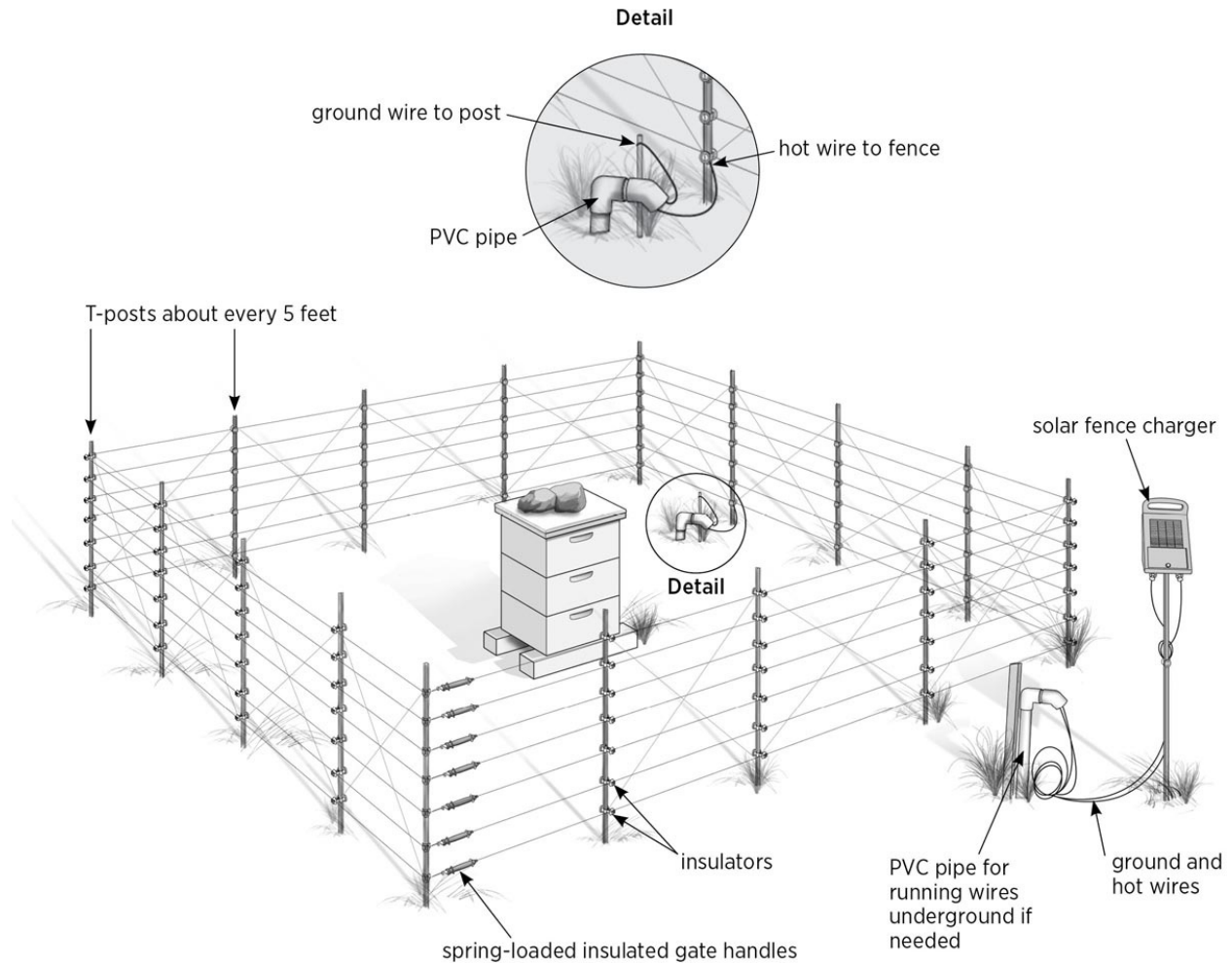
Beekeeping advice: I can attest to the shock provided by a solar charger. I was once putting an extra strand on a fence I had set up, and made the mistake of not turning off the system first. As I was screwing on an insulator, I had one hand on the post and reached around and accidentally touched an unseen wire with my other hand. It felt like someone had put the paddles on my chest and yelled, "Clear!" And it hurt. I don't want to imagine what putting a wet nose on the wire feels like.

Fence Components

There are plenty of product options for setting up an electric fence, and lots of advice and opinions out there on chargers, posts, and fencing (as well as whether or not to bait your fence). For example, I heard a few people on a beekeepers' forum recommend not buying a particular brand of fence charger, saying it doesn't last a year, while I've used the exact brand in three bee yards for seven years without a single problem. I can only speak from the experience I've had with the bears and what works for me.

Here's a brief rundown on the components you'll need to set up an electric fence. It's a good idea to shop at a reliable business where knowledgeable staff can help you match all the pieces and give you some helpful tips and advice.

Electric fence setup around a hive



ABOVE: *This fence may seem extreme, but it has kept out the black bears regularly seen in the area. Notice that there are wires strung from the top insulator of one post to the bottom of the next to form Xs, giving the bears less room to get their heads between the wires without getting shocked.*

Charger. A fence charger, also called a “fencer,” is by far the most expensive component of your system. While it may seem costly, consider what you have invested in the way of hive equipment, the cost of bees, and the value of any honey you might lose if a hive were destroyed. A fence charger that runs on household current is

far less expensive than one that runs on solar power, and can give you a higher output for less money. The disadvantage is that if the power goes out, your fence is down. Depending on the location of your hives, a solar charger may be the only option. Do some research before buying a charger.

The power rating you normally see for fence chargers is in *joules*. The higher the rating in joules, the stronger the shock, but even this can be a little misleading. One joule is equal to one watt for a 1-second duration, and since fence chargers pulse on and off, the duration of on-time also contributes to the strength of the shock.

Another consideration is that many chargers are listed according to length of fencing they will adequately charge. Read the specs for various chargers telling you what they are designed for. If a charger is designed to keep rabbits penned in, it probably isn't what you want to keep bears out.

Solar chargers *do* work. I know because I have beehives in five locations that use solar chargers to power the fences. You can go online or talk to your local ag salesperson, find the specifications for various brands and models of fence chargers, and make your choice.

Posts. You'll need some kind of posts to string your wires to. You can buy formed metal posts, but I prefer the heavy metal T-posts available at better farm supply stores. You can also use round wooden posts.

Insulators. There are a variety of insulators available. They come in different lengths, and the type you buy will be dictated more by the type of post you're using. Some are two-piece screw-on types, while others are clip-on, and yet others nail directly to the post.

Wire. Fence wire comes in different materials and diameters, or gauges. The lower the number, the bigger the diameter. Fence wire is generally galvanized steel or solid aluminum. Steel is physically stronger and costs less, while aluminum is a better conductor, is easier to work with, and won't rust. Most fence chargers are rated for charging at least 3 miles of wire, so either choice will work. You can also buy electric fence netting, and I've seen a company that sells a quick-setup portable electric fence for use when camping in grizzly bear country. I doubt there's a better test of an electric fence's performance than that.

Gates. You'll need some way of getting into and out of your bee yard. All you really need are the spring-type gate handles that will keep tension on the wires. Get one for each strand of wire you plan on installing. The wire attaches directly to these handles. You can make loops in your wire to hook them to, or buy handle hookups that attach to the T-post and have a hole that your gate handle fits into.

Connectors. You can buy a variety of connectors to join the hot wire to the rest of the wire fencing. Some crimp on, while others require no tools and are reusable. With one type, the wire slides into them and the tension holds the wire in place. There is also a U-clamp type where you slide a couple of wires into it and tighten the nut to secure them. Another connector you'll need is one for connecting your ground wire to the ground post. You can buy battery-type clamps for this purpose.

Ground post. Don't overlook the value of a good ground post. Without a good ground, the fence will be pretty useless, since the whole concept depends on current traveling from the fence, through the predator, and into the earth, where it returns to the

charger via the ground post to complete the circuit. The number of ground posts you'll need depends on the size of area you're covering and, to a great extent, the type of soil and its moisture content.

Tester. So, you get your fence all set up and wonder if it works. How do you tell? Take your shoes off and grab the wire? NO! Don't try that! If you unhook a gate and let the wire touch the earth, you should hear the click and maybe even see the spark, but the proper way to test it is to get a tester. You can buy a simple type that hooks on the fence wire and has a probe that you push into the ground. They usually have four or five lights that indicate the voltage, up to about 5,000 or 6,000 volts. There is also a digital tester (around \$30 at the time of writing) that measures voltage up to 9,000 volts and is more accurate than the hook-type tester.

Every so often, I happen to bend over in the bee yard and my back end accidentally touches the fence. Both my eyes light up, and I know that the fence does indeed work. Keep your tester in whatever box or bucket you have your hive tools in, and make it a point to test your fence often.

Other considerations. Undoubtedly, grass and weeds will grow up along your fence and touch the wires, reducing its effectiveness. There are a few things you can do to help. One is to put down landscape fabric or some kind of material to stop the growth of vegetation. I had some old pieces of scrap sheet aluminum that I used in one location. Also trim around the fence often. You can use a string trimmer, if your bees have a good temperament and don't mind the noise. You'll know the first time you try it (it's probably a good idea to wear your veil). I keep a sickle in my truck and use a

combination of that and pulling. I don't really like the noise and exhaust of a string trimmer any more than the bees do.

Some beekeepers lay down a layer of chicken wire along the outside of their fences and connect it to the ground to ensure anything standing on the chicken wire and touching a fence wire will surely make a complete circuit and feel the zap, even if there's a lot of grass in the way.

Setting Up Your Fence

The fence I put up after the bears got my hive has been called a "fortress" by some other beekeepers. Well, I'm not sure if it's overkill, but it works, and I believe the extra money spent for more posts and strands of wire was well worth it. The 82 pounds of honey that came from one hive there this year, at a market price of over \$7 a pound, makes it an investment worth protecting.

Making space. My bee yard is approximately 20 feet long and 10 feet deep and holds up to four hives. When setting up your fence, be sure to leave enough room around the hive (or hives) so that a bear can't reach through the fence and get it, and also be sure you have plenty of room to work. You'll be setting outer covers, boxes, and other pieces of equipment on the ground. You may want to roll a garden cart in to stack full supers on, or you might decide to add a hive or two in the future, so make it as big as you think you might need it in a year or two. It's also nice to have room for a lawn chair where you can sit and take a break on a hot summer day, or maybe just go out with a cup of coffee to sit and watch the bees going about their business.

Posts and wiring. I like to space my T-posts about every 5 feet. That way I know my fence is sturdy and there won't be much sagging of wires between the posts. I use six to eight strands of wire on my fence. Okay, I've been laughed at, and maybe it is a little much, but it keeps the bears out. Some people put alternating hot and ground wires on their fences, the idea being if an animal sticks its head through, it will touch two wires and be sure to get shocked. One potential problem I see with this setup is that a bear could touch its nose to one of the ground wires alone and, not receiving a shock, be emboldened to plow through.

It's said that if a bear gets shocked on the head, it will back up. If it makes it in past the head and gets shocked on the shoulders, it will move forward. I've made my fences with all strands hot, and made sure they have good grounds. That way, if they touch any wire, they will get a shock. I start with my first wire about 6" above the ground, and then run a wire about every 6" to 8" up after that.

Using solar. The bee yard behind my house doesn't receive full sunlight all day, and I needed to place the solar charger in a better location in full sun. To solve this problem, I found a good spot for the charger and dug a shallow ditch from there to the inside of the fence area. I laid lengths of PVC pipe glued together to run the wire through. At each end I used a few short pieces and elbows so the openings would be above the ground and facing down to keep out rain.

I ran two lengths of 12^{1/2}-gauge electric fence wire (made for controller hookup and rated for underground use) through the PVC pipes and mounted my charger on a fence post. The solar panel gets full sun, and I can look outside my window at night, see the red light flashing on the panel that indicates that the charger is working, and sleep with peace of mind.

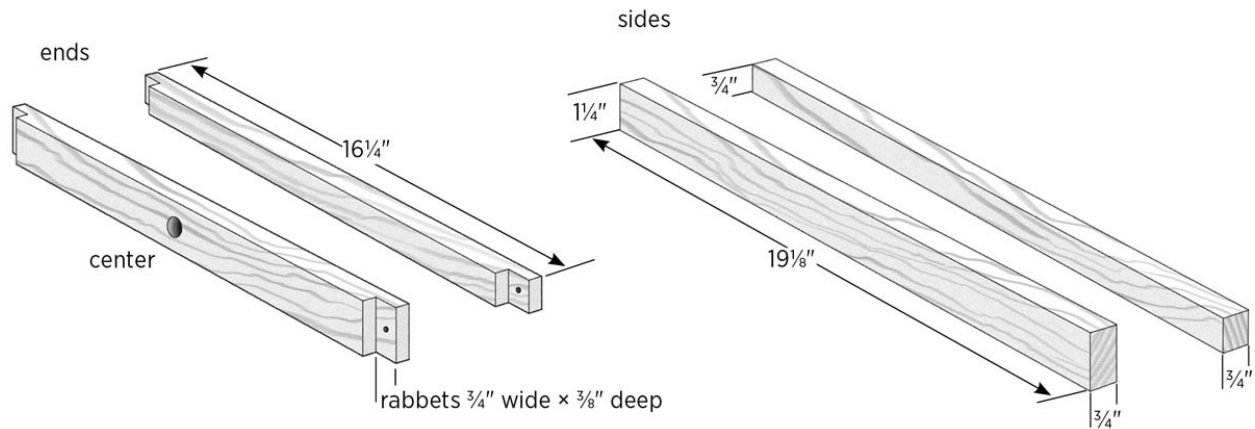
PROJECT

Hive Spacer

A spacer is just a frame with the same dimensions as the outside of the hive. It can vary in thickness depending on the need. Spacers have a number of uses, such as installing queens in a package, feeding pollen patties, treating for mites, or creating an upper entrance.

You can make use of a spacer right away if you're starting with package bees: After trying a few of the recommendations on where to hang or wedge a queen cage when installing a package and not being crazy about any of them, I thought, "Why not just use a spacer and set the queen cage right on top of the frames?" If it's chilly out, the bees will keep her warm, and when it comes time to check on her, you only need to lift the cover to see if she made it out. Plus, if you're feeding a pollen patty, there's room for that too. It's the only way I do it now.

I always keep several spacers around and make them from whatever strips of scrap I have on hand. If you made the Insulated Inner Cover for Winter in chapter 4 (**page 45**), you've already made a spacer (or at least cut the parts for it). So let's make a few different sizes.



ABOVE: *Hive spacer parts.*

Tools

Table saw

Drill with combination drill/countersink bit

Materials

3-foot pine 1×5 (or scrap pieces)

Waterproof glue

1 3/4" deck screws

1. Cut the frame parts.

Cut a piece of 1×5 or other material to length at 16 1/4" for the frame ends. Cut another piece to length at 19 1/8" for the frame sides.

2. Rabbet the end pieces.

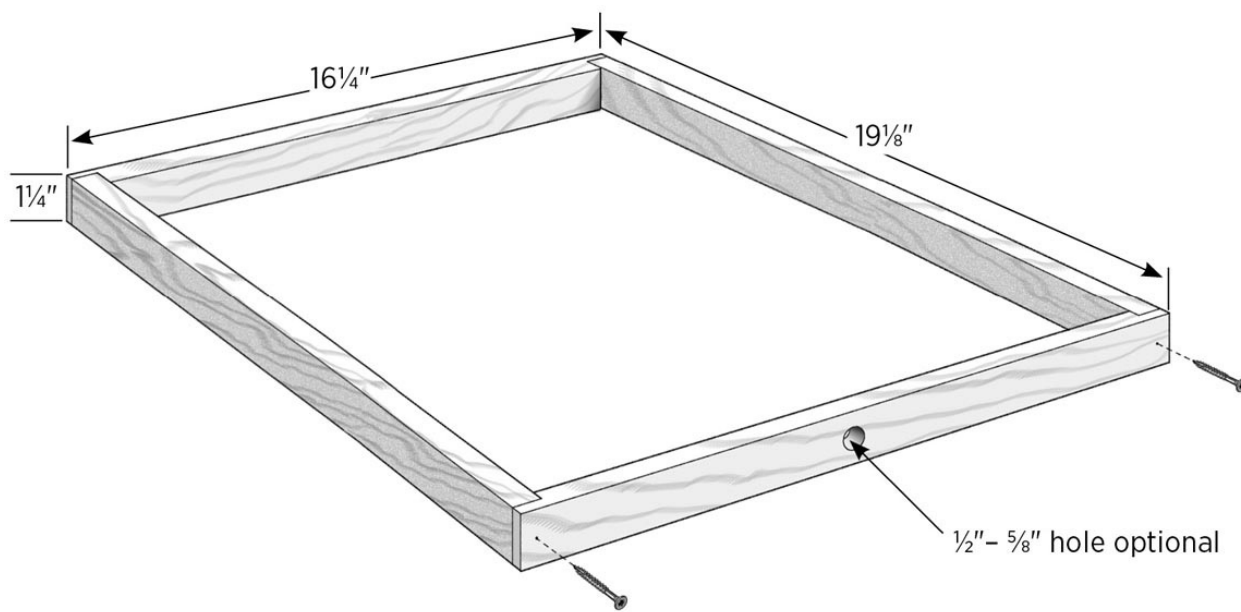
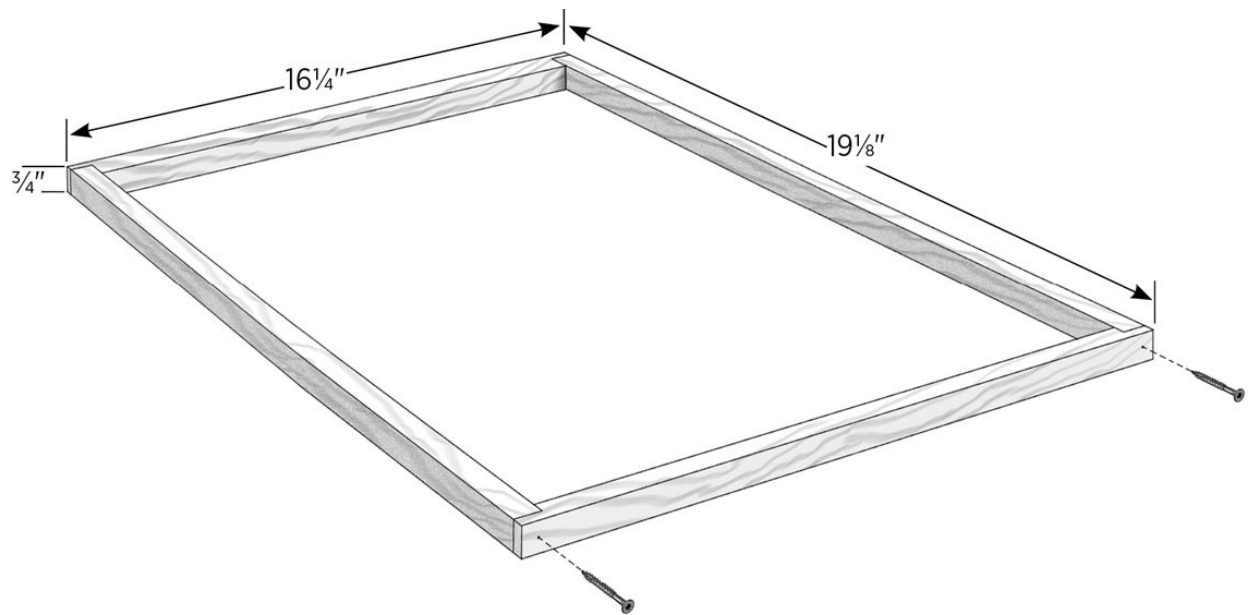
The frame ends get a $\frac{3}{8}$ "-deep \times $\frac{3}{4}$ "-wide rabbet at each end to accept the side pieces. You'll cut the rabbets on the one end piece, then rip that piece down to create the two finished end pieces. Set the blade height on the table saw to $\frac{3}{8}$ " and set the fence at $\frac{3}{4}$ " to the far side of the blade. With a standard blade on the saw, use a miter gauge to make the rabbet cuts, starting with the $\frac{3}{4}$ " shoulder cut, then moving the workpiece out a bit with each successive cut to remove the remaining material. Rabbet both ends of the 1 \times 5.

3. Rip the frame pieces to width.

Raise the saw blade to rip the 1 \times 5, and set the fence to $\frac{3}{4}$ ". Cut two strips 16 $\frac{1}{4}$ " long and two strips 19 $\frac{1}{8}$ " long. Move fence to 1 $\frac{1}{4}$ " and cut two strips 16 $\frac{1}{4}$ " long and two strips 19 $\frac{1}{8}$ " long. You can use the leftover pieces to make entrance reducers.

4. Assemble the spacer.

Drill a countersunk pilot hole at the end of each end piece, centered over the rabbet, as shown. Glue and screw the frames together, using 1 $\frac{3}{4}$ " deck screws. As an option, you can create an upper entrance by boring a $\frac{1}{2}$ " to $\frac{5}{8}$ " hole centered on one of the end pieces.



ABOVE: *Completed hive spacers.*

PROJECT

Entrance Reducer

As you may know, a honey bee hive has guard bees whose job it is to protect the entrance, letting sister bees into the hive and keeping intruders out. The hives we just made have a bottom entrance that is about 14" wide. When you first install a package of bees, they don't have the girlpower to easily protect an entrance that large.

You can help them by providing an entrance reducer. It serves to shorten the usable width of the bottom entrance. You could liken it to narrowing the width of a soccer goal, making it easier to defend. Other occasions when you might use a reducer are when you are using an entrance feeder, when you first move a hive to a new location, or if you want to reduce the entrance in the wintertime.

Inevitably, you will have plenty of scrap material for making entrance reducers. You can simply use a piece of $\frac{3}{4}$ "-square \times 13"-long wood placed in the bottom entrance to the hive. When traffic starts to get crowded, cut a few inches off or just replace it with a shorter piece of wood to make the entrance opening wider.

Here's a simple plan for making two multisize entrance reducers. No matter how you place the reducer, only one entrance can be used. It's a good idea keep the entrance opening on the same side of the hive when you switch sizes.

Tools

Table saw (or router table)

Materials

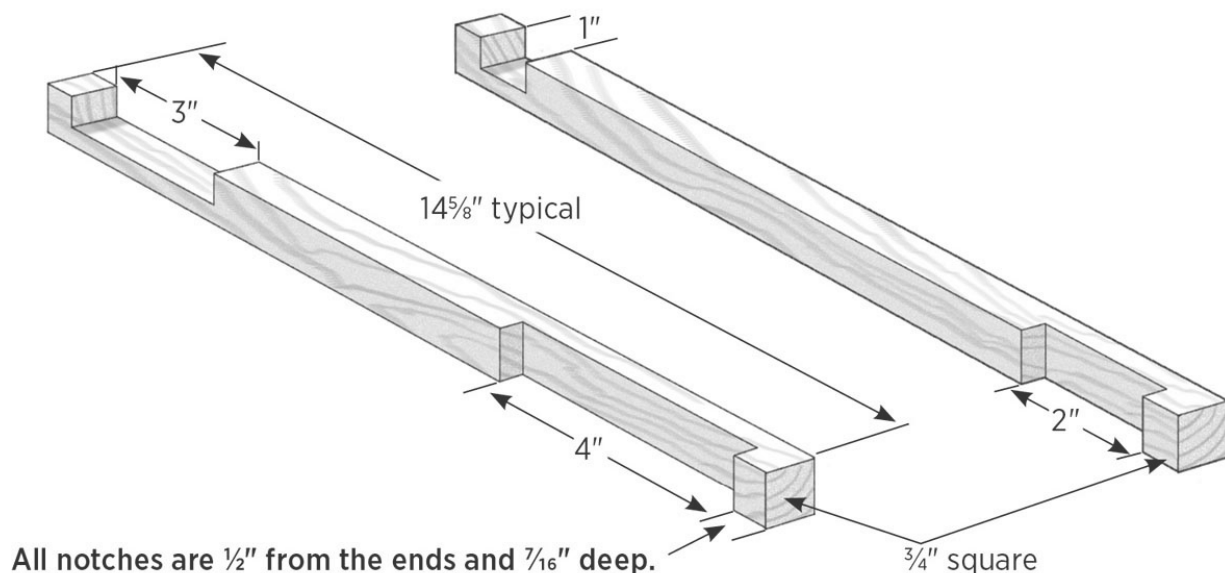
One 30" pine 1×1 or larger lumber (or any $\frac{3}{4}$ "-thick scrap lumber)

1. Cut and mark the reducer strips.

Cut two strips of $\frac{3}{4}$ " × $\frac{3}{4}$ " pine to length at $14\frac{5}{8}$ ". Mark two notches on each piece as shown. One strip gets 1" and 2" notches; the other strip gets 3" and 4" notches.

2. Cut the notches.

Set the table saw blade height at $\frac{7}{16}$ ", and cut the notches using a miter gauge. You can use the fence for accuracy, but it's not necessary; you can simply notch the ends up to the lines.



ABOVE: *Entrance reducer dimensions.*

Feeders

One way to make a new beekeeper's head spin is to run through all the different choices of feeders. Styles include entrance, hive-top, division board, bucket, baggie, and more. New and complicated ways are always being developed to do a simple thing: give the bees some sugar syrup.

I out-and-out don't like the Styrofoam hive-top feeders. Yes, they hold a lot of syrup, but you have to take them off to check the bees, and that can be very awkward. If you don't believe me, fill up a roasting pan with water and try walking around the kitchen table with it.

You can make a variety of feeders, some at no cost at all, using materials you probably have on hand. Entrance feeders don't hold as much syrup as some other types, but you can check the level just by looking at the front of the hive. New paint can feeders are simple to make using only a hammer and nail, and they hold a gallon of syrup each. You have to open them or at least lift them to check the syrup level.

Bucket feeders require a purchased insert and are a little more work to make. If you have a lot of feeding to do, I'd suggest one of the feeders that sits on the inner cover. You can use several at one time. Keep in mind that you will also need an empty deep super to cover them. If you are using a top-bar hive, any of the feeders that will fit can be placed right inside the hive to feed your bees.

Beekeeping advice: In the spring, fill your feeder with a ratio of 1:1 sugar to water. In the fall, use a ratio of 2:1 sugar to water.

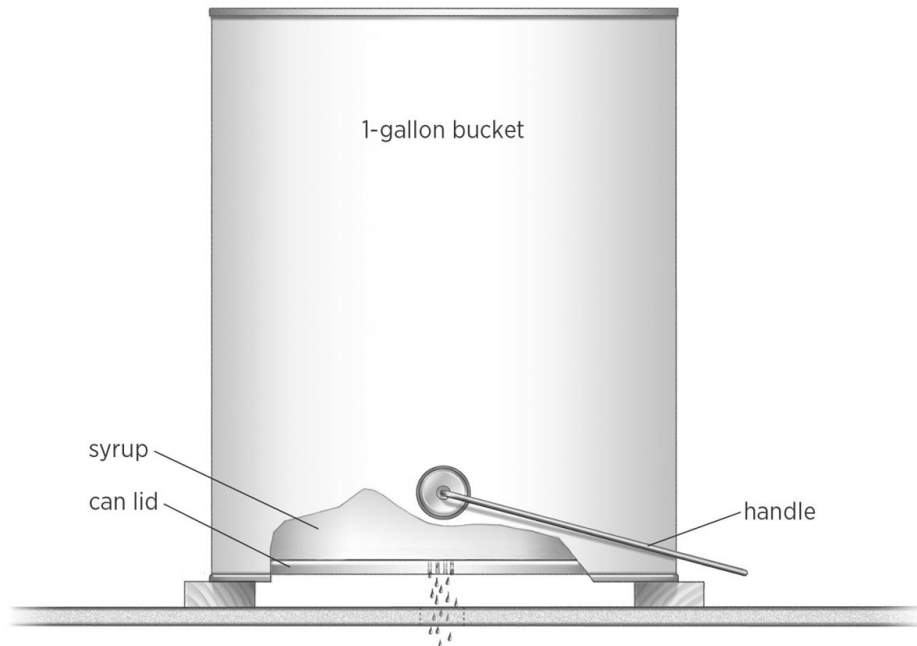
Package-Bee Feeders

If you've ever gotten package bees, you know they come with a can of sugar syrup. The can has a few tiny holes poked in it where the bees access the syrup. (Entrance feeders work on the same principle.)

When I get a package of bees, usually there's still plenty of syrup left in the can, and why let it go to waste? Just set a couple of $\frac{3}{8}$ " or thicker pieces of scrap wood on the inner cover to create a space, and set the can on top. Use an empty super to cover it, and the bees will take the syrup.

PROJECT

Paint Can Feeder



ABOVE: *Paint can feeder — side view.*

A gallon-size paint can is a great way to supply a good amount of syrup to the bees. And you can fit up to four on top of an inner cover. You can cut extra holes in the inner cover, but it isn't really necessary. The bees will access it easily enough through the regular slot.

Tools

Hammer

Small nail (such as a 3d box nail)

Materials

One-gallon paint can (with coated/lined interior)

Wood scraps, approximately 6" long

1. Prepare the can lid.

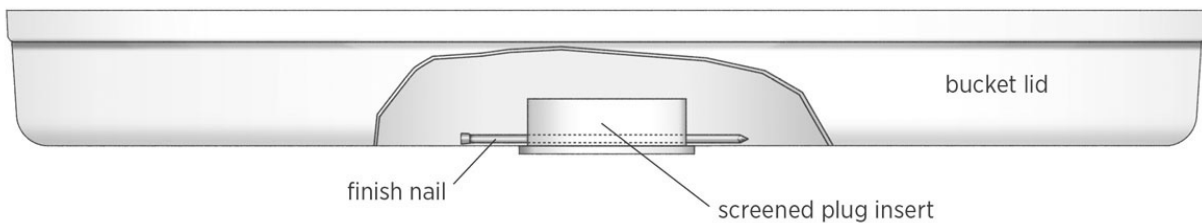
Place the inside of the lid of the can on a block of wood for support, and use a hammer and a small nail to punch a dozen or so very tiny holes near the lid's center, driving the nail from the top side of the lid. Make the holes just big enough to barely show light through. To test your holes, fill the can with water, pop on the top, and invert the can. After a few seconds no water should drip out of the holes. If it does, the holes are too big. You can remedy this by removing the cover and tapping lightly on the protruding edges of the holes to close them up a bit. Replace the cover and test again. If the holes pass the water test, they will work with the sugar syrup, which is thicker.

2. Fill and set the feeder.

Fill the can with syrup (see Beekeeping Advice on facing page). Fit the lid onto the can and tap it with the hammer to secure it. Set the wood scraps on the inner cover, invert the can on the sticks, and call up the bees. Cover the feeder with an empty super, followed by the telescoping outer cover. Chances are by the time you get the super in place the bees will already have found their new source of food.

PROJECT

Bucket Feeder with Screened Plug Insert



ABOVE: *Bucket feeder — cutaway view.*

Another way to make a feeder is to use screened feeder plugs, available at some bee supply houses. You mount them in the lids of 2-gallon plastic buckets that often are available for free at bakeries. Buckets with O-ring seals are the best. The lid has to seal well to maintain the surface tension needed at the holes to keep the sugar syrup from draining out quickly.

Tools

Clamps

Scrap wood

Drill and 2" hole saw (see step 1)

Pliers

Materials

2-gallon plastic bucket

Screened plug insert

Silicone caulk or other sealant

One 7d or 8d finish nail

1. Cut the lid.

Mark the approximate center of the bucket lid, then clamp the lid to a solid surface with a piece of scrap wood underneath. Using a drill and hole saw, cut a 2"-diameter hole through the lid at the center mark. Alternatively, you could mark the hole with a compass and make the cut with a utility knife, but you have to be accurate.

2. Install the screen.

Apply a bead of silicone caulk around the rim of the screened insert, then set the insert in the hole. Push a finish nail through the insert, just inside the cover as shown in *Bucket Feeder — Cutaway View*, below, to hold the insert in place (without the nail, an insert can work loose and leak the sugar syrup).

3. Fill and set the bucket.

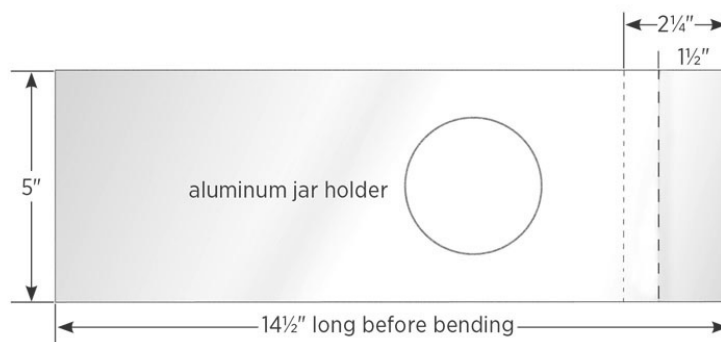
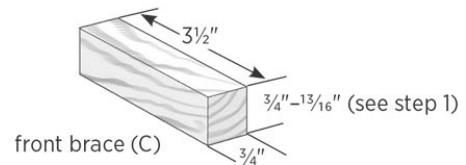
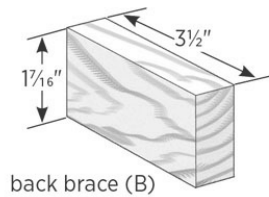
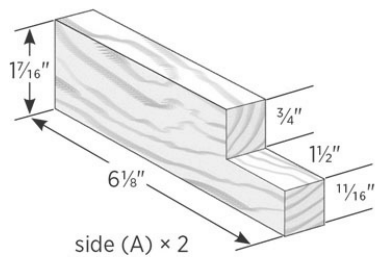
Fill the bucket with syrup (see syrup ratios in *Beekeeping Advice* on **page 76**) and snap on the lid securely. It works best if the bucket is filled almost to the top. As with the paint can feeder, invert and set it on top of two pieces of scrap wood over the inner cover, place an

empty deep box on top followed by the telescoping outer cover, and you will have happy bees.

PROJECT

Traditional Boardman-Style Entrance Feeder

Now we'll make a Boardman-style feeder. I'm not sure where the name came from or when the feeder was invented. Entrance feeders are particularly appealing to new beekeepers because you can stand outside the hive and see how much sugar syrup is left, and you can top up or replace it without opening the hive. Use this type of feeder on a Langstroth-style hive, along with an entrance reducer (see [page 75](#)) that restricts the entrance opening at the far end of the hive to help prevent robbing. I designed this feeder around a plastic quart-size mayonnaise jar and used scraps of wood I had lying around. The materials listed are for making two feeders.



ABOVE: *Entrance feeder parts.*

Tools

Table saw

Gloves and safety glasses

Vise or homemade bending jig (see **page 89**)

Drill and $\frac{1}{2}$ " (or larger) brad-point bit (see step 5)

Tin snips

Staple gun and $\frac{3}{8}$ " staples

Materials

One 13"-long pine 1×6

Waterproof glue

Four 5d galvanized box nails

Two 5" × 14 $\frac{1}{2}$ " pieces aluminum flashing

Emery cloth or sandpaper

Twenty-six 3d galvanized box nails

One 1-quart mayonnaise or mason jar

1. Cut the wood frame pieces.

Cut three strips from the 1×6 at $1\frac{7}{16}$ " wide. Two of these will be used for the sides (A); set them aside. From the remaining strip, cut two pieces to length at $3\frac{1}{2}$ "; these are the back braces (B).

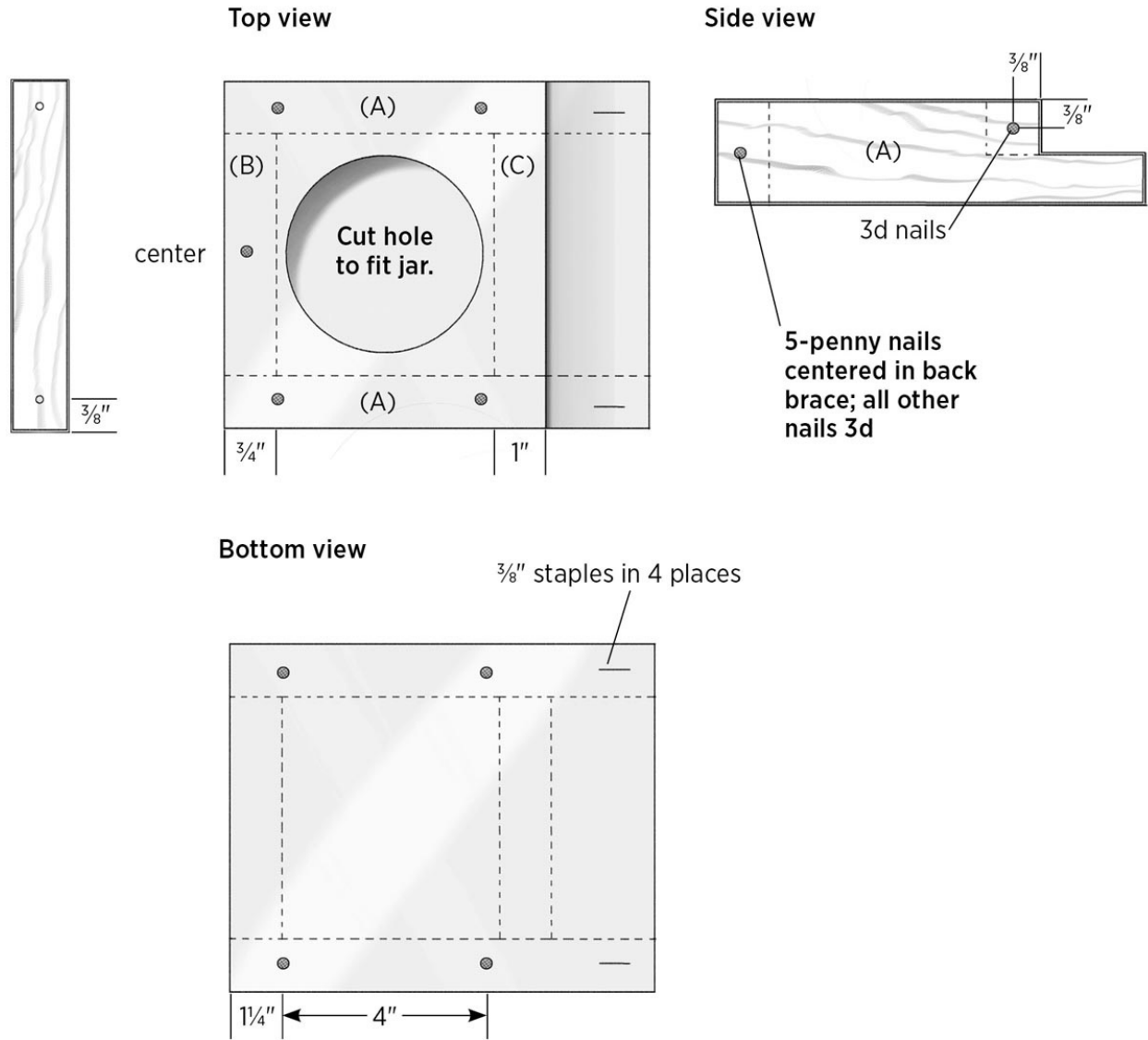
The leftover 1×6 material should be around $1\frac{3}{16}$ " wide. Cut two pieces to length from this at $3\frac{1}{2}$ "; these are the front braces (C).

2. Rabbet the side pieces.

Each side (A) gets a $\frac{3}{4}$ "-deep × $1\frac{1}{2}$ "-wide rabbet at each end before being cut to length. Set the table saw blade height at $\frac{3}{4}$ " and set the fence at $1\frac{1}{2}$ ". Cut the rabbets using a miter gauge, moving the workpiece away from the fence a bit with each pass to remove the waste. When the rabbets are done, cut each finished side piece to length at $6\frac{1}{8}$ ".

3. Assemble the feeder frames.

To assemble each frame, spread some glue on the ends of the braces and assemble the frame as shown. Fasten the pieces with 5d nails on the back brace and 3d nails on the front brace, as shown. Set these assemblies aside to dry.



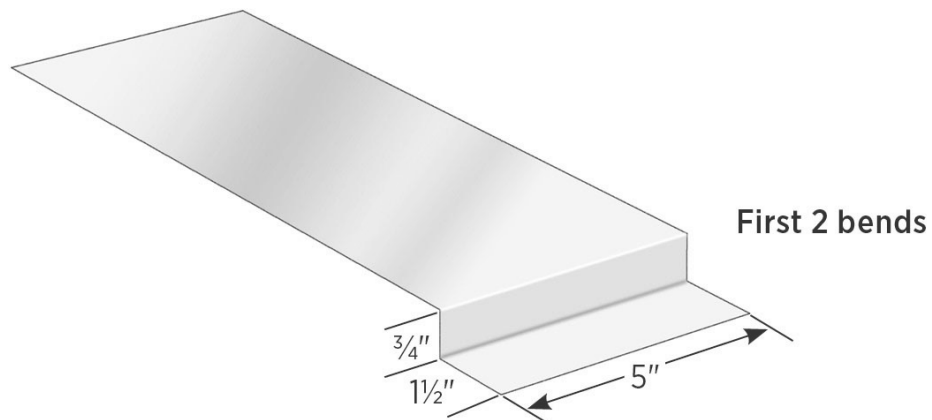
ABOVE: *Nail locations.*

4. Bend the aluminum jar holders.

Cut two pieces of aluminum flashing to size at 5" wide \times 14 $\frac{1}{2}$ " long (be sure to wear gloves while working with sheet metal). Touch the edges with emery cloth to remove any burrs.

Decide which face of each piece will be the top, then draw a line across the width of each piece (on the top face) at 1 $\frac{1}{2}$ " from one end.

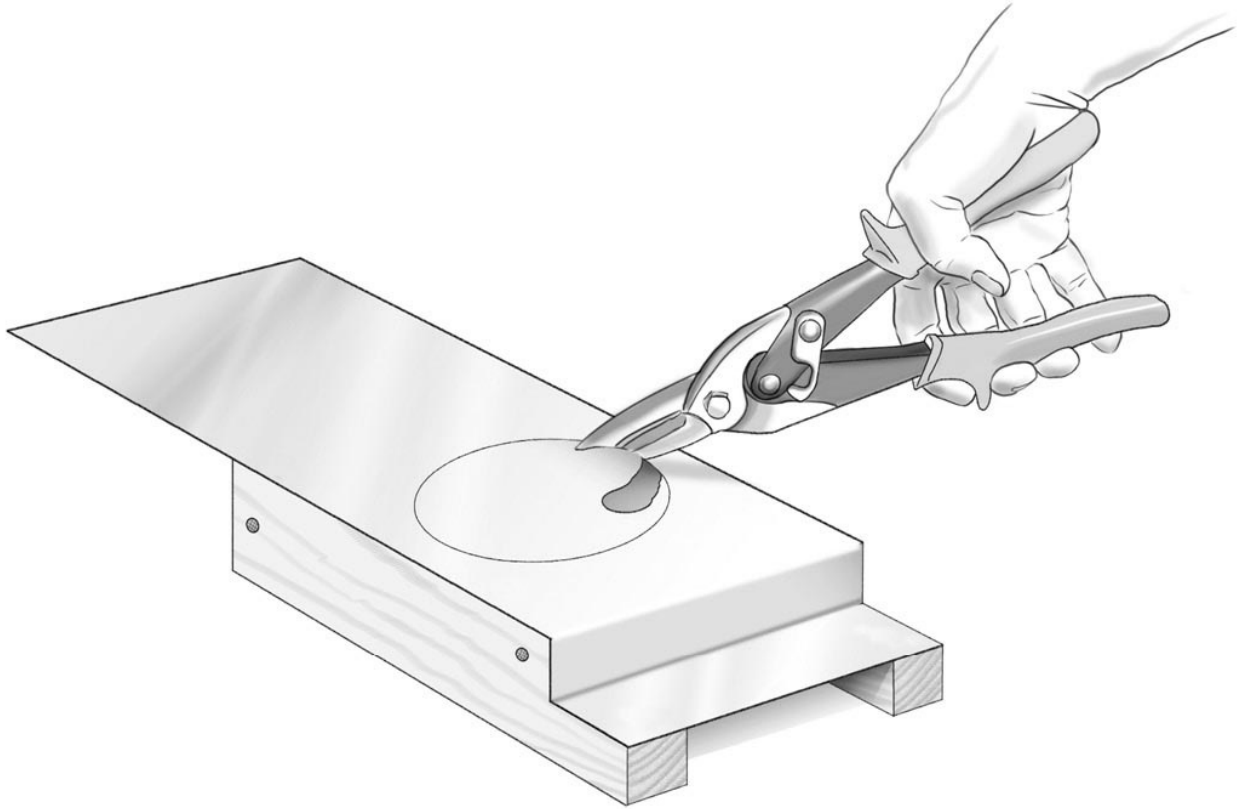
Flip the piece over and draw another line on the bottom face at $2\frac{1}{4}$ " from the same end. Clamp each piece into the bending jig from **page 89**, or into a vise, and bend the metal at 90 degrees along the $2\frac{1}{4}$ " line. It's easy to bend by hand, but try to keep your bends sharp and square. Make the second bend along the $1\frac{1}{2}$ " line as shown.



ABOVE: *Bending the aluminum jar holder.*

5. Cut the jar holes.

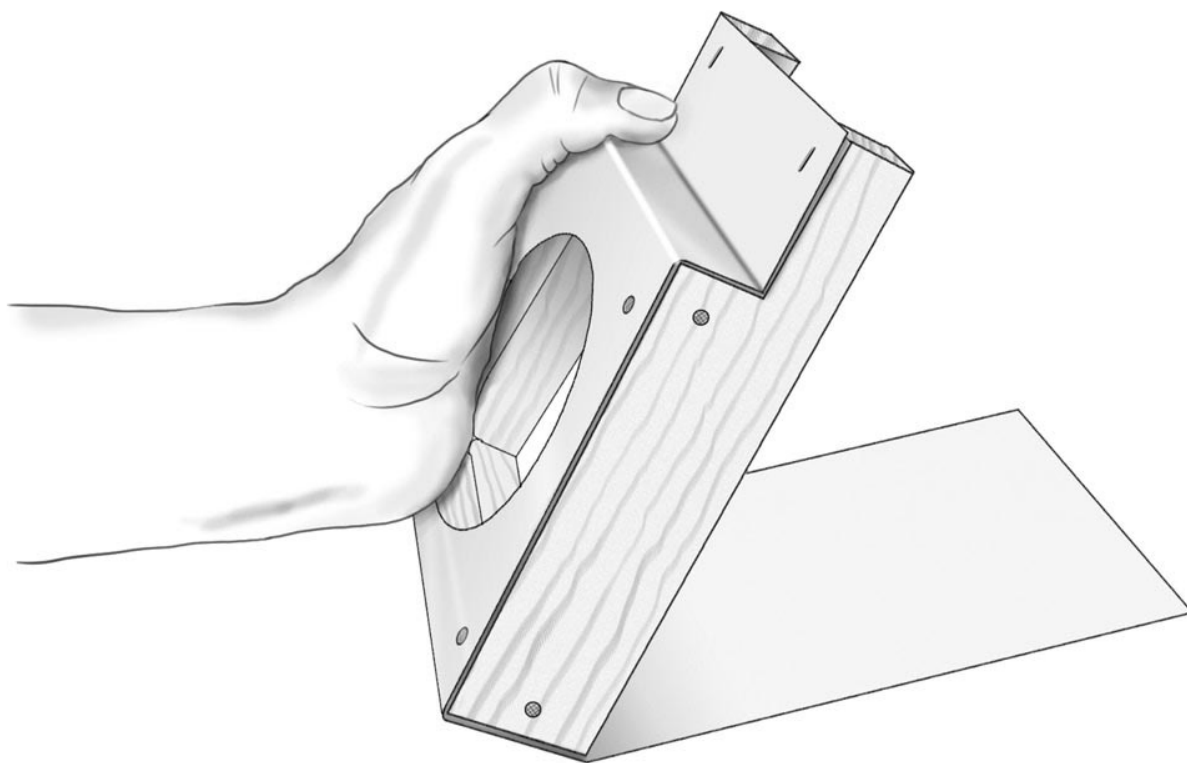
Nail each aluminum sheet to one of the wood feeder frames with two 3d nails, about 1" from the inner bend. With the lid screwed on, center the inverted jar over the opening in the wood frame, and trace around the rim of the jar onto the metal. Using a $\frac{1}{2}$ " brad-point bit, drill a starter hole in the metal, then carefully cut along the traced circle with tin snips — staying inside the line. Test-fit the jar in the hole; the lid should fit through the metal, and the jar should stand straight up. There should also be at least a $\frac{5}{16}$ " space below the lid for the bees to access the food. Keep in mind that you can make the hole bigger once you cut it, but you can't make it smaller.



ABOVE: *Cutting out the jar hole.*

6. Complete the feeder assembly.

Add three more 3d nails in the top of each feeder, across the back brace. Bend the aluminum around the back and bottom of the wood frame and nail it to the bottom edges of the sides (it's okay if the end of the metal overhangs or comes up short a little). Staple the metal to the top and bottom of the entrance end with $\frac{3}{8}$ " staples as shown.



ABOVE: *Finish bending the aluminum. Nail each side as you finish bending.*

8. Load and install the feeder.

Punch 10 or 12 tiny holes in the lid of the feeder jar from the top side, using the tip of a 3d nail; they should be very tiny, just big enough to see a little light through. Pour water in the lid and hold it steady; if water drips out, the holes are too big. If you have a hole or two that drip, try tapping the protruding inside edges of them lightly with the hammer to close them a little. If you're using a two-piece canning jar lid, you'll have to do the water test with the lid screwed onto the jar.

If you don't have any drips, your feeder is ready. Fill the jar with syrup (see Beekeeping Advice, **page 76**), then add the lid and tighten

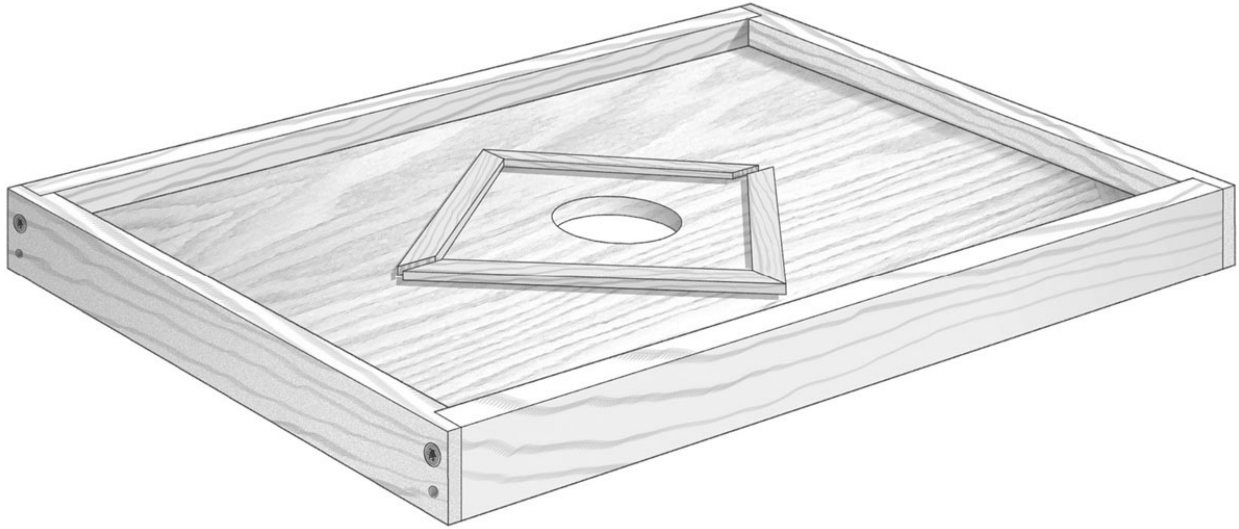
it securely. Invert the jar and set it into the feeder. Slip the front of the feeder into the hive entrance.



ABOVE: *Completed entrance feeder — back view.*

PROJECT

Escape Boards



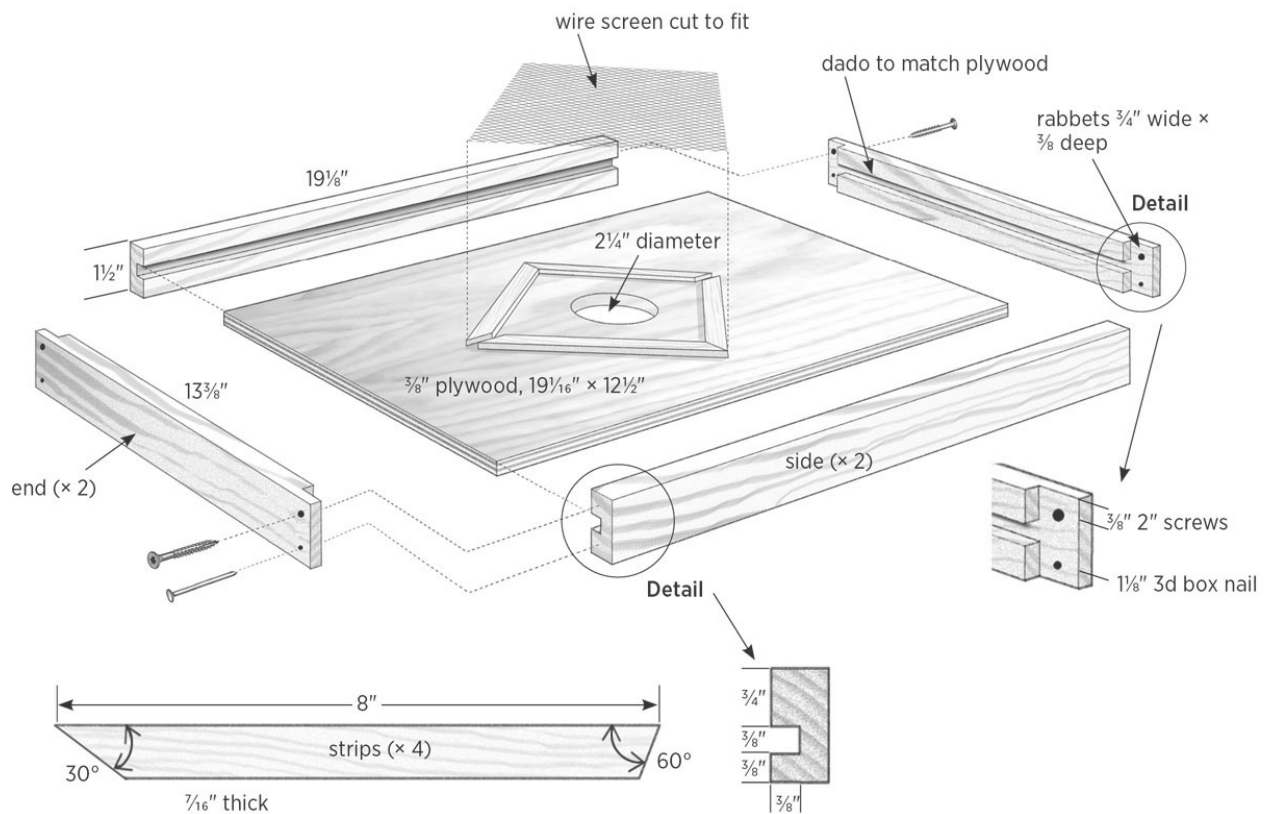
There are many ways to get bees out of the supers once they are full and capped off, and ready for you to harvest. One way that has been practiced probably as long as movable frames have been used is simply to pull one frame out at a time and use a bee brush to gently remove the bees. If the frame is entirely capped, the bees are very easy to remove. On the other end of the spectrum are methods I've never used, such as fume-boards that employ a chemical the bees don't like to drive them out of the super. Pretty harsh, eh?

What we're going to build here falls in between those two extremes. Escape boards work as one-way gates. They allow bees down into the hive, but they can't seem to find their way back in. It's a very low-impact way of emptying supers. The only drawback is that you have to pull the supers off to place the escape board below them,

then return the next day to remove them for extracting. But it works very well, and it's the method I use.

If you built 10-frame hives, make the 10-frame escape board, and likewise with the 8-frame version. To use it, you take off the super of capped honey that still has bees in it, install the escape board on the hive with the screen side down, put the super on top of the escape board, and replace the inner and outer covers. Make sure there aren't any openings in or between supers that would allow bees into the supers from the outside of the hive (duct tape works well for covering holes).

Come back the next day and the honey super will be free of bees, save a few possible stragglers. Remove the super and enjoy the bounty. The escape board will also work if you have several supers on the hive. Just put it under the bottom super. (See photos on [page 160](#).)



ABOVE: *8-frame escape board — exploded view.*

Tools

Table saw

Drill and combination drill/countersink bit

2 1/4" hole saw (see step 5 on **page 86**)

Miter saw or small handsaw and protractor

Brad nailer (optional)

Marker

Tin snips

Staple gun and 3/8" or 1/2" staples

One piece cardboard, 6" square minimum (for 10-frame board only)

Materials

One 4-foot 1x4 (for 8-frame escape board)

One 6-foot 1x4 (for 10-frame escape board)

One piece 3/8" plywood:

- size for 8-frame: 19 1/16" x 12 1/2"
 - size for 10-frame: 19 1/16" x 15 7/16"
-

Waterproof glue

Four 2" deck screws

One piece #8 galvanized hardware cloth:

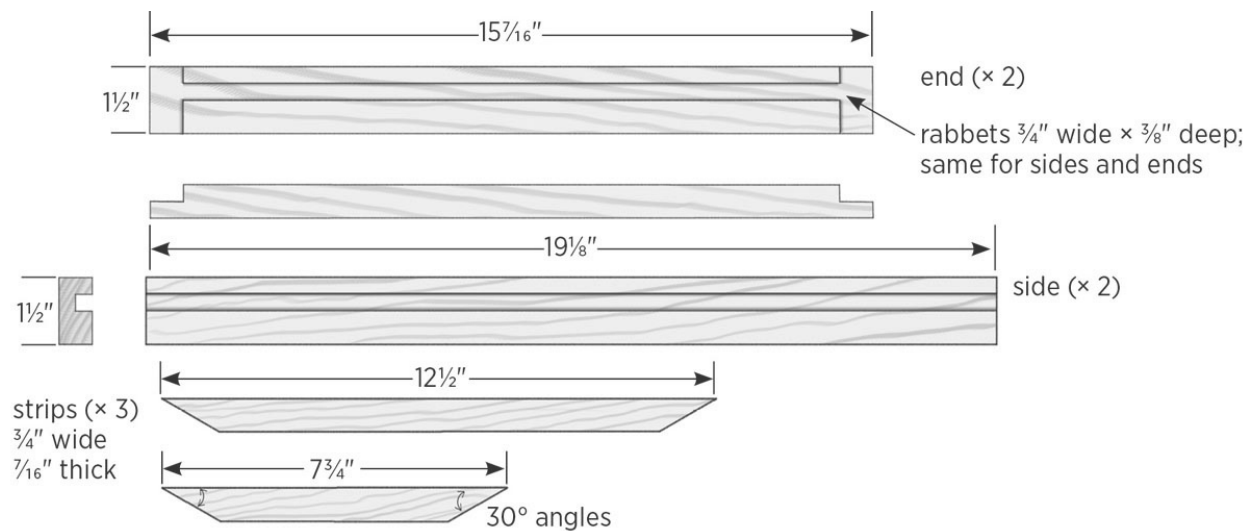
- size for 8-frame: 8" x 14 1/2"
 - size for 10-frame: 12" x 15"
-

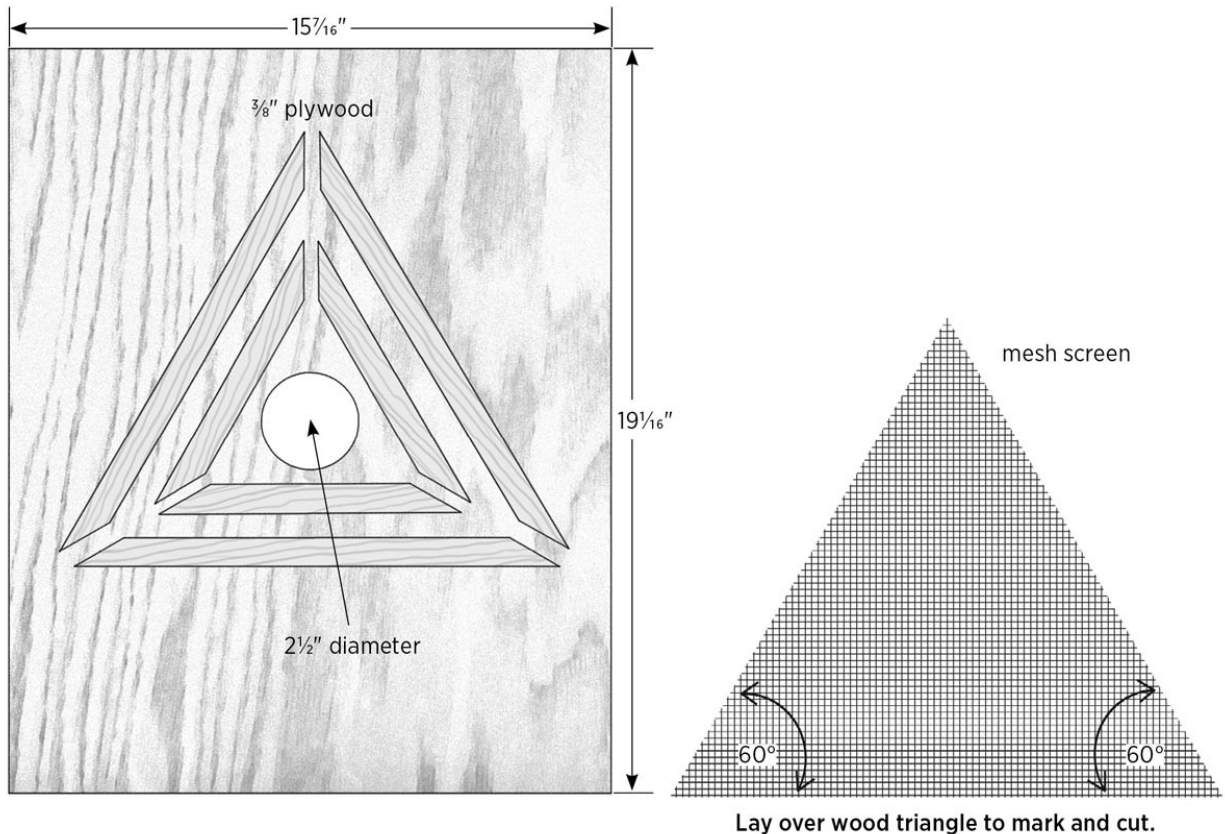
Six 1" deck or drywall screws (for 10-frame)

1" brads

3d nails

Construct the Boards





ABOVE: *10-frame escape board parts*

1. Cut the frame parts.

For the **8-frame** board: Cut one piece of 1x4 to length at $19\frac{1}{8}$ " for the sides, and cut one piece at $13\frac{3}{8}$ " for the ends. Also cut one piece at 8"; you will use this to make screen strips for the escapes.

For the **10-frame** board: Cut one piece of 1x4 to length at $19\frac{1}{8}$ " for the sides, and cut one piece at $16\frac{1}{4}$ " for the ends. The leftover piece will be used for screen strips.

2. Dado the frame sides and ends.

Each of the frame sides and ends gets a $\frac{3}{8}$ "-wide \times $\frac{3}{8}$ "-deep dado, $\frac{3}{8}$ " from each long edge of the board (later, you'll rip these pieces lengthwise to get the four frame pieces). The dados will accept the plywood panel. With a standard blade on the table saw, set the blade height at $\frac{3}{8}$ ". Start with the fence at $\frac{3}{8}$ " and move it over a little with each pass until the dado fits snugly over the plywood (test fit as you go).

3. Rabbet the frame ends.

While the saw blade depth is still $\frac{3}{8}$ ", cut a $\frac{3}{4}$ "-wide rabbet in each end of the end piece, using a miter gauge to guide the workpiece.

4. Rip the frame pieces.

Set the blade height at about 1" and set the fence at $1\frac{1}{2}$ ". Rip the four frame pieces to width, keeping the edge nearest the dado next to the fence.

5. Prepare the plywood.

Cut the plywood to size: $19\frac{1}{16}$ " \times $12\frac{1}{2}$ " for the 8-frame or $19\frac{1}{16}$ " \times $15\frac{7}{16}$ " for the 10-frame. Measure and draw horizontal and vertical centerlines across the full length and width of the panel for the 8-frame escape board. You only need to go from corner to corner to mark the centerpoint of the 10-frame panel. At the intersection of the lines, drill a $2\frac{1}{4}$ " hole, using a hole saw. Alternatively, you can draw a $2\frac{1}{4}$ " circle with a compass, drill a $\frac{1}{2}$ " or larger starter hole inside the hole, then cut out the hole with a jigsaw.

6. Assemble the board.

Dry-fit the frame around the plywood, clamp the assembly, and make sure the frame is square. Drill a countersunk pilot hole at the end of each end piece, as shown in 8-Frame Escape Board — Exploded View, on **page 84**. Apply glue to the frame joints and assemble the board with 2" deck screws and four 3d nails.

Make the Escapes

8-Frame

1. Cut the screen strips.

Rip six $\frac{7}{16}$ "-thick strips from the 8" piece of 1×4. On each strip, cut a 30-degree angle on one end and a 60-degree angle on the other end, as shown in 8-Frame Escape Board — Exploded View, on **page 83**. You can make these cuts on a miter saw or mark them with a protractor or rafter square and cut them with a handsaw.

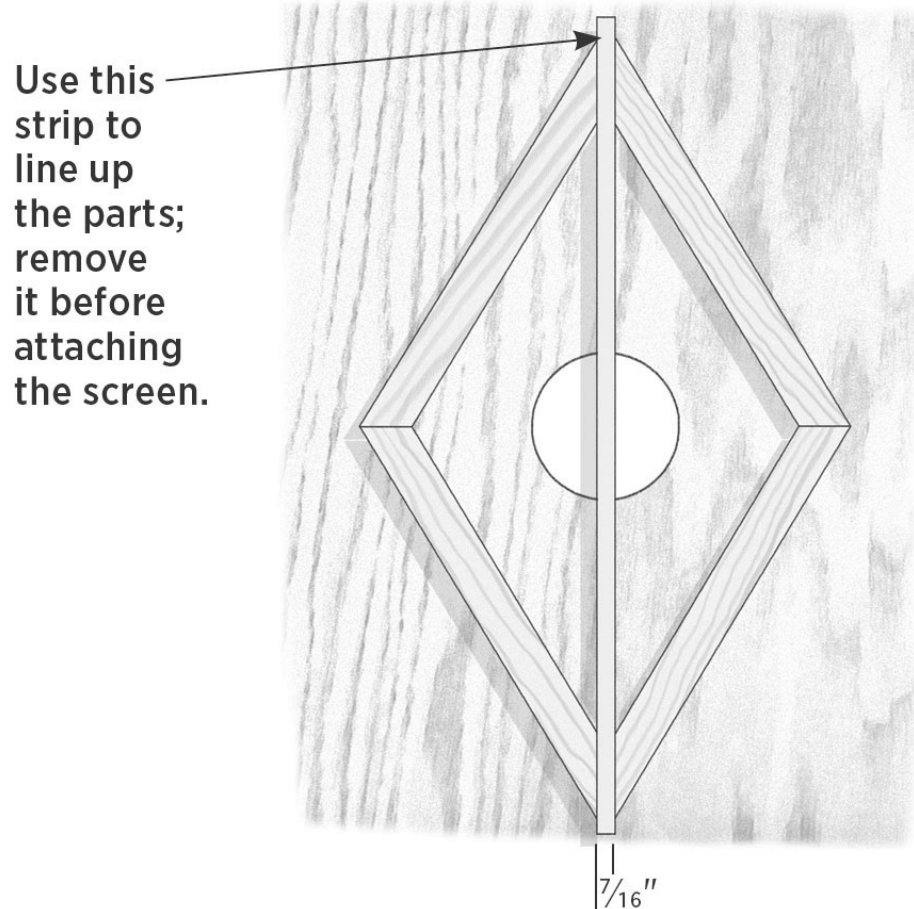
2. Install the strips.

Working in the deep side of the board (where the plywood panel is $\frac{3}{4}$ " from the frame edges), glue and nail four of the strips to the plywood, using the centerlines and following the layout shown below. Use the two extra strips, each placed on-edge lengthwise along the centerline, as spacers. Nail the strips with three 1" brads, then cinch the nails over on the back side of the plywood. Make sure the spaces

between strips are $\frac{3}{8}$ " to $\frac{7}{16}$ " wide; if they get too wide, some bees will find their way back in.

3. Add the screen.

Lay the #8 hardware cloth over the strips, and mark the outline of the strips with a marker. Cut the screen with tin snips, and secure it to the strips with $\frac{3}{8}$ " staples. Now you're all set to get some bees out of those supers.



ABOVE: *Attaching the 8-frame escapes.*

10-Frame

1. Cut the screen strips.

Using leftover 1×4 material, which should be about 36" long, rip four $\frac{7}{16}$ "-thick × $\frac{3}{4}$ "-wide strips on the table saw. Cut six strips to length at 12 $\frac{1}{2}$ " and three at 7 $\frac{3}{4}$ ", making 30-degree angle cuts on both ends of each strip. You can make these cuts on a miter saw or mark them with a protractor or rafter square and cut them with a handsaw. From the remaining strip, cut three pieces approximately 6" long to be used as spacers.

2. Install the inner strips.

Create a layout template from cardboard, cutting it into a triangle with three 6" sides; the angles will be 60 degrees. Center the template over the hole in the board's plywood panel (the placement doesn't have to be perfect). Spread glue on the short strips, position them around the template, using the spacers placed on-edge to create $\frac{7}{16}$ " openings at the three triangle points, and nail the inner strips to the plywood with three 1" brads. (See layout on **page 85**.)

3. Install the outer strips.

Leave the three spacer strips on-edge in the spaces between the inner strips and use them to line up 12 $\frac{1}{2}$ " strips for the outer triangle. Make sure the openings where the bees will exit are $\frac{3}{8}$ " to $\frac{7}{16}$ " wide. If they get too wide, some bees will find their way back in. Attach the outer strips with brads, remove the spacers and

cardboard template, then flip the board over and cinch all of the nails over with a hammer.

4. Add the screen.

Lay a piece of #8 hardware cloth over the outer strips and trace along the outside of the outer strips with a marker. Cut the mesh along the lines, using tin snips. Fasten the screen to the outer strips with $\frac{3}{8}$ " staples.

5. Install the top strips.

Drill and countersink two pilot holes in the three remaining $12\frac{1}{2}$ "-long strips about 4" from each end and centered. Place these on the screen, in line with the attached strips, and attach them with the 1" screws. Your escape board is ready to use.

CHAPTER SEVEN

Let's Do a Little Jig

CHAPTER CONTENTS

Simple Bending Jig

Frame Assembly Jig

The Best-Ever Jig for Installing Foundation

Jigs are handy little devices that improve life by ensuring repeatable accuracy, making assembly faster and easier, or simply holding parts to free up your hands. The time it takes to make jigs is saved many times over while using them. During my years of machine shop and metal fabrication, I've made hundreds of jigs for different purposes. It was always one of the most fun and challenging parts of the job.

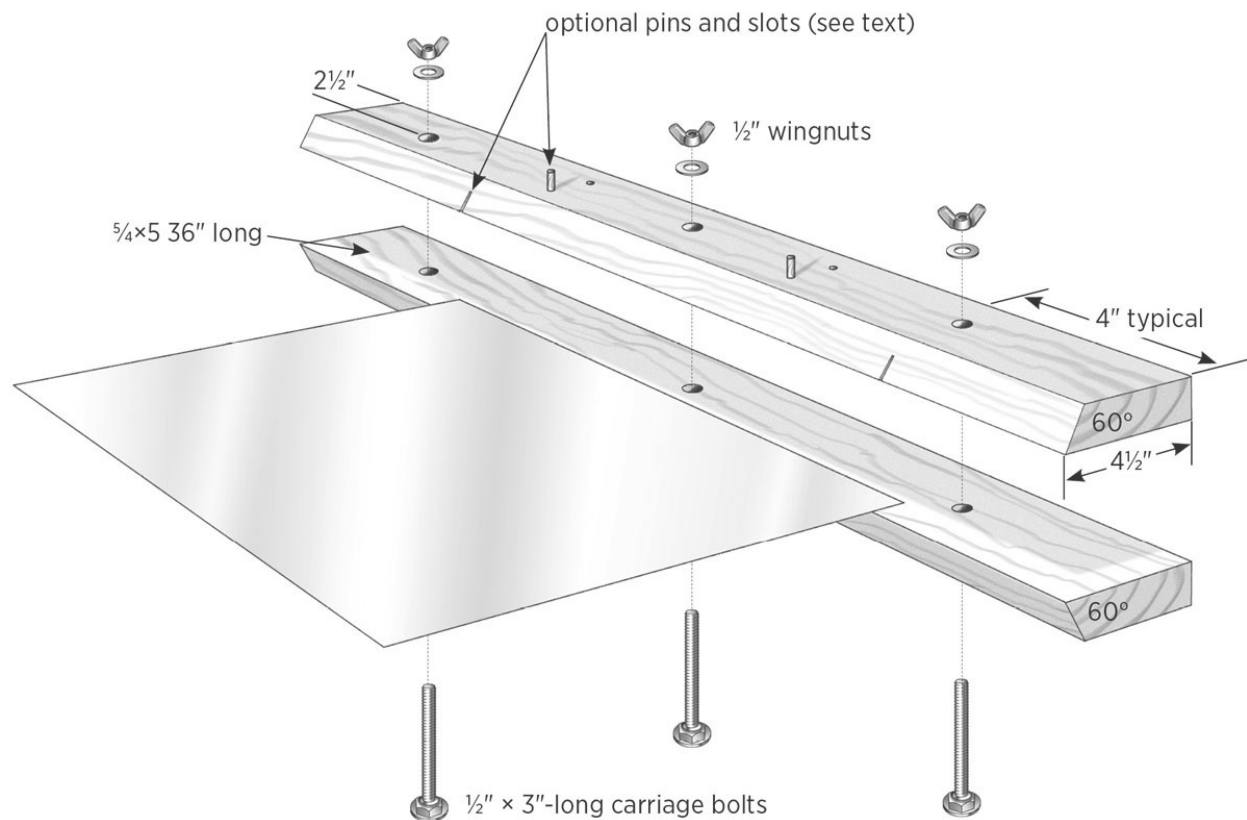
While jigs often are made for mass production, the ones shown here will come in handy even if you're building only a couple of hives. After all, two 10-frame hives with two deep hive bodies each and just two supers means you'll be assembling a minimum of 80 frames. That's worth having a jig for.

PROJECT

Simple Bending Jig

I designed this simple jig for bending the aluminum flashing I used on telescoping covers (see [page 52](#)). I had the wood on hand and only needed to buy the hardware. For your own jig, you can keep things simple and stick with the basic design, or add one or more of the additional features described in Customizing Your Jig ([page 90](#)).

Either way, you'll have a super-handy jig for bending light aluminum sheet metal. And even if you use it only for the first bend on your outer covers, you'll be starting out with a good, clean bend that will make the rest of the installation easier.



Tools

Table saw

Drill press or portable drill

1"-diameter Forstner or spade bit

1/2" brad-point bit

Materials

One 6-foot $5/4 \times 5$ board

Three $1/2" \times 3"$ carriage bolts with washers and wingnuts

Epoxy (optional)

1. Cut the boards.

Cut the $5/4 \times 5$ board into two equal lengths. Use a table saw to cut a 60-degree angle lengthwise along the edge of both boards, as shown.

2. Add the carriage bolts.

Clamp the boards together with all edges aligned. On the bottom face of the bottom board, make three marks $2\ 1/2"$ from the back (square) edge: two at 4" from each end and one in the center. At each mark, drill a 1"-diameter hole to a depth of about $5/16"$ — enough to recess

the carriage bolt head. Then, drill 1/2" holes all the way through both boards for the bolts.

Install the carriage bolts from the bottom. Add washers and wingnuts on top and tighten the bolts to set the bolt heads into the bottom board. If desired, you can also add a little epoxy on the heads (now or later) to keep the bolts from turning.

3. Use the jig.

To use the jig, simply mark your bend line onto the sheet metal and clamp the sheet between the two boards, tightening down the wing nuts. Hold the jig in both hands with the metal on a flat surface, then pivot the jig as you apply downward pressure.

Customizing Your Jig

There are a few options you can add to your jig to make it more useful and easier to use:

Slots. Once you bend up the first two opposite sides of a metal top at 90 degrees, those lips will hit the jig and get distorted when you try to bend the last two sides. To remedy this, cut vertical slots in the top board of the bending jig where those lips line up. Make those slots a little deeper than the height of the lips you are bending. Now, when you bend the last two sides of your cover, line the lips up with the slots, allowing you to bend all four sides for things like outer covers.

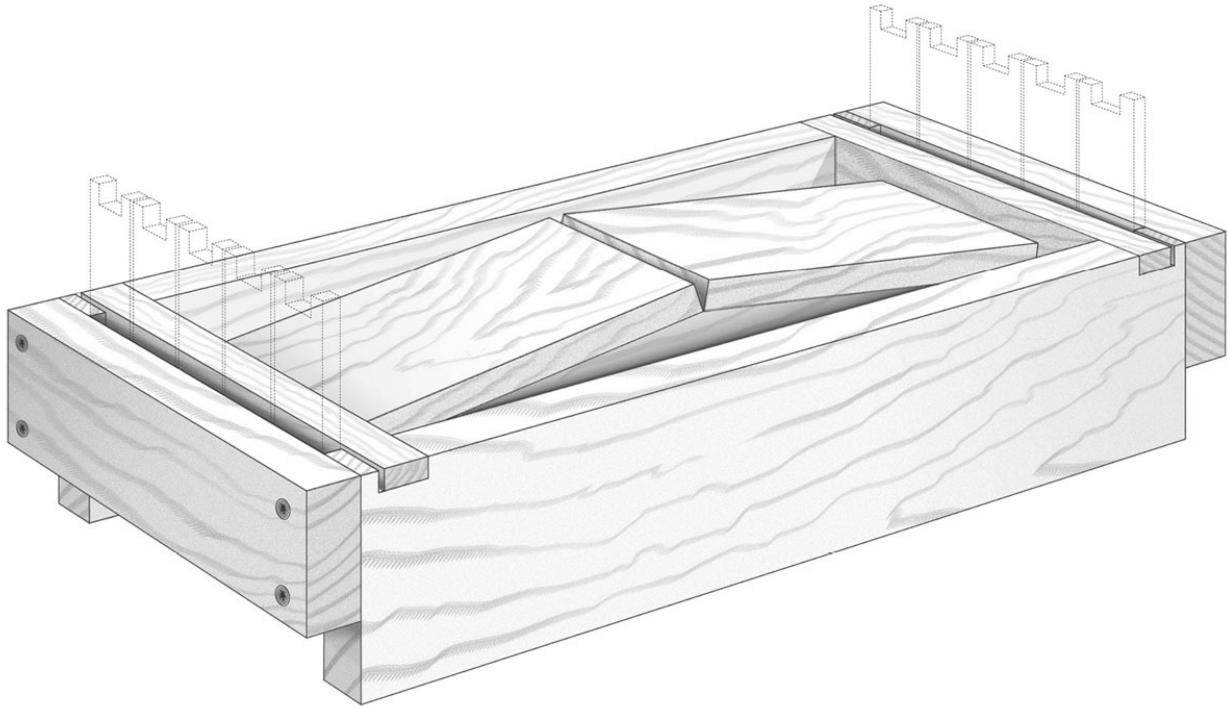
Stop pins. Add holes for stop pins at widths you will be bending frequently. To locate the holes, measure back the bending-

width distance plus one-half the diameter of the pins you will use. For example, for a $\frac{1}{2}$ "-wide bend, using a $\frac{1}{4}$ " pin, you would drill $\frac{5}{8}$ " from the front of the jig. Drill through the top board and partway into the bottom board. Drop your pins in, and slide the sheet against them for repeat bends.

Springs. A couple of springs mounted between the boards automatically opens the jig when you loosen the wing nuts. You can buy small coil springs at hardware stores; they should be strong enough to push the boards apart but not so strong that it's hard to tighten the wing nuts. Drill counterbore holes for the springs to set in.

PROJECT

Frame Assembly Jig



ABOVE: *Frames in place.*

If you've decided to use only plastic frames, you can skip this project (or tear out one of its pages and use it as a bookmark). But if you're anything like me and prefer the smell of freshly cut pine over the finest perfume, you'll probably be assembling frames at some point in your beekeeping experience.

A jig for assembling frames doesn't necessarily make the finished product come out better; it just makes the job a little easier and

faster. The frame jig holds the end pieces upright and frees up your hands for the gluing and nailing (see photos on pages **116-117**.)

You can make your jig hold any number of frames. I've seen many that hold 10 frames, and if you're using an air nailer, setting up to do that many at once makes sense. I still do mine the old-fashioned way, with a hammer and nails, and my jig holds 5 frames at a time. With limited space on the workbench, this works out just right for me (see What Makes a Good Assembly Jig, on **page 95**).

Perhaps the best things about this jig are that no tools are required to use it, and once it's assembled, there are only four parts to deal with. The construction does require some accurate cutting, but you can start it, say, after lunch, and you'll be putting frames together by dinnertime. As always, I recommend that you read through the whole project before starting construction.

Tools

Table saw

Dial calipers, decimal type (see step 3)

Small handsaw (such as a coping saw or hacksaw)

Drill and combination drill/countersink bit

Tin snips

Materials

One 8-foot pine 1×4 (must be straight and square; see step 1)

Scraps of pine 1-by lumber (about 12" long, for frame guides and spacers)

Sixteen $\frac{3}{4}$ " wire nails

Six 4d box nails

Eight $1\frac{1}{4}$ " deck screws

Four $\frac{1}{2}$ " or $\frac{5}{8}$ " wire nails

Eight 2" deck screws

Wood glue

One piece aluminum flashing or other thin sheet metal, approximately 2" x 4"

One $1\frac{1}{2}$ "-wide x 3"-long hinge with screws

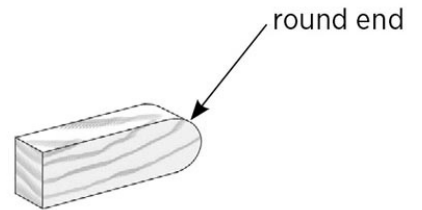
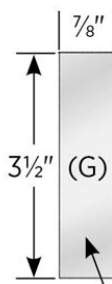
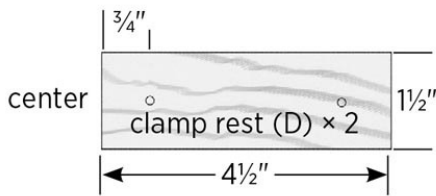
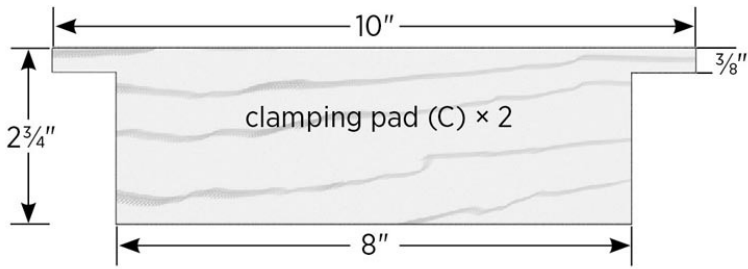
1. Cut the main wood parts.

Note: When cutting the identical parts for this project, it's best to use a stop to ensure the lengths of like parts are the same. This will make it easier to build your jig square. You can also substitute hardwood for increased strength.

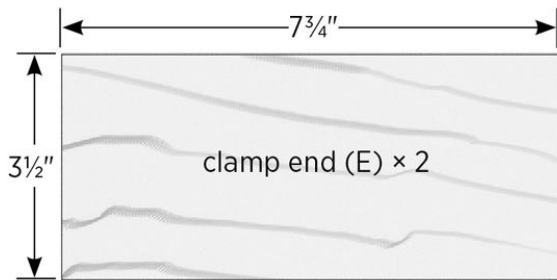
Cut the following pieces to length from 1x4 lumber:

- Two sides (A) at $17\frac{13}{16}$ "
- Two ends (B) at $9\frac{3}{4}$ "; rip each of these to $2\frac{7}{8}$ " in width
- Two clamping pads (C) at 10" (see step 5 for an optional cutting method)
- One piece at $4\frac{1}{2}$ "; rip this piece into two $1\frac{1}{2}$ "-wide pieces for the clamp rests (D)
- Two clamp ends (E) at $7\frac{3}{4}$ "

Note: You will cut the frame guides (F) later.



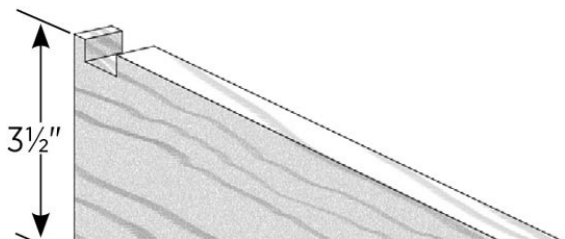
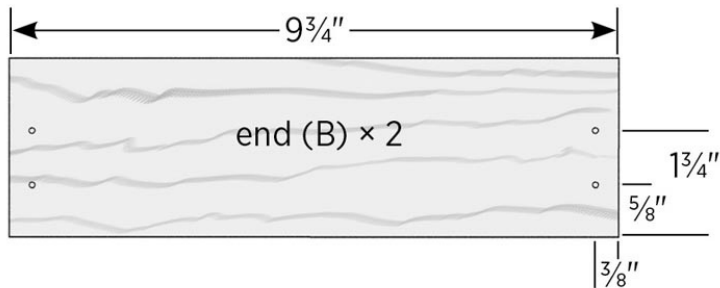
thin metal clamp plate, ×2

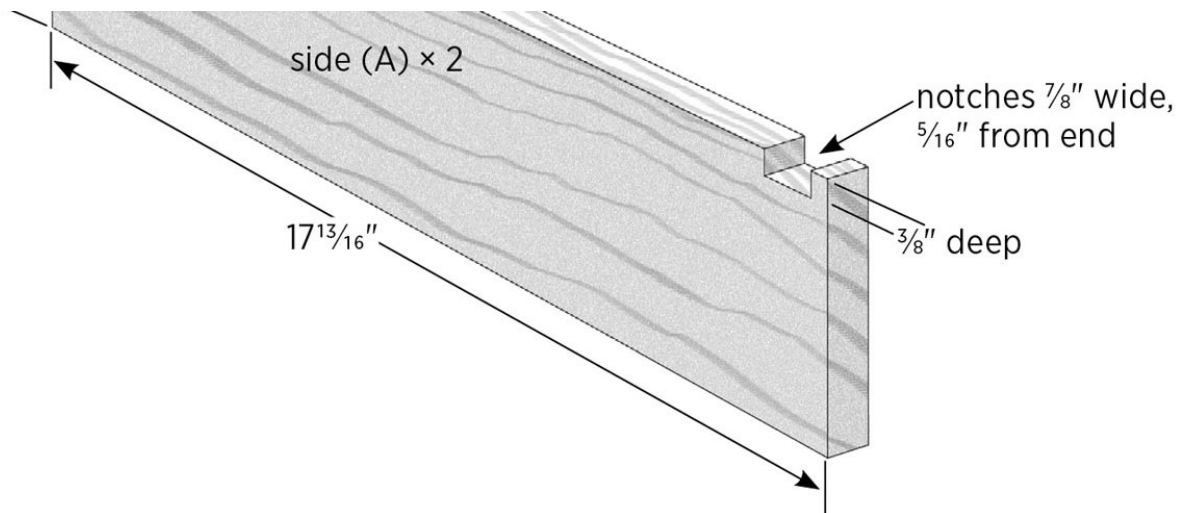


center



**Drill and countersink 1
end for deck screws to
be used for adjustment.**





ABOVE: *Frame assembly jig parts.*

2. Notch the side pieces.

The sides (A) get two notches near each end that the clamping pads will set into. To cut the notches, set the table saw fence to $\frac{5}{16}$ " to the *near side* of the blade. Set the blade height to $\frac{3}{8}$ ". Test-cut a scrap piece, then cut the notches, moving out the fence with each pass until the notches are $\frac{7}{8}$ " wide.

3. Cut the frame guides.

Note: The 12 frame guides (F) are small and must be cut carefully and accurately. Here's how I cut mine.

Set the table saw fence at $\frac{3}{8}$ " and cut a test piece. Measure the cut piece with calipers (available at woodworking supply houses and many hardware stores), and adjust the fence as needed so it's within 0.005" of 0.375" ($\frac{3}{8}$ "). Set a 12"-long 1-by board on-edge against the fence with the saw blade set to just over $\frac{3}{8}$ " high, and make a full-length cut on each long edge.

Raise the saw blade above $\frac{3}{8}$ ", nudge the fence in to about $\frac{5}{16}$ ", and lay the board down with the saw cut you just made facing the fence, so that this second cut will cut out the strip. The width isn't fussy as long as it's less than $\frac{3}{8}$ " (the thickness of the frame ends). You will now have a $\frac{3}{8}$ " \times $\frac{5}{16}$ " strip. With the wide end of the strip on the table, draw a line along the length for reference during assembly. Sand the edges of this strip, then use a small handsaw to cut 12 frame guides to length at $1\frac{1}{4}$ ". On one end of each strip, round over the narrow edges with sandpaper. This will help guide the ends of the frames as you slide them into the jig for assembly.

Work tip: When I had my first two hives built and my bees were on order, I spent a few winter nights sitting on the floor by the heater, gluing and nailing frames together one at a time. I have to say that I enjoyed it, and still do, although I've found that it's easier on the back to stand or sit at my workbench.

4. Install the frame guides.

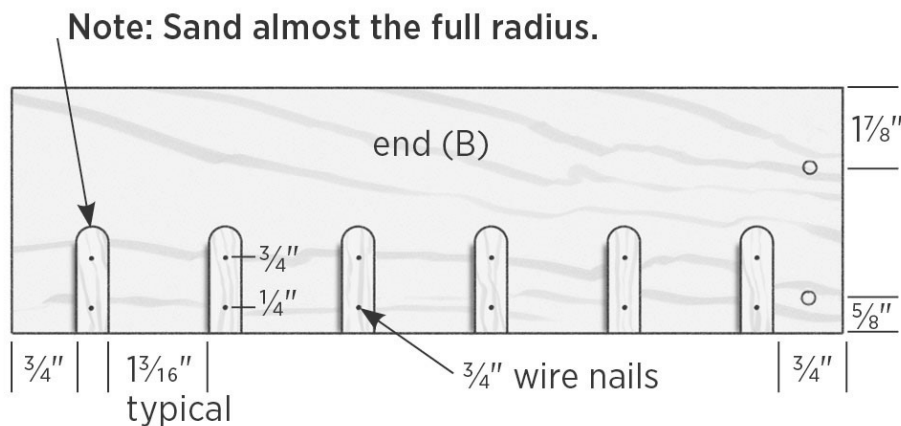
Unplug the saw, tighten the fence, and place the two end pieces side-by-side, with their ends against the fence. Set a scrap piece of $\frac{3}{4}$ " wood on-edge on top of them and against the fence. Place one frame guide (F) on each end piece, tight against the block, and fasten the guide to the end with glue and $\frac{3}{4}$ " wire nails. This ensures the guides on both boards will line up properly when you assemble the jig.

Install the remaining frame guides, using the $1\frac{3}{16}$ " spacer strip to set gaps between each pair of guides.

5. Prepare the clamping pads.

You can make the T shape of the clamping pads (C) with one piece, if you have a band saw, or with two pieces, using the table saw. The point is that you should *not* attempt to notch the ends of these pieces on the table saw.

For the two-piece method, cut a $\frac{3}{8}$ "-wide strip from each part C, and set them aside. Cut the two C pieces to length at 8" and rip them to width at $2\frac{3}{8}$ ". Glue and nail the $\frac{3}{8}$ " strips back onto the top edge of each C piece so the strips overhang 1" at each end. Use three 4d nails on each strip.

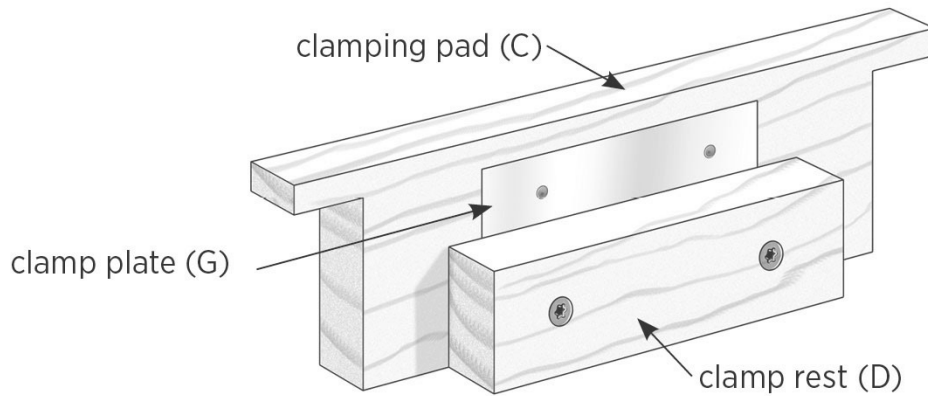


ABOVE: *Locating frame guides.*

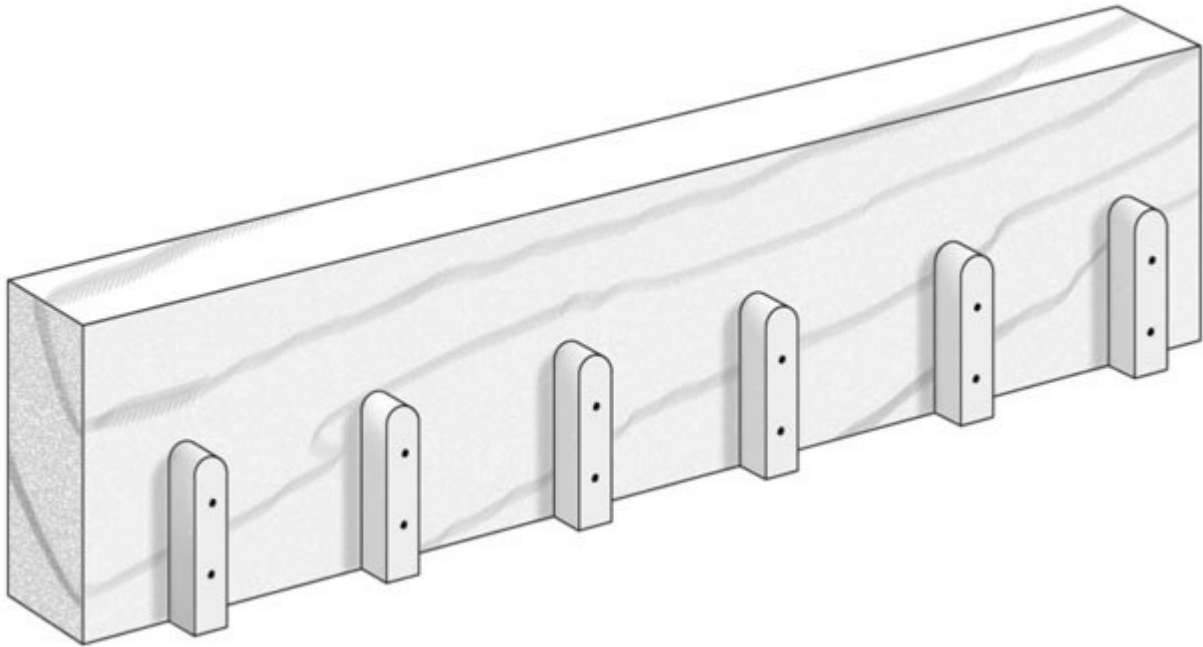
6. Complete the clamping assemblies.

Spread some glue on each clamp rest (D) and place it onto the clamping pad, centered and with the bottom edges flush. Fasten through the rest with two $1\frac{1}{4}$ " deck screws (drill pilot holes, if necessary).

Cut two strips of aluminum flashing or other thin metal to size at $\frac{7}{8}$ " \times $3\frac{1}{2}$ ", using tin snips; this is the clamp plate (G), and the size is not fussy. Center a clamp plate over the clamping rest and nail the plate to the clamping pad with a pair of $\frac{1}{2}$ " or $\frac{5}{8}$ " wire nails. The plates will take the pressure of the screw heads on the clamp so they don't dig into the wood with continued use.



ABOVE: *Finished clamp block assemblies.*



ABOVE: *Ends with all frame guides glued and nailed in place.*

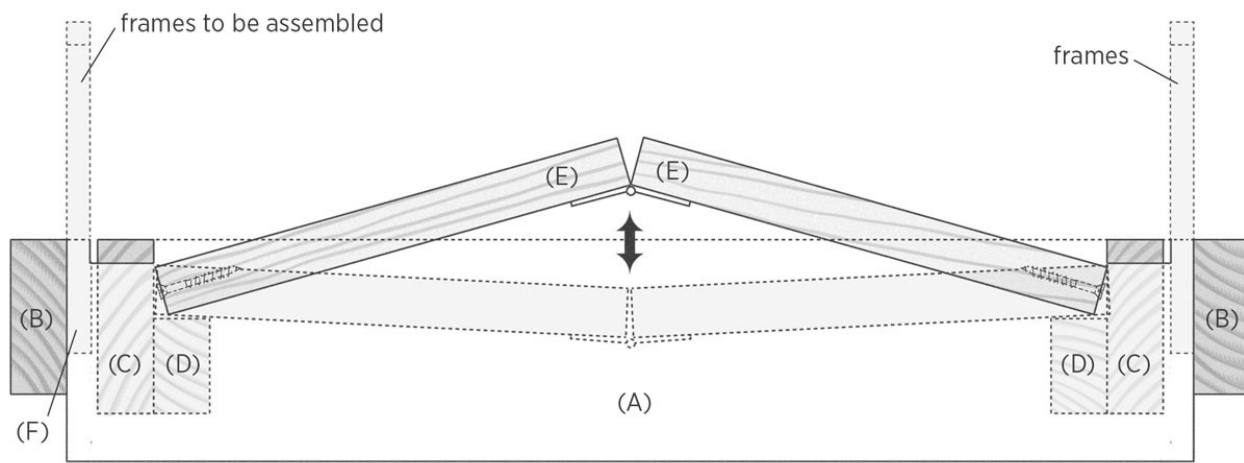
7. Assemble the jig frame.

Set the two side pieces (A) upside down (so the notches are on the bottom) on a flat work surface. Position the end pieces (B), also upside down (frame spacers at the top), aligned with the sides. Clamp the parts together, leaving room to drill holes in the ends. Make sure all ends are flush and the frame is square. Drill countersunk pilot holes about $\frac{5}{8}$ " and $1\frac{3}{4}$ " down from the bottom, and fasten each corner with two 2" deck screws.

Note: Do not glue the ends on. If you need to make any adjustments to the length of your jig, you can always rabbet the edges to make it shorter, or shim it with thin plastic to make it longer.

8. Create the clamp.

Drill two countersunk pilot holes into one end of each clamp end (E) as shown in Frame Assembly Jig Parts, on **page 92**, and drive in two 1 1/4" deck screws so they're flush. Lay the two pieces end-to-end with the screws at the far ends. Center and fasten the hinge to both pieces to create the clamping mechanism (see Clamping Action with Completed Jig, below).



ABOVE: *Clamping action with completed jig.*

9. Test the jig.

It's time to take your frame jig for a test-drive. Position the frame right-side up. Drop the clamping pads into the slots in the sides. Load up the jig with five frame ends on each side. Holding the clamp with the hinge side facing down, bend it slightly to form an angle, like the peak of a roof, and set it down on the clamp rests so it's square to the frame. Then, press down. Be careful not to have your fingers where they will get pinched. As you press down you will feel pressure, then the clamp should snap into place and hold. If there isn't enough resistance, back out the screws on the ends of the clamp a little; you can adjust these in and out to make the clamp looser or tighter.

If there's too much pressure and you can't push the clamp down all the way, remove the screws on one end of the clamp and trim the board slightly on the table saw. If the clamp snaps down but then pops back up, remove one board from the hinge and trim a little where the two boards meet at the hinge.

When the clamp fits properly, it literally takes a second to secure and release the frames, and you can do it with one hand. (Also see the photo sequence on pages **116-117**.)

What Makes a Good Assembly Jig

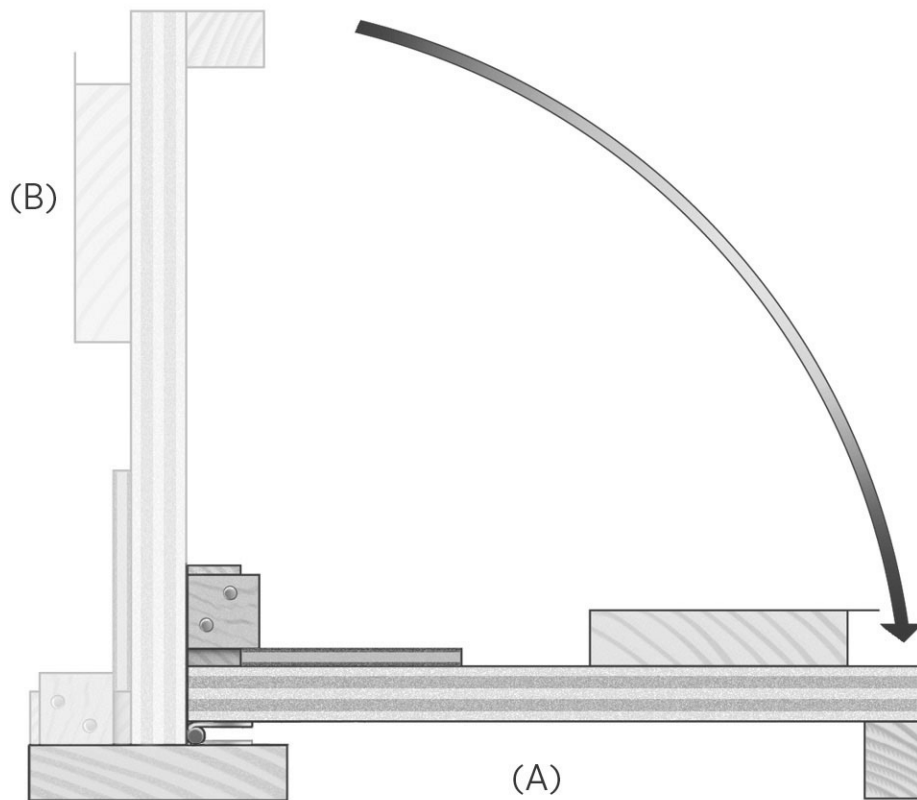
First of all, it has to be easy to load the side bars into the jig and then hold them in the right position to allow you to glue and nail the top bars on. It also must be able to be turned over so you can glue and nail the bottom bars on. But the real trick to frame assembly jigs is making sure that whatever holds the frames in place on the inside is removable; otherwise, you won't be able to get the frames out once they're made. I've seen all kinds of methods devised for doing this, from pieces of wood attached to rubber bands to wedges that get hammered in. I found a simple answer sitting right on the desk in my workshop, in the form of a hinged pair of boards salvaged from a folding set of tiered shelves I designed as a craft fair display.

My first prototype looked great on paper and didn't take very long to build, but it had eight parts to deal with. When I got it finished and did an initial dry run, I put five frame ends in each side. The top bars were easily installed. I thought, "This is nice." Then, I flipped it over and realized that my clamping setup was in the way of putting the bottom bars on all of the frames. That meant "back to the drawing board." While I was there I noticed

a few other issues. My second attempt solved all of those problems and eliminated four parts, and when I did a dry run, it worked great.

PROJECT

The Best-Ever Jig for Installing Foundation



ABOVE: *Use the foundation board in its lowered position (A) to slide the foundation into frame. Pivot it into an upright position (B) to nail the frame wedge into place.*

If you are using wooden wedge/grooved or wedge/split frames that you've purchased from a bee supply house, installing the sheets of wax foundation can be a little challenging. You have to slide the

foundation into the slot on the bottom bar of the frame. The sheets are only somewhat flexible and they don't always cooperate. On my first hive, I just struggled to put the sheets in by hand. Then I heard about foundation boards: a board with slots cut in it to hold frames at the proper height, allowing the foundation to slide right in.

I made one of these boards and it worked pretty well at first, but if the frame had any twist in it, it was hard to line up the foundation. Also, when I tried using frames from different suppliers, they didn't fit properly. I tried sticking with frames from one bee supplier, but then they changed the design and those frames didn't fit. It got kind of frustrating.

Writing this book inspired me to come up with a better way. The jig I designed takes more time and materials to build than the simple foundation board, but I've tested it with frames from three different companies and it works with all of them. Another great feature of this jig is that it's hinged, so once you slide the foundation in place, you can just flip the jig and easily nail in the frame wedge. But what really makes this jig shine is how easily it lets you move the frame and the fact that the thin sheet metal easily aligns with the slot in the frame and guides the wax sheet into it. You will definitely want one of these jigs, so why not make it now? (See photos on pages **118-119**.)

Frame Variations

I ordered frames from three different companies — Mann Lake, Brushy Mountain, and Dadant — to see how different they were. The top bars varied in width from 1.006" to 1.087". The width of the bottom bars measured from 0.41" to 0.5". Distances from the edge of the bottom bars to the slots varied from 0.275" to 0.315". The width of the slot was fairly close,

varying only 0.01", and averaged 0.17". These variations pose no problems for this jig.

Tools

Table saw

Drill and bits:

- Combination drill/countersink bit
 - $\frac{3}{16}$ " bit for metal
-

Combination square

Tin snips

Materials

One 5-foot pine 1×4

One piece $\frac{3}{8}$ " or $\frac{1}{2}$ " plywood, approximately 12" × 24"

Scraps of $\frac{1}{4}$ " lauan plywood

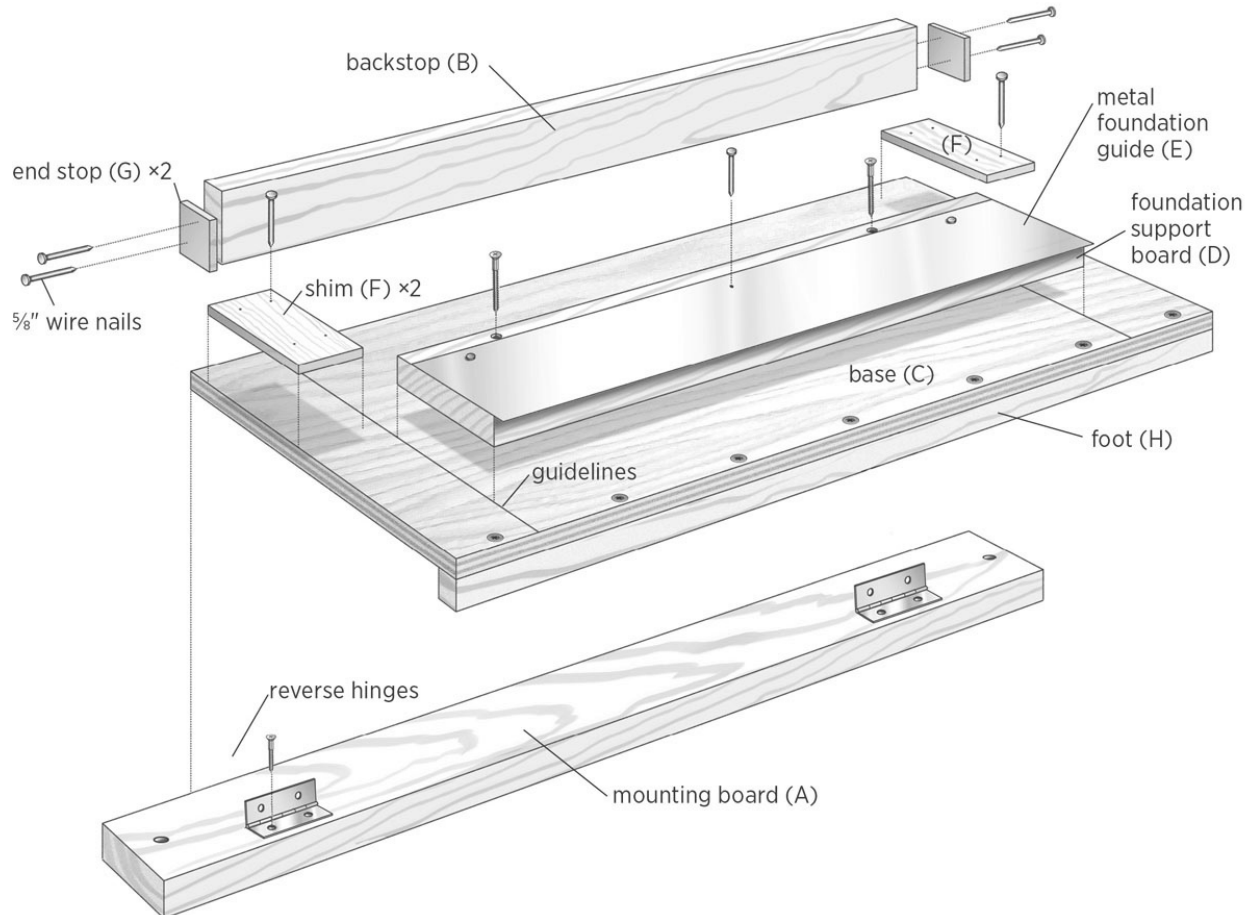
Eighteen 1 $\frac{1}{4}$ " deck screws

Fifteen $\frac{5}{8}$ " wire nails

Wood glue

One piece 26-gauge (0.020" to 0.035" thick) sheet metal, 3" × 16" minimum

Two 3" hinges with screws



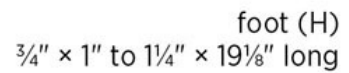
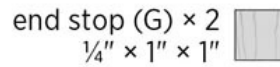
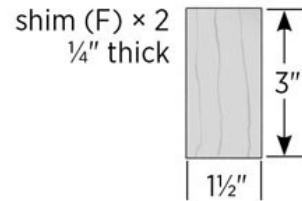
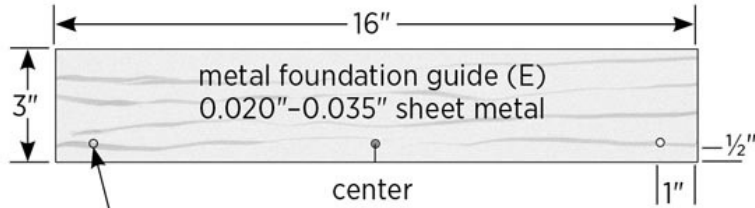
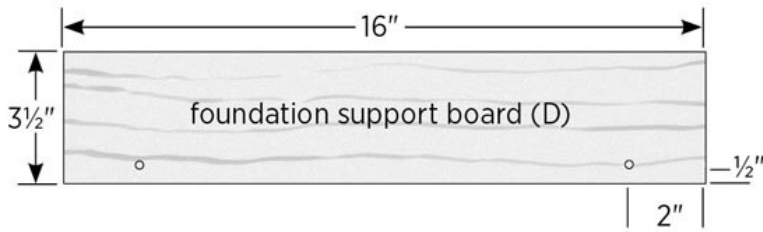
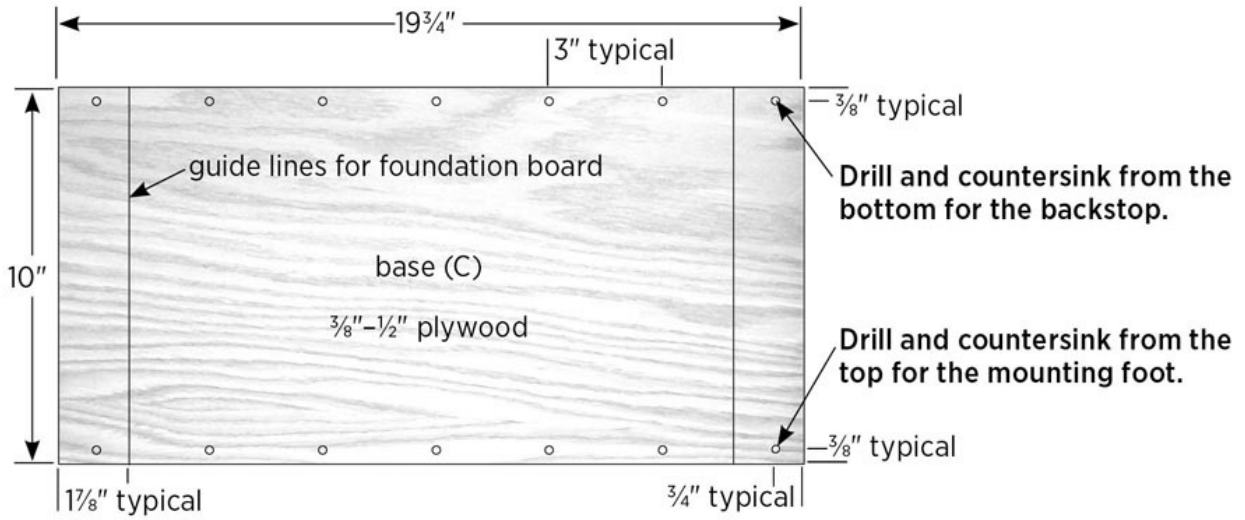
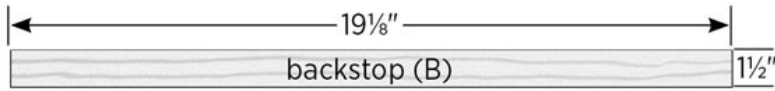
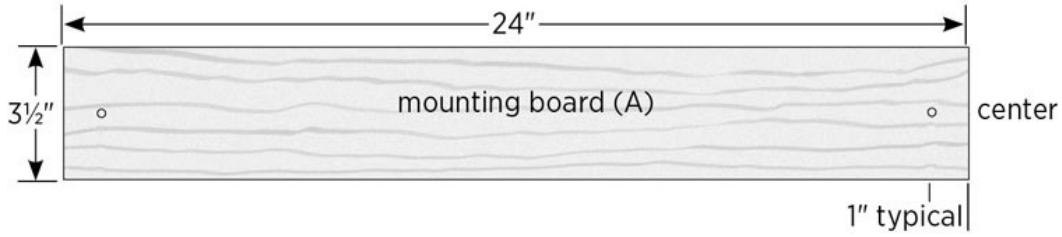
ABOVE: *Jig assembly — exploded view.*

1. Cut the lumber parts.

Cut a piece of 1×4 to length at 24" for the mounting board (A). If you plan on screwing your jig to a workbench, drill and countersink a hole for a wood screw, 1" from each end and centered on the board's width. Alternatively, this board is long enough that you can C-clamp the jig to a bench or table.

Cut a piece of 1×4 (or wider 1-by scrap) to length at $19\frac{1}{8}$ ", then rip one strip to width at $1\frac{1}{2}$ "; this is the backstop (B). Rip another strip to width at 1" to $1\frac{1}{4}$ " wide; this is for the foot (H).

Cut a piece of 1×4 to length at 16" for the foundation support (D). Drill two countersunk pilot holes at 2" from each end and $\frac{1}{2}$ " from one side as shown.



ABOVE: *Foundation board parts.*

2. Prepare the plywood base.

Cut the plywood base (C) to size at 10" wide × 19³/₄" long. Set a combination square to 1⁷/₈" and draw a line across each end of the base; these are reference lines for mounting the foundation support board.

Drill pilot holes in the base for the backstop (B) and foot (H), ³/₄" from the ends and about every 3" in between, as shown in Foundation Board Parts, on facing page. The backstop will be attached to the top face of the base, so you should drill and countersink from the bottom face of the base. The foot will be attached to the bottom face of the base, so drill and countersink from the top face.

3. Mount the backstop.

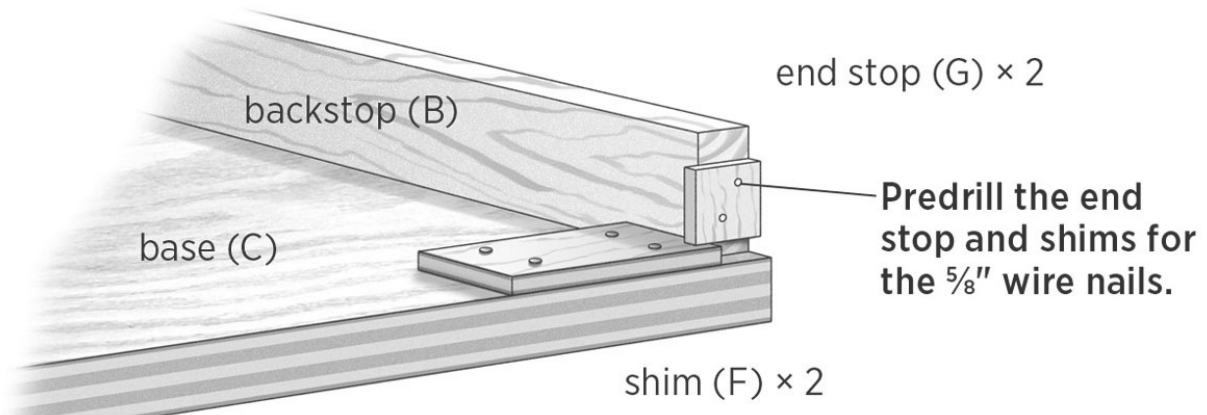
Set the backstop on-edge on the top face of the plywood base, aligning it flush with the bottom edge of the base and centering it lengthwise; there should be about ⁵/₁₆" between each end of the backstop and the side edge of the base. Clamp the backstop in place, then flip over the base and drive 1¹/₄" deck screws into your predrilled pilot holes, working from the bottom side of the base.

4. Cut and install the shims and end stops.

Cut two shims (F) to size at 1¹/₂" × 3", using scraps of ¹/₄" lauan plywood. Spread some glue on the shims and attach one to each end of the base, using ⁵/₈" wire nails. Butt the 1¹/₂" edge of the shim

against the backstop, with the 3" edge flush with the side edge of the base.

Cut two end stops (G) at 1" × 1", using 1/4" lauan plywood. Attach the end stops to the ends of the backstop with glue and 5/8" wire nails.



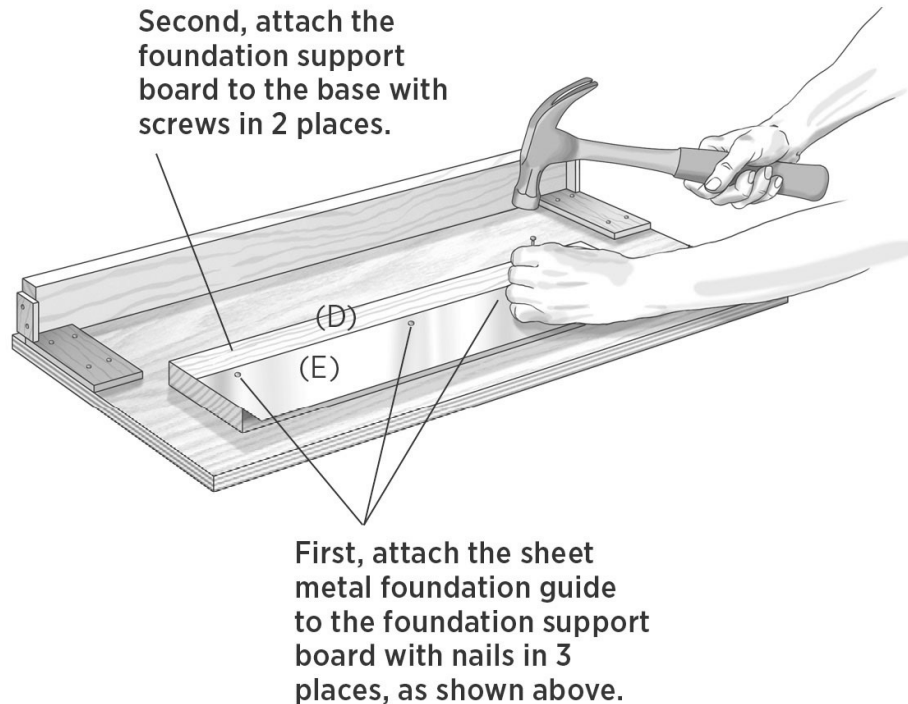
ABOVE: *Shims and end stops installed.*

5. Mount the foundation guide.

Cut the foundation guide (E) to size at 3" × 16" from 26-gauge sheet metal. You can find galvanized steel sheet metal at home centers, hardware stores, metalworking shops, and vocational schools (where you might be able to get a scrap for free, as well as have the piece cut for you.) You can also use copper, which you can probably nail right through without drilling pilot holes.

Drill pilot holes for nails using a 1/16" bit; locate these 1/2" from one long edge side, spacing them 1", 8", and 15" from one end. Set the guide on the foundation support board (D) so that the ends are flush and the metal guide overhangs the front edge (opposite the pilot

holes you drilled in step 1) of the support board by $\frac{1}{2}$ ". Fasten the guide with $\frac{5}{8}$ " wire nails.



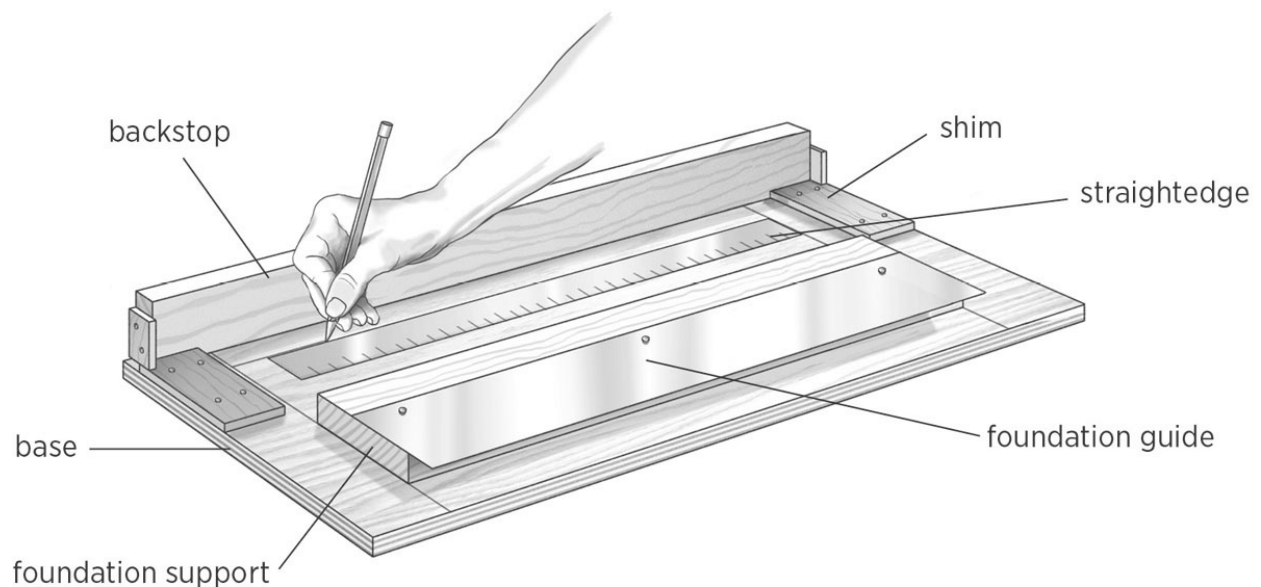
ABOVE: *The Foundation guide nailed to the support board.*

6. Make the foundation support holes.

In this step you will mark and create holes for the foundation support board (with metal guide attached) to accommodate three different frame depths. First, place a deep frame on the base, with the top bar of the frame clamped against the backstop. Place the foundation support on the inside of the frame so the metal guide bottoms out in the groove of the deep frame. Hold the guide in place, then carefully remove the frame. Measure the distance between the backstop and the foundation support board, subtract $\frac{1}{8}$ ", and write down this

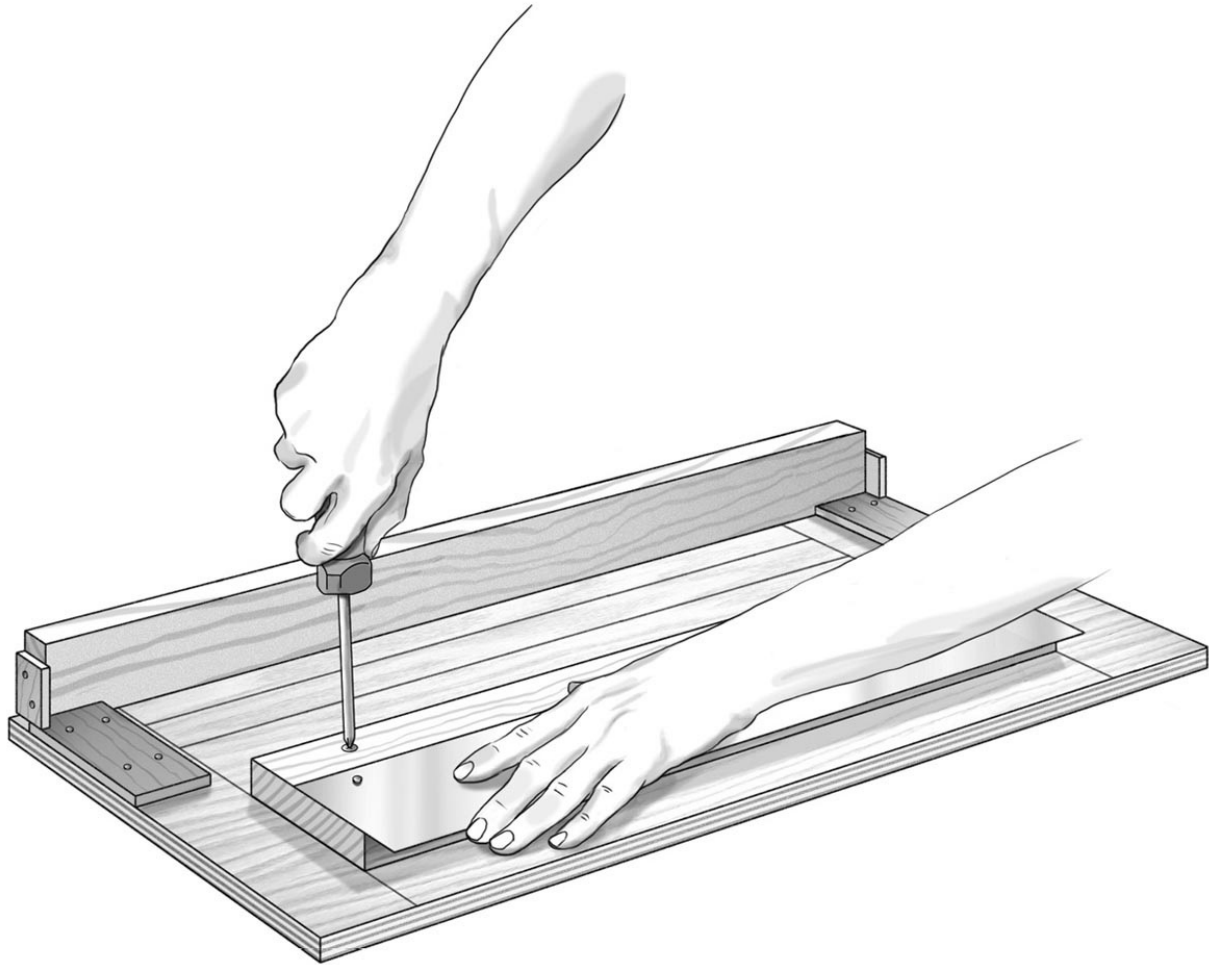
figure. Repeat this process with medium and shallow frames, being sure to subtract $\frac{1}{8}$ " from your measurements.

Mark and draw lines at each of your three noted distances from the backstop. Position the foundation support board at each line so both ends are on the $1\frac{7}{8}$ " reference lines you made in step 2. Using the combination drill/countersink bit placed in the mounting holes in the support board, drill into the plywood base to mark the positions. Enlarge the holes in the support board only (not the base) using the $\frac{3}{16}$ " drill bit, then screw the support board in at each of the three locations.



ABOVE: Lining up the foundation guide, measuring, and drawing guidelines on the base.

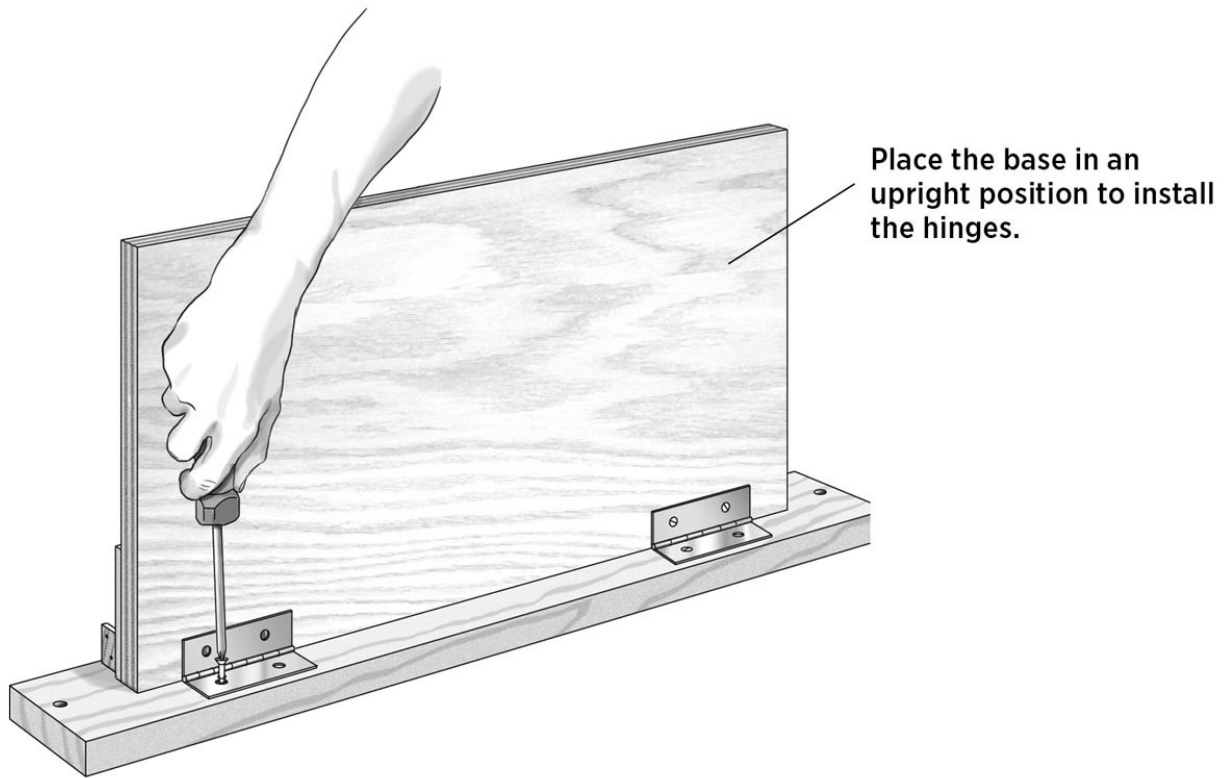
Screwing the support board to the base



ABOVE: *The drawing shows the first position for the deep frames.*

7. Add the mounting board.

Stand up the jig assembly and position it so the backstop is resting on the mounting board and the bottom of the plywood base is facing you. The top of the backstop should be flush with the far edge of the mounting board. Position a hinge 1" from each side edge of the base, and mark the holes for the hinge mounting screws. Fasten the hinges to the base and mounting board with the provided screws.

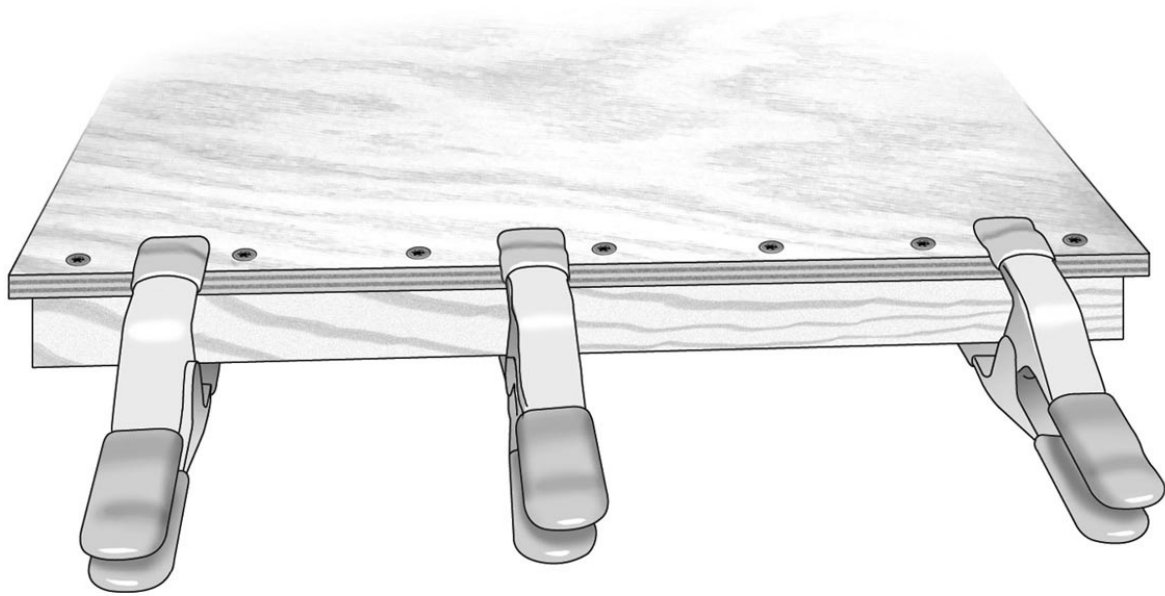


ABOVE: *Installing the hinges.*

8. Install the foot.

Attach the foot to the bottom of the plywood base (opposite the backstop), using $1\frac{1}{4}$ " screws driven through the predrilled holes in the front face of the base. The foot should be flush with the long edge of the base.

Installing the foot

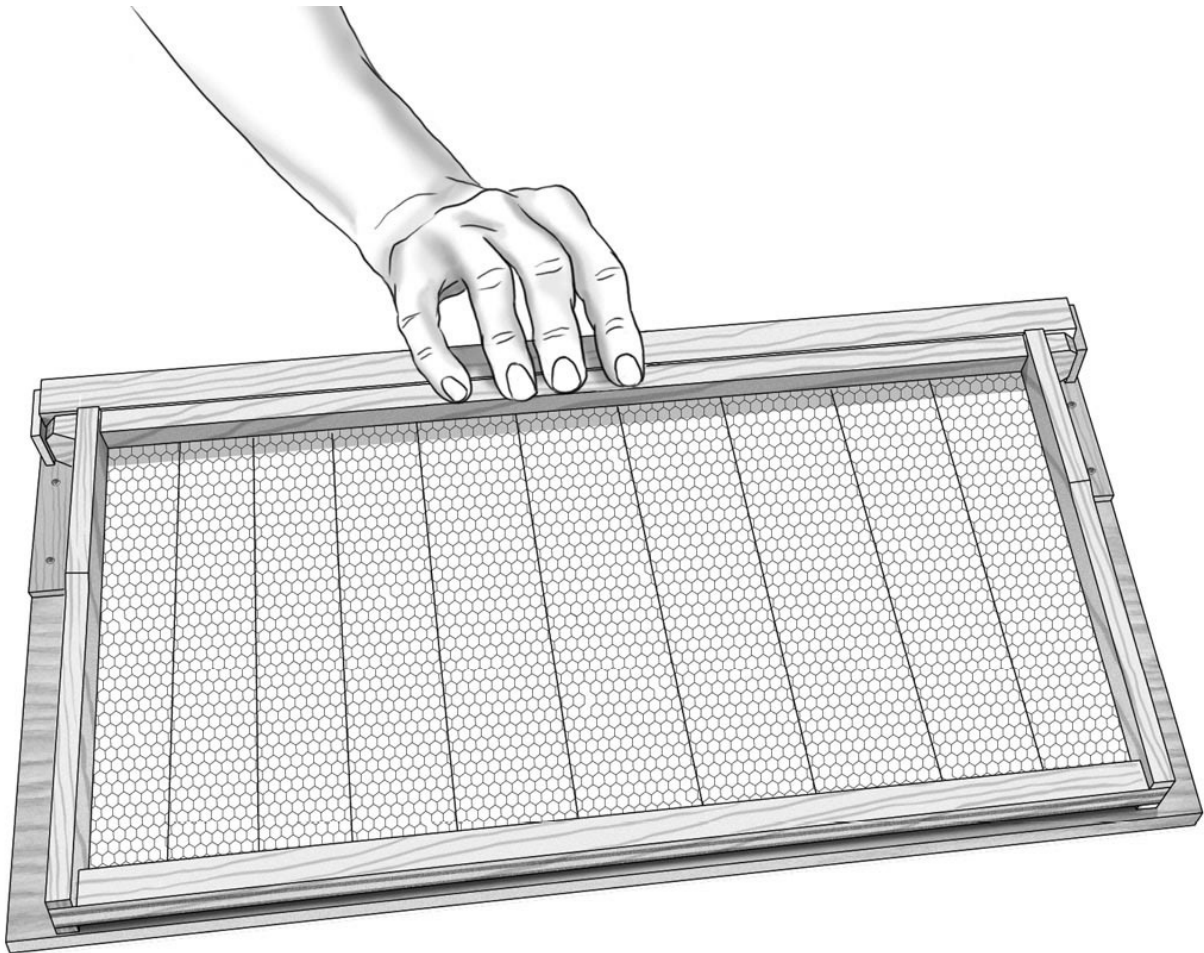


ABOVE: Glue and clamp the foot to the base. Install 1¼" screws from the top. Using several screws helps ensure the plywood stays flat.

9. Try it out.

Set a frame on the jig and slide the top bar toward the backstop as you direct the metal foundation guide into the frame's groove (this is easy because the frame is free to move up and down slightly). With the top bar fully against the backstop, push down slightly to raise the other end, creating a gap between the metal guide and the top edge of the groove; this makes it super-easy to slide the foundation into the groove.

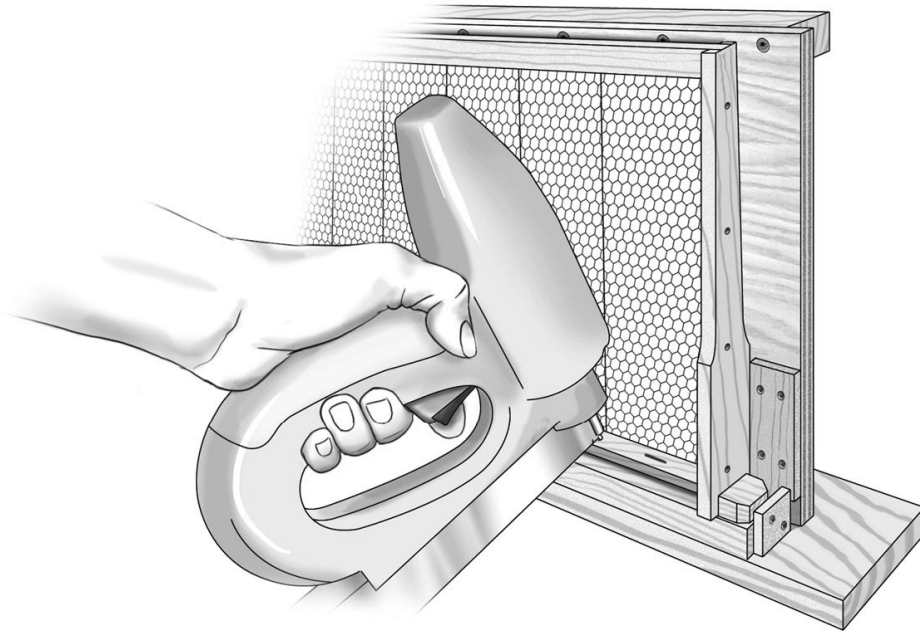
Installing the foundation



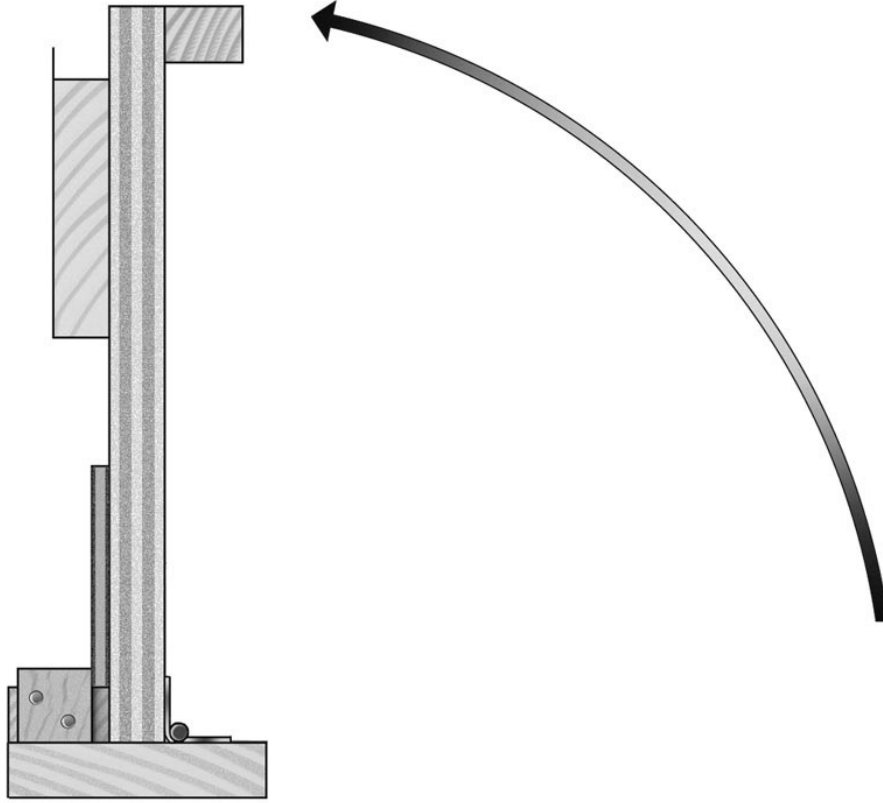
ABOVE: After sliding a frame in place with the guide in the slot of the bottom bar, you need only push down on the top bar to slide the foundation into the slot.

Install the foundation, then simply pivot the jig into vertical position, nail your wedge into place, lift the frame off the jig, and you're ready for the next one. It couldn't be easier. (Also see photo sequence on pages **118-119**.)

Nailing the wedge into place



ABOVE: Use an electric brad nailer and $\frac{5}{8}$ " brads to install the frame wedge.



ABOVE: *Pivoting the fixture into its upright position.*

CHAPTER EIGHT

Make a Swarm-Catching Kit

CHAPTER CONTENTS

Simple Bucket Swarm Catcher

Variation: Swiveling-Bucket Swarm Catcher

Wire-Frame Swarm Catcher

At some point during your beekeeping adventures, you will probably either have a hive that swarms, or you'll get a call from someone who has spotted a swarm of bees. If you are like I used to be, you will be totally unprepared to deal with it, but after making these projects, you'll be sitting by the phone waiting for that swarm call, or letting your hive get overcrowded, just so you can try out your new tools. Okay, maybe you won't go to those extremes, but you *will* be prepared when the opportunity arises, and when you remove the bees from someone's backyard after their panicked phone call, you'll be their hero.

Swarm Catching

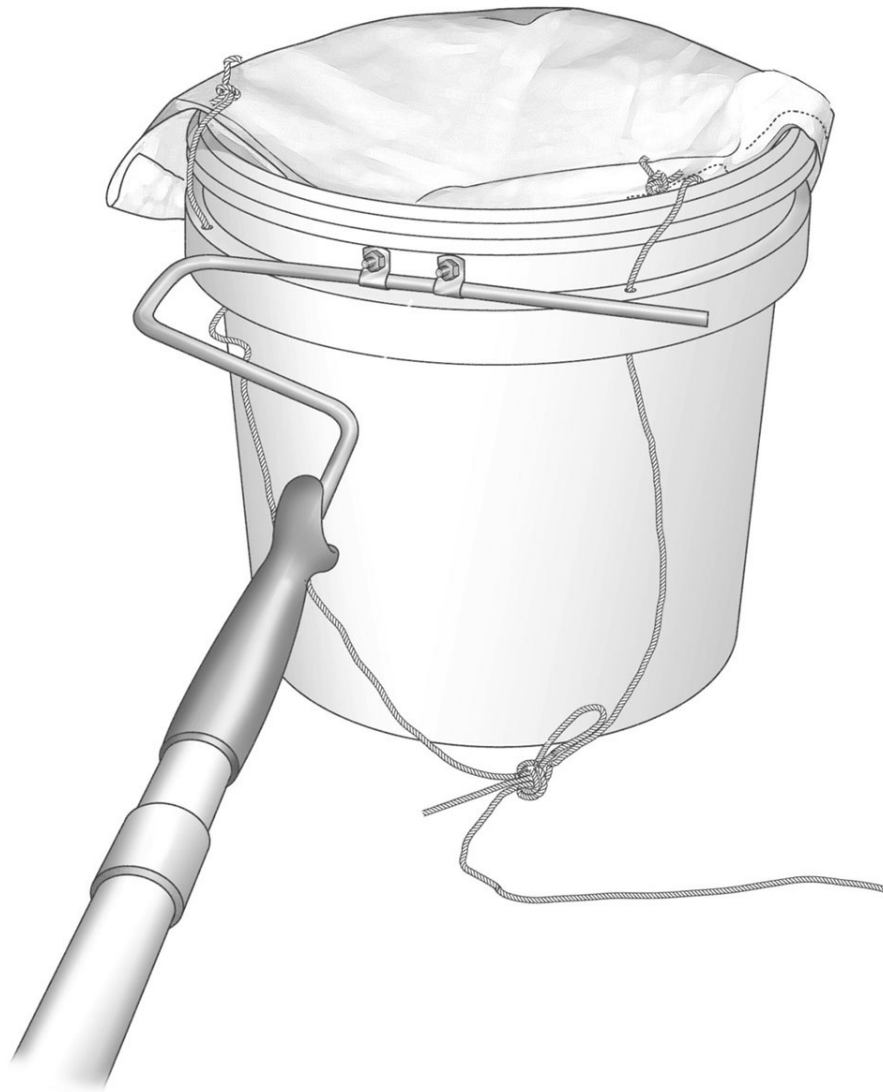
One time, my friend Becca called to say her hive had swarmed and was in a nearby tree, about 15 or 20 feet up. I ran around trying to gather the things I thought we would need to retrieve them. Baling wire and duct tape almost always fit into this kind of scenario. I had some long aluminum tubes, and we bent a coat hanger to form a frame and taped it to one tube. Then, we attached a grocery sack to this frame with baling wire, lifted it up under the swarm, and shook the branch. The swarm dropped into the grocery sack and we quickly lowered it to the ground and shook it into an empty hive. That got me thinking that I should have something ready-made for the next time the situation arose.

Sometimes the bees are a few feet off the ground and sometimes they are totally out of reach, or in a dangerous location. Before you even think about catching a swarm, you need to know what you will do with the bees once you have them. You should bring an 8-or 10-frame hive box with some drawn frames, if you have them. The bottom board should be attached with hive staples.

Have a piece of screen to block the entrance. A screened inner cover (see **chapter 4**) can be screwed to the top once the bees are inside. A ratchet strap is good insurance to hold things together. Now let's make something to *catch* them in.

PROJECT

Simple Bucket Swarm Catcher



You can make this basic swarm catcher with readily available materials, some of which you probably have on hand already. For my version, I used a bucket obtained for free from the bakery department of a local supermarket — the same type of bucket I use for storing honey. Depending on what you have for materials, you may have to vary the plans a little.

Note about materials: I chose these materials because I had many of them hanging around. The extension handle is one that twists to lock and extends from 6 feet to 12 feet. The outside diameter measures just 1". To go higher, I can extend it with 1" EMT metal electrical conduit, which is made for running wires and readily available at hardware stores and home centers. The inside diameter is a little over 1".

Tools

Hacksaw

File

Drill and small drill bits for wood and metal, including $\frac{3}{16}$ " and $\frac{1}{4}$ " bits

Screwdriver and small sockets or adjustable wrench

Scissors

Sewing machine or hand-sewing supplies

Materials

One plastic bucket, 4-or 5-gallon (often available at bakeries for free)

One paint roller with extension pole (used or new)

Two cable clips with fastening hardware (see step 3)

One 18" × 18" piece cloth (any type of sturdy yet workable cloth is suitable)

Two grommets for $\frac{1}{8}$ " rope, with grommet tool (optional)

$\frac{1}{8}$ " braided nylon rope (or similar material; about 48" length plus the length of the extension handle[s]; see note, below)

One 10-foot length 1"-diameter EMT metal electrical conduit

One $\frac{1}{4}$ "-diameter hitch pin, 1 $\frac{1}{2}$ " minimum length

1. Remove the bucket handle.

Some bucket handles are all plastic, while others are metal. A hacksaw will make quick work of removing either type. Be sure to recycle the handle rather than add it to the landfill. I saved up a few metal handles and used them to create a mini hoop-house over my lettuce seedlings.

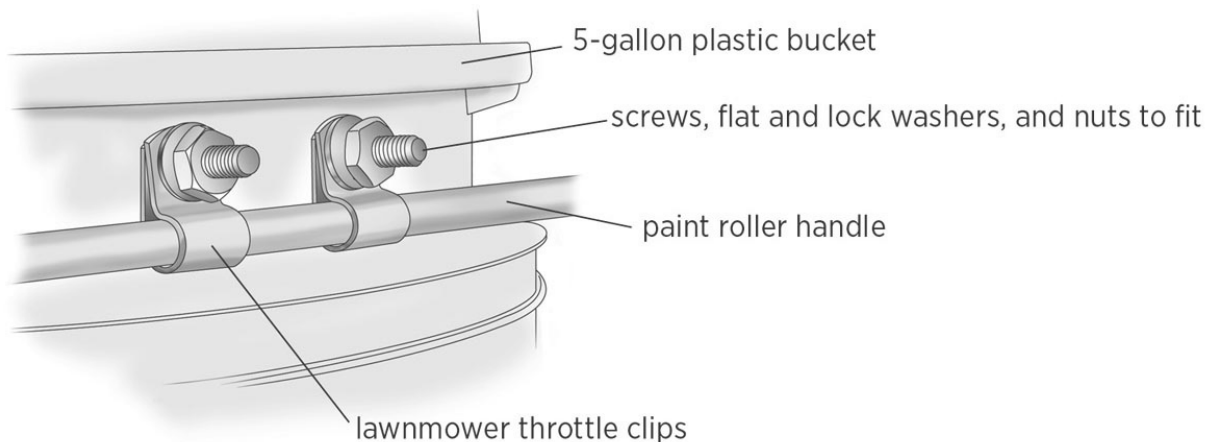
2. Disassemble the paint roller.

First you have to remove the paint roller cage (the spinning part that holds the roller cover) from the roller handle. Rollers are made in a number of different ways. Some have crimped shafts, while others have a spring clip that secures the roller. My shaft was crimped so I

cut off the end with a hacksaw, removed the roller, and filed the end smooth.

3. Attach the roller handle.

Next up is attaching the roller handle to the bucket. I took a quick trip to the hardware store and found a couple of clips that fit the bill. They were in a drawer listed as lawnmower parts, for holding the throttle cable to the handle, and they fit nicely between the two ridges on the bucket. I spaced them about 1½" apart, marked and drilled clearance holes through the side of the bucket, and attached them using screws, flat washers, lock washers, and nuts, as shown.



ABOVE: *Attaching the roller handle.*

4. Sew the cloth cover.

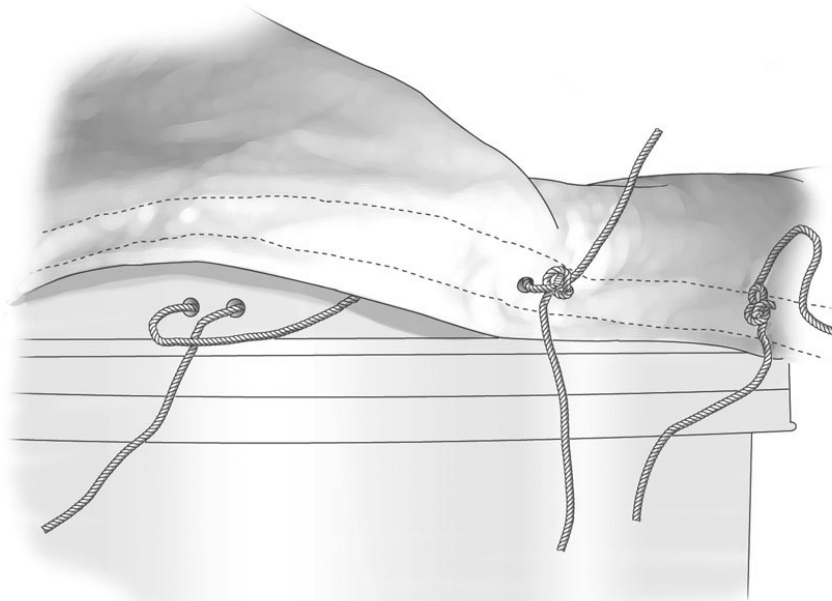
Cut a piece of cloth about 18" square. Create a hem on two opposing edges by folding each twice, about ¾" wide, and sewing the hem on a sewing machine or by hand; this gives the edges strength. Hem the

other two sides by folding the edges once, about 1 1/4" wide, before sewing.

5. Attach the cover.

On the back side of the bucket (opposite the roller handle) drill three pairs of 3/16" holes, spaced about 1/2" apart; locate one pair directly opposite the clips holding the roller to the front of the bucket, and position the other pairs about 4" to the left and right of the first pair.

Center the cloth over the bucket left-to-right, with the wide hems toward the front and back. Now center the hem in the back, over the holes and transfer the hole locations to the cloth (I used an awl to punch through the holes and cloth). Using three short pieces of 1/8" rope, tie loops through the holes in the bucket and holes in the cloth and tie each in a double knot (see **Attaching The Roller Handle**, above).



ABOVE: *Cloth bucket cover attaches to the back of the bucket in 3 places.*

6. Attach the cover loop.

On the front side of the bucket, drill two $\frac{3}{16}$ " holes down through the rim (my bucket has a double rim, and I used the lower one). Center the holes in relation to the front brackets and space them 9" apart. Transfer the hole locations to the hem of the cover. If desired, add grommets to these holes for strength.

Cut a piece of the $\frac{1}{8}$ " rope about 30" long. Thread one end up through each hole in the rim, then through the holes in the cloth, and knot the ends so they won't pull back through, creating a loop that hangs down at the front side of the bucket, as shown on **page 104**.

7. Add the pull rope.

Tie a long piece of rope to the center of the loop hanging down from the cover; this pull rope should be as long as the pole when fully extended so you can pull on the rope to pull the cover over the top of the bucket. Screw the handle extension into the end of the paint roller handle to complete the swarm catcher.

Work tip: My initial setup reaches 12 feet high, but often you need to go higher than that. I don't recommend using a long extended pole while standing on a ladder. The awkward length and weight can easily throw you off balance, especially if your swarm catcher is fully extended at an angle and 4 or 5 pounds of bees suddenly drop in. It's better to make a pole extension

(see next step) so you can get the height you need from the ground.

8. Make a pole extension.

EMT conduit comes in 10-foot lengths, and 1" conduit measures $1\frac{1}{6}$ " inside, so a 1"-diameter handle will slide right in. Drill two $\frac{1}{4}$ " holes all the way through the conduit, one at 24" from one end and another at 60". Use a prick punch and center drill to start the holes, and use a drill press if available. The holes are for adjusting the range of the bucket.

To use the extension pole, pop a hitch pin through one of the holes in the conduit, depending on how much height you need to add to your reach. The pin will act as a stop for your extension handle to rest on. These pins have a spring-loaded ball that keep them from falling out, but they can easily be pulled out. You can also use a $\frac{1}{4}$ " bolt and nut instead of a hitch pin. Slide the roller handle into the conduit, and you're good to go.

It's best not to extend your pole any longer than it needs to be for the situation. The shorter it is, the easier it is to handle. This setup will get you up about 20 feet. If you have to go higher, you could use a coupling and another length of conduit.

Warning!

Never try to catch a swarm near any kind of power lines. Metal poles are excellent conductors, and if you're holding one when it contacts an electrical wire, your friends and family will be attending your funeral. Even using a 20-foot pole when a

power line is 30 feet away is still way too close. Always look up and around very carefully before raising your swarm catcher. If you get called to a swarm and see electrical wires, say, “No, thank you,” and walk away. **I can't stress this enough.**

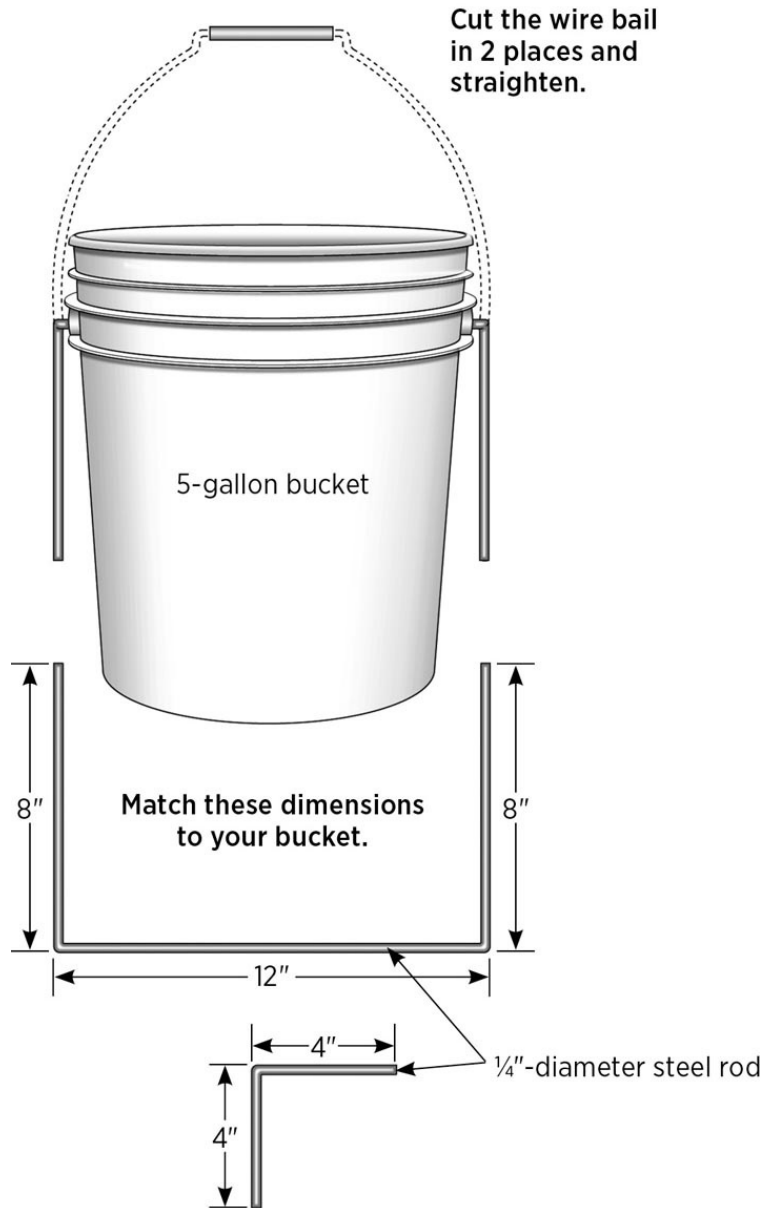
PROJECT

Variation: Swiveling-Bucket Swarm Catcher

My original idea for a bucket-style swarm catcher included a swiveling bucket, but this required some simple welding, and I didn't think many people would have access to a welder, so I changed the design. But one day, as I was driving to the lumberyard, I passed the local vocational school where I studied machine shop many moons ago and remembered we used to help people who walked in with small projects. (If you have a trade school in the area, it's a great source of help and knowledge.) I returned to the school later with my parts in hand, and the next day I was on my way with a welded piece.

I've seen the swarm catchers you can buy that use straight EMT pipe mounted to a flange or bracket on the bottom of a bucket. The problem with these is that as the pole is raised or lowered, the bucket tilts at an angle along with the pole. The beauty of my swiveling design is that the bucket full of bees stays upright, regardless of the pole's angle as you lower the bucket to the ground.

The tools, materials, and steps required for making the swiveling-bucket catcher are much the same as for the Simple Bucket Swarm Catcher (**page 104**), except you don't need the clips for attaching the roller handle to the bucket. You do need a 36" length of $\frac{1}{4}$ "-diameter steel rod to create a welded bracket that holds the bucket. This size of rod is big enough to be strong yet small enough to bend without heating. It turned out that it also was the same size as the other roller handle I had.



ABOVE: *Swiveling-bucket swarm catcher parts.*

1. Remove the handle.

Start by cutting off the handle part at the center of the bail, leaving the long, curved wire sections of the bail connected to the bucket.

Using a vise or pliers, or both, straighten out the bail sections as best you can so they hang down fairly straight on the sides of the bucket.

2. Make the bracket.

Cut one piece of $\frac{1}{4}$ " steel rod to length at 28". Mark off 8" from each end, then bend the rod into a U shape with 90-degree bends. The distance between the sides should match the distance between the bails hanging on the side of the bucket (mine was 12"). The bracket arms are long enough to allow overlap of the bails for welding while being able to pivot around the *entire* bucket. This way, no matter what position your extension pole is in, the bucket will pivot and remain upright. The remaining piece of steel rod is about 8" long; bend this in the center at 90 degrees.

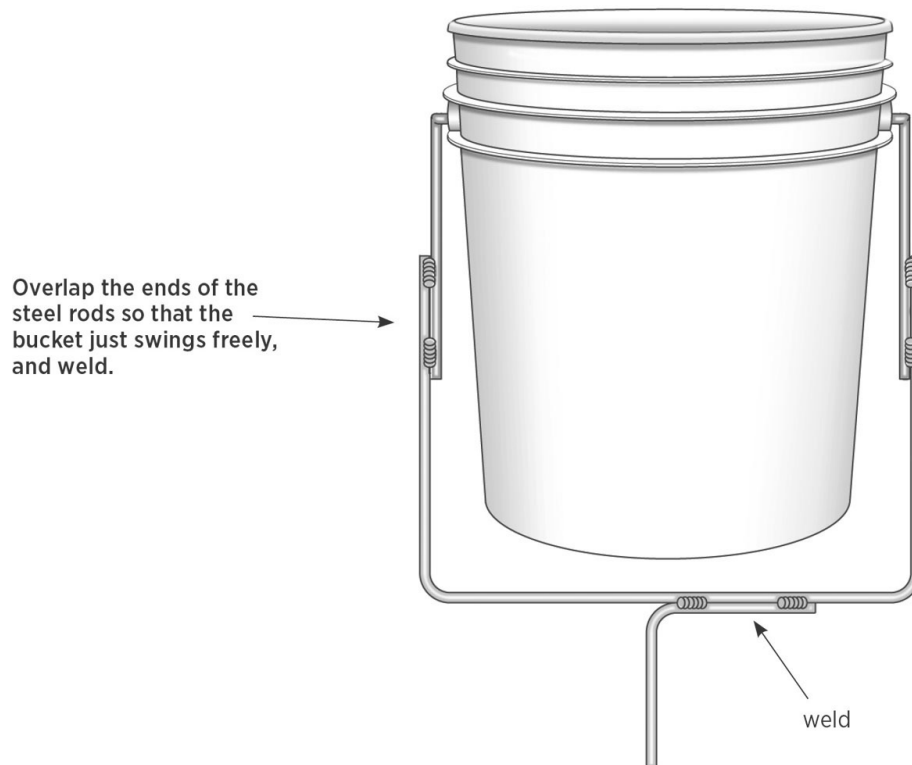
3. Weld the bracket parts.

A wire-feed welder is perfect for this step. If you don't do any welding yourself, visit the local vocational school to have it done. Lay the U-bracket and the 4 x 4 bracket on a flat surface. Weld the two together so that the one leg of the angle bracket extends below the U-bracket and is centered on the U-bracket. Next, let the ends of the bail and the ends of the U-bracket overlap each other enough so the bracket will just swing freely around the bottom of the bucket.

4. Add the paint roller handle.

Separate the handle from a paint roller, using any means necessary. Once removed, fit and/or attach the handle to the straight 4" end of the welded bucket bracket. Follow the steps of the Simple Bucket Swarm Catcher to add a cover and extension pole, if desired.

My roller handle was molded onto the shaft. A lot of twisting and tapping persuaded them to part, and the handle fit nicely on my welded bracket. I decided not to glue the handle on the new shaft. This allows me to use it for more than one purpose.



ABOVE: *Completed swiveling swarm bucket.*

PROJECT

Wire-Frame Swarm Catcher



I have to confess that I love a good, hotly contested local election. It's not that I'm into politics in a big way. It's because an interesting election means lots of lawn signs, and lawn signs are a great source of free metal after the election is over. The type of sign I'm talking about has metal frames made from about $\frac{3}{16}$ "-diameter steel. You can usually get all you want for free, and they're great for all sorts of projects, such as garden tunnels and making hooks, as well as what we're going to use it for: a frame for our swarm catcher.

The advantages of this type of swarm catcher are its light weight and ability to fit behind the seat of a truck. There are a couple of ways you can make this. One way is to use an old pillowcase or laundry bag and make the frame to fit it. I had a lot of cloth left over from another project, so I based my size on the pieces of metal I had, and the catcher bag came out to about 12" x 15" and 30" deep. This is large enough to transport the bees in. A pillowcase or large cloth grocery bag is okay if you have a waiting hive box to dump the bees into once you get them to the ground.

Some of the tools and materials listed for this project are "optional," depending on how you want to make your swarm catcher. The metal pieces I had on hand were about 27" and 42" long; two pieces at about 35" or any combination in between would work just as well. I used muslin to make the bag. It's thin but strong, and the bees can breathe through it.

Sewing looks so easy when you watch someone who is an expert at it, like my wife. I got out the sewing machine and ironing board and went to work, and it took me the entire afternoon to make a bag. (I guess it isn't as easy as it seems, or is that *seams*?) If you decide to use a premade bag, you might want to read through the sewing steps anyway, just to see how much trouble you saved yourself. However, I do want to point out that this handmade bag, which is wider and deeper than a standard tote, is likely to give you a better chance of getting the bees all the way down to the ground.

Tools

Vise

Hacksaw

File

Scissors

Marking pen (for cloth)

Steam iron

Sewing machine

Materials

Two metal rods, about $\frac{5}{32}$ " to $\frac{3}{16}$ " in diameter

Duct tape

3 yards 44"-wide muslin fabric

Grommets for $\frac{1}{8}$ " rope, with grommet tool (optional)

One 8-foot length $\frac{1}{8}$ " braided nylon rope (or similar material)

Four or more binder clips (see step 6)

Paint roller handle and extension pole

Automotive hose clamps or duct tape (optional)

1. Create the metal frame.

Secure the two metal rods in a vise (and put on gloves and safety glasses) and make a 90-degree bend 4" from one end on each piece; this is the part that will attach to your pole. With these ends sticking up in the vise, make a 90-degree horizontal bend in each piece at 7 1/2", with one bend going to the left and one going to the right, to begin the side runs of the frame. Again with the 4" ends facing up, make a 90-degree bend 12" from the 7 1/2" bends.

Lay the parts down on a flat surface with the 4" ends together; you should have a rectangular frame with overlapping ends. Tweak your bends so that the frame lays flat and is fairly square (has 90-degree corners). Trim off the ends if they stick out past the frame, but be sure to maintain some overlap for taping the pieces together.

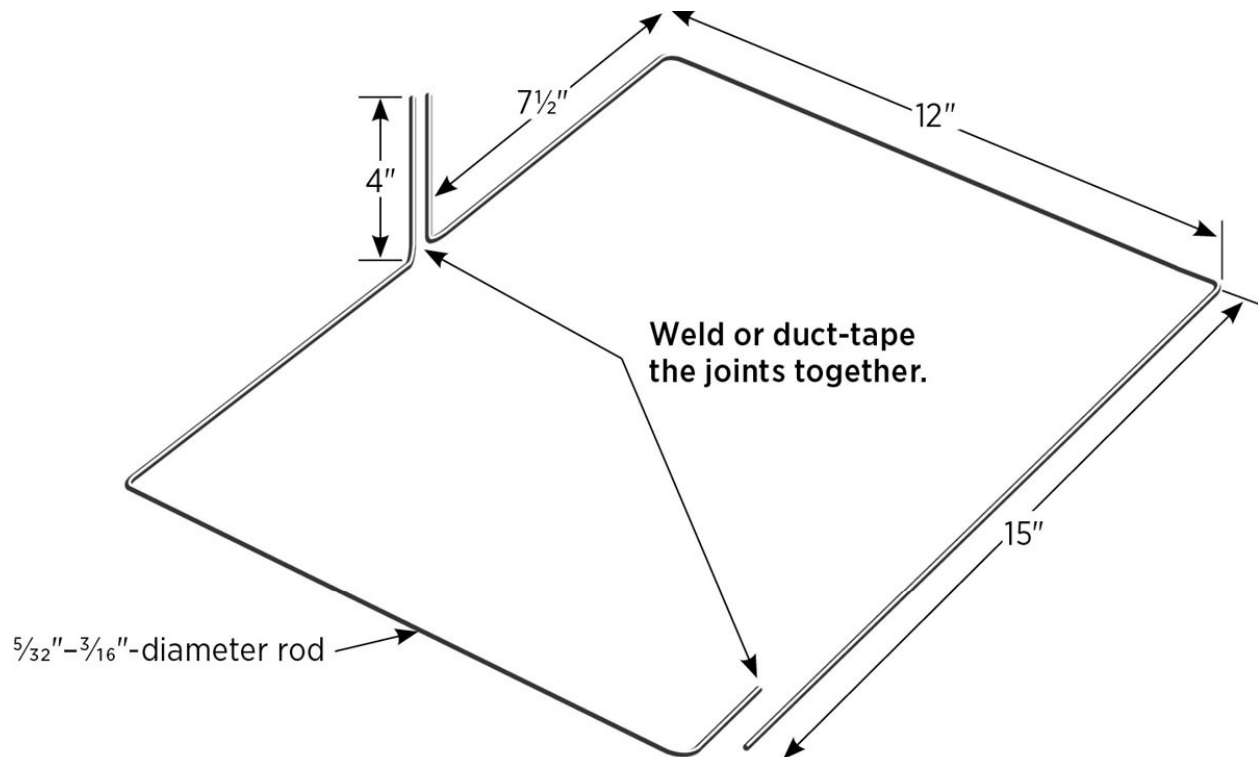
File any cut ends to remove sharpness. Join the frame parts with duct tape (or you can weld them yourself or have this done at a local metal shop; see Variation: Swiveling-Bucket Swarm Catcher, on [page 107](#)).

2. Cut the bag parts.

Cut a strip of fabric to size at about 72" long × 18" wide; this will form the two wide sides and the bottom of the bag, leaving about 12" to hang over the sides of the frame. (The extra overhanging length can be cinched with rope if you don't have something to put the bees into right away.) Make two lines across the cloth strip, 30" from each end, leaving 12" in the center for the bottom. Fold over the cloth at the lines and crease them with a steam iron to create clear guidelines. Then, fold and press a 1"-wide hem down each long side of the strip.

Cut two more pieces of fabric at 14" wide × 30" long for the sides. Fold and press a 1" hem along each long edge of both pieces.

Frame pieces with bends

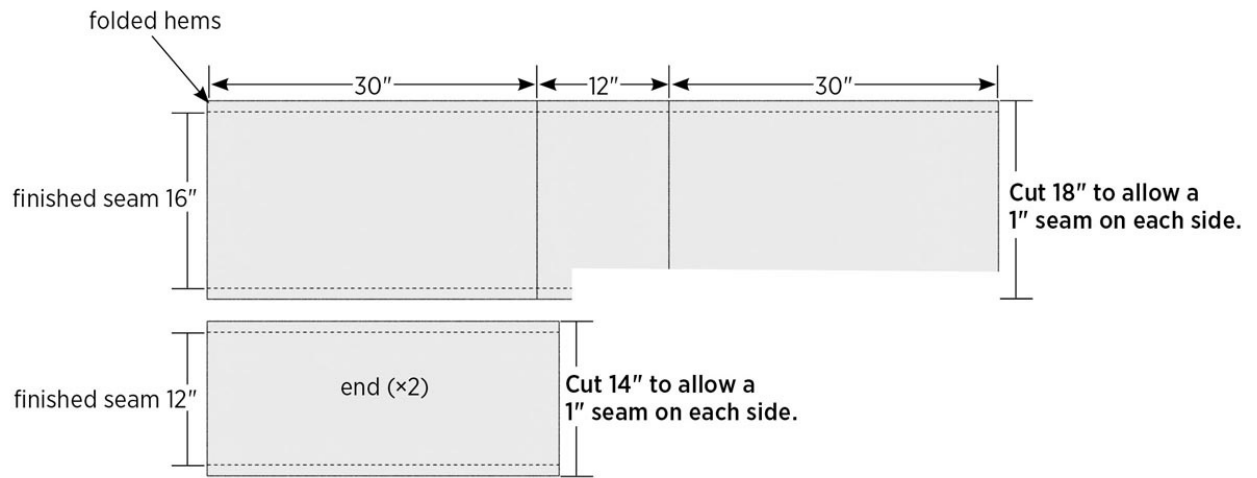


ABOVE: *I removed the metal part of a paint roller, and the end of this frame fit snugly in the hole left in the handle.*

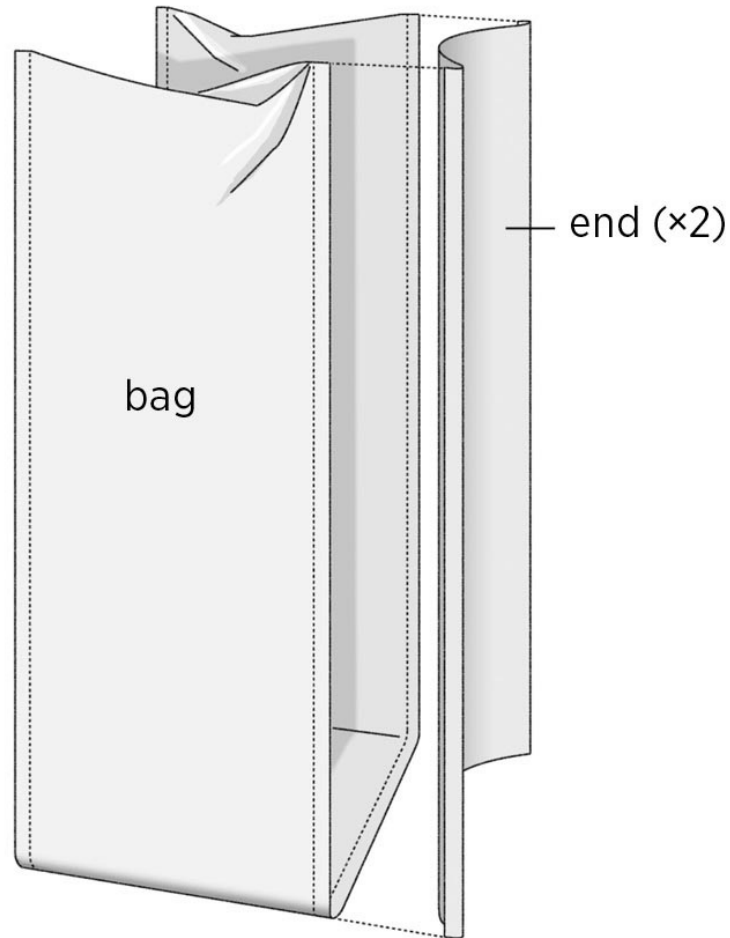
3. Sew the bag.

Overlap and pin the edges of an end piece to the sides of the bag, and stitch them as shown. Repeat to attach the other end to the other side of the bag. Turn the bag inside out, fold a little of the fabric over the bottom edges and pin, then stitch the seam twice for good luck.

Work tip: I found out, after the first try, that my wife uses pins for a reason. I had tucked my folded seams together, then ran a stitch the full 30", only to find that they had pulled away enough so that my thread never touched the piece that was tucked in.



ABOVE: *Cloth bag parts and measurements.*



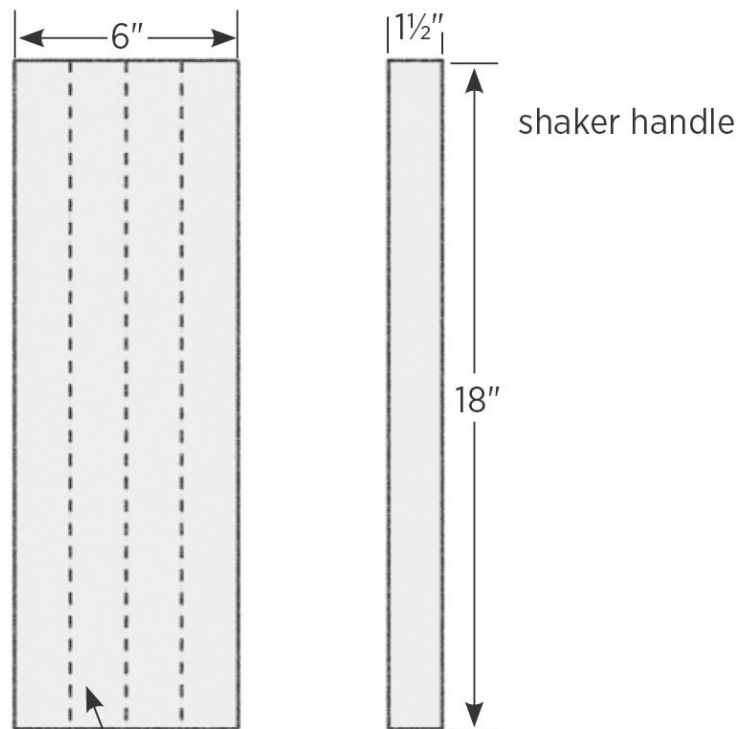
ABOVE: *I found it easier to iron seams with a steam iron to set before pinning.*

4. Make a shaker handle.

A fabric handle on the bottom of the bag comes in really handy when it's time to shake out the bees. To make the handle, cut a strip of fabric about 6" wide and a little longer than the length of the bottom (I made mine 18"). Fold the strip in half twice along its length to make a 1½"-wide strip of fabric, then sew along its length to secure everything. Sew the ends of the handle to the end-panel seams at the bottom of the bag.

5. Sew the top.

Fold over the top edge of the bag twice by 1" and stitch it all the way around. If you want to add a rope for cinching the bag shut, punch holes around the hem every 3" to 4", and install grommets in the holes, following manufacturer's directions. Thread a $\frac{1}{8}$ " nylon rope in and out through the grommets, as shown below.



Fold over twice.
Sew lengthwise,
then sew to the
bottom of the bag.

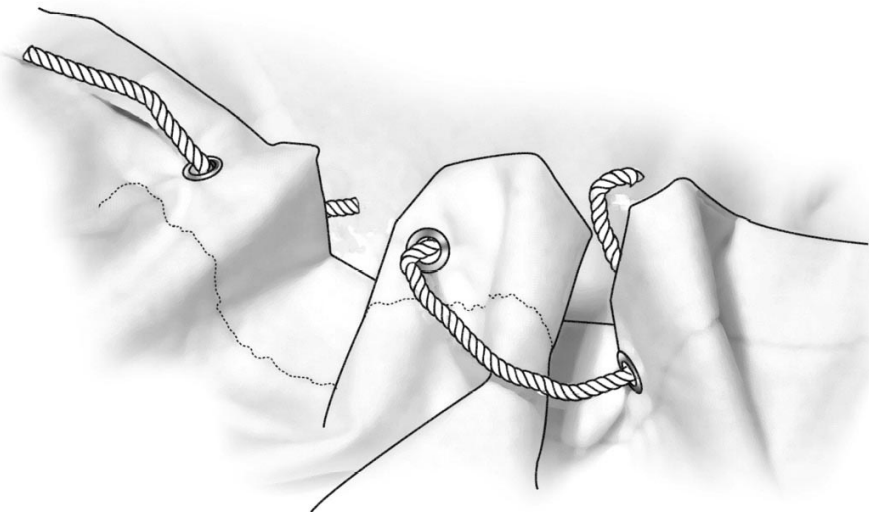
6. Complete the assembly.

To attach the bag to the frame, wrap about 6" of the top of the bag over the frame and secure it to the frame with binder clips. If you plan on transporting the bees in the bag, use four large clips, which you can quickly remove to take the bag off the frame. If you are going to shake the bees into a box right away, eight smaller clips will work fine.

To attach the frame to your pole, you can use a variety of methods, depending on the type of roller handle you have. If the ends of your bag frame fit snugly into the handle (that's how mine works), you might not need fasteners. Otherwise, you might use automotive hose clamps or duct tape to secure the frame.

Because the handle is removable from the extension pole, once you've captured a swarm, you can unscrew the pole and use both the roller handle and the cloth handle on the bag to easily handle the bag full of bees while you dump it into a waiting hive box.

Final details



ABOVE: Add grommets and a drawstring if you'd like.

CHAPTER NINE

Building 8-Frame Hives and Nucs

CHAPTER CONTENTS

8-Frame Deep Hive Body

8-Frame Solid Bottom Board

8-Frame Screened Bottom Board

8-Frame Slatted Rack

8-Frame Inner Cover

8-Frame Telescoping Outer Cover

Nuc Hive Body

5-Frame Nuc Bottom Board

Many beekeepers choose to go with 8-frame hives instead of 10-frames, primarily because of weight: Traditional 10-frame hives are just plain heavy, often weighing in at 70 or 80 pounds. The process for building an 8-frame is exactly the same as with a 10-frame, but with 8-frames everything is narrower. For some reason, commercially available 8-frame boxes seem way out of proportion; you can actually fit 9 frames into the ones I looked at. My box is proportioned to fit 8 frames, and this chapter includes everything else you need to set up a complete 8-frame hive.

PROJECT

8-Frame Deep Hive Body

It's easiest to make all of your boxes at one time because the joint cuts will be the same for all of them (see Building 8-Frame Supers, on facing page). In our area of the Berkshires, in western Massachusetts, I recommend running three deep boxes for brood and adding honey supers on those. Check with local beekeepers in your area for recommendations on how many frames total you should have for brood.

I recommend using Doone's Double-Hive Stand ([page 65](#)) for your 8-frame hive. Even if you plan to have only one hive, this will give you a place to set boxes while you're working — and if you decide to expand to two hives in the future, you'll be set to go.

See [pages 84](#) and [87](#) for instructions on building an 8-frame escape board so you can harvest all of that sweet honey.

Box Dimensions

For the 8-frame and nuc hive box construction, we will use a rabbet joint as with the 10-frame boxes, so the sides of these boxes are exactly the same as for our 10-frame and nuc boxes. For a deep box, the height is $9\frac{5}{8}$ " high; for a medium it's $6\frac{5}{8}$ ", and for a shallow it's $5\frac{11}{16}$ ". For our 8-frame boxes the two dimensions that will remain constant are the length of the sides ($19\frac{1}{8}$ ") and the width of the ends ($13\frac{3}{8}$ ").

Tools

Table saw

Bar or pipe clamps with 24" capacity

Framing square

Combination square

Drill and combination drill /countersink bit

Materials

One 6-foot pine 1×12

Waterproof glue

Sixteen 2" deck screws

Twelve 1 1/4" deck screws

1. Cut the main parts.

Cut two pieces of 1×12 to length at 19 1/8" for the sides and two pieces at 13 3/8" for the ends.

Tilt the table saw blade to 15 degrees (accuracy isn't critical), and set the fence so that the blade won't quite cut the full edge of the board. Cut an angle along one edge of each of the side and end pieces; these are for the handles. There will be plenty of extra material to use for other boxes, and it's safest to cut the angled edges while the boards are still full width.

Rip all four pieces to a width of $9\frac{5}{8}$ ". The sides are done. Save the cut scraps to make handles.

2. Rabbet the end pieces.

The $13\frac{3}{8}$ " end pieces get rabbeted ends to accept the side pieces, as well as a rabbet along their top inner edges to create a recess for the frame rest in. Cut the rabbets $\frac{3}{8}$ " deep \times $\frac{3}{4}$ " wide on each side edge of the end pieces. Then, cut a rabbet $\frac{3}{8}$ " deep \times $\frac{5}{8}$ " wide across the top to make the frame rests.

3. Assemble the box.

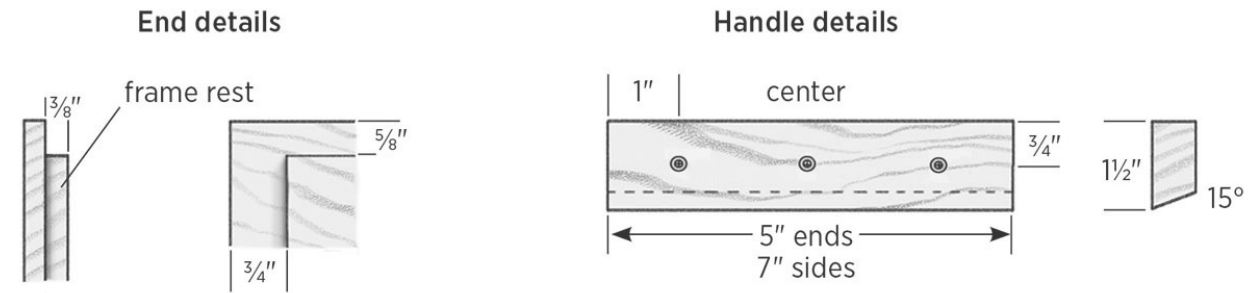
Test-fit the sides and ends by dry-assembling the box. Apply glue to the side rabbets of both end pieces, then clamp the box together and check it with a framing square. Drill countersunk pilot holes $\frac{3}{8}$ " from the side edges of the ends (so they're centered over the side boards) and drive 2" deck screws through the ends and into the sides at $\frac{3}{4}$ ", $2\frac{3}{4}$ ", centerline, $6\frac{5}{8}$ ", and $8\frac{5}{8}$ " for a total of five screws in each joint.

4. Add the handles.

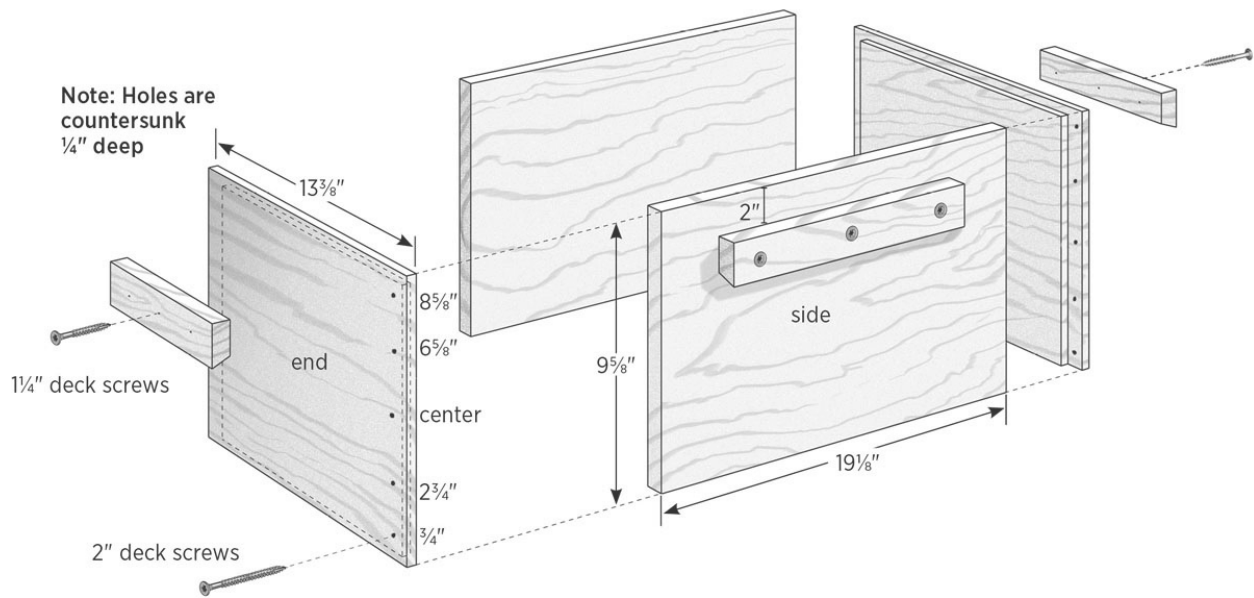
Using your leftover angled strips, cut two pieces to length at 5" and two at 7" (I like fairly long handles for a good grip). Drill three countersunk pilot holes into each handle, as shown in 8-Frame Hive Bodies and Supers, below. Mark the center along of each side of the box, 2" down from the top, then use a combination square to extend a reference line about 3" on each side of the center.

Apply glue to the back (the narrower side) of each handle and position it so its top edge is on the horizontal reference line and the

center pilot hole is on the center mark. Fasten the handle in place with 1 1/4" deck screws. By having the bottom of the handles angled, your fingers will be drawn into the box as you lift it.



Side view of end



ABOVE: 8-frame hive body and super parts.

Building 8-Frame Supers

Supers are the exact same thing as hive bodies — they're just shorter — so build them all at the same time and save from having to repeat setups. To make a medium or shallow super,

follow the instructions here for the 8-Frame Deep Hive Body. You'll need a 6-foot 1×8 for each super. To build a medium, rip the board to width at $6\frac{5}{8}$ "; for a shallow, rip it at $5\frac{11}{16}$ ".

Note: With a medium super, there isn't enough material to make handles, so don't cut the angle on those boards. Shallow supers will have plenty, so you can use that material (plus any left from the deeps) to make enough handles for everything.

PROJECT

8-Frame Solid Bottom Board



In chapter 2, we made a solid bottom board for a 10-frame hive. The same information about materials and methods holds true for an 8-frame solid bottom board. The only difference is that the 8-frame will be a few inches narrower.

Tools

Table saw

Drill with combination drill/countersink bit

Materials

One 2-foot pine 1×5

One pine 1×5 and one pine 1×8, approximately 26" (see step 2)

Waterproof glue

2" deck screws (see step 3)

Three 3d galvanized nails

1. Cut the sides.

Cut the 2-foot 1×5 to length at 22". Cut two $\frac{1}{4}$ "-deep × $\frac{3}{4}$ "-wide dadoes into the same face of the board, each $\frac{3}{8}$ " from a long edge. Confirm that the boards for the platform (see step 2) fit into the dadoes. Rip the dadoed sections to width at $1\frac{7}{8}$ " to create the two side pieces, as shown in 8-Frame Solid Bottom Board Assembly, on facing page. Set the leftover piece aside.

2. Prepare the platform.

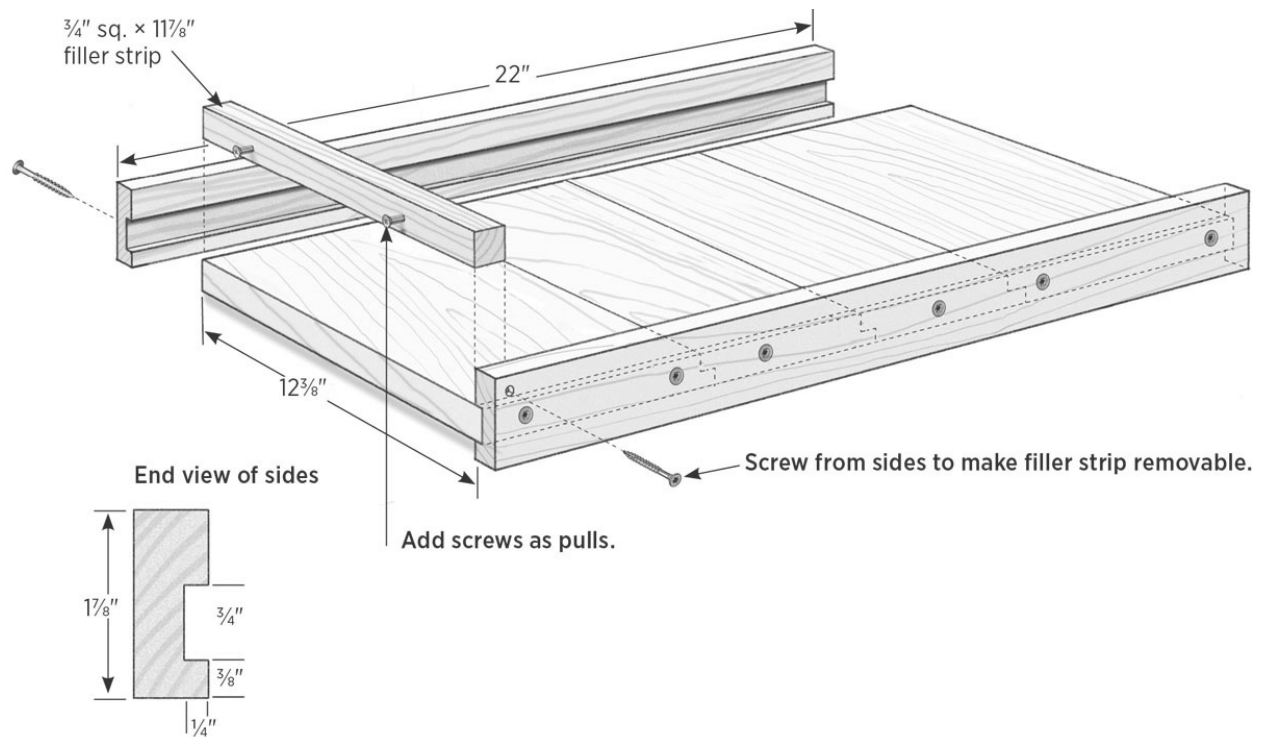
You can use any suitable material you have on hand (including $\frac{3}{4}$ " plywood) to make a finished platform that's $12\frac{3}{8}$ " wide × 22" long. (I used one piece of 1×8 and one 1×5.) Boards can be joined with simple butt joints, tongue-and-groove joints, or half-laps (see **page 19**).

3. Assemble the board.

Apply waterproof glue generously to the dadoes of the side pieces, then assemble and clamp the sides and platform. Drill pilot holes and drive 2" deck screws through the sides and into the platform boards, centered on the dadoes. I used one screw at each end of the narrow boards and two for the wider boards.

4. Add the filler strip.

Cut a piece from the leftover pine strip to length at $11\frac{7}{8}$ ". This fills in the space across the back of the bottom board. Fit the strip in place and fasten it with a pair of 3d nails or screw from sides, and add screw pulls for removal as in the illustration.



ABOVE: 8-frame solid bottom board assembly.

PROJECT

8-Frame Screened Bottom Board

We'll build an 8-frame screened bottom board the same way as the 10-frame. Bees in an 8-frame hive will still have the same issues with varroa mites, so a screened bottom board is handy to use.

Tools

Table saw

Drill with combination drill/countersink bit

Tin snips

Staple gun

Materials

One 5-foot pine 1×5

Waterproof glue

Six 2" deck screws

Ten 1 1/4" brads

#8 mesh galvanized hardware cloth, 12" × 20" minimum

$\frac{3}{8}$ " staples

Two 1 $\frac{1}{4}$ " deck screws

Six 1" galvanized box nails

1. Cut the sides.

Cut one piece of 1×5 to length at 22". Dado and rip the board to create the two side pieces (A), following the same process used for the 8-Frame Solid Bottom Board (step 1, **page 124**).

2. Cut the remaining wood parts.

Cut one piece of 1×5 to length at 12 $\frac{3}{8}$ " for the landing board (B).

Cut the following parts from the remaining piece of 1×5:

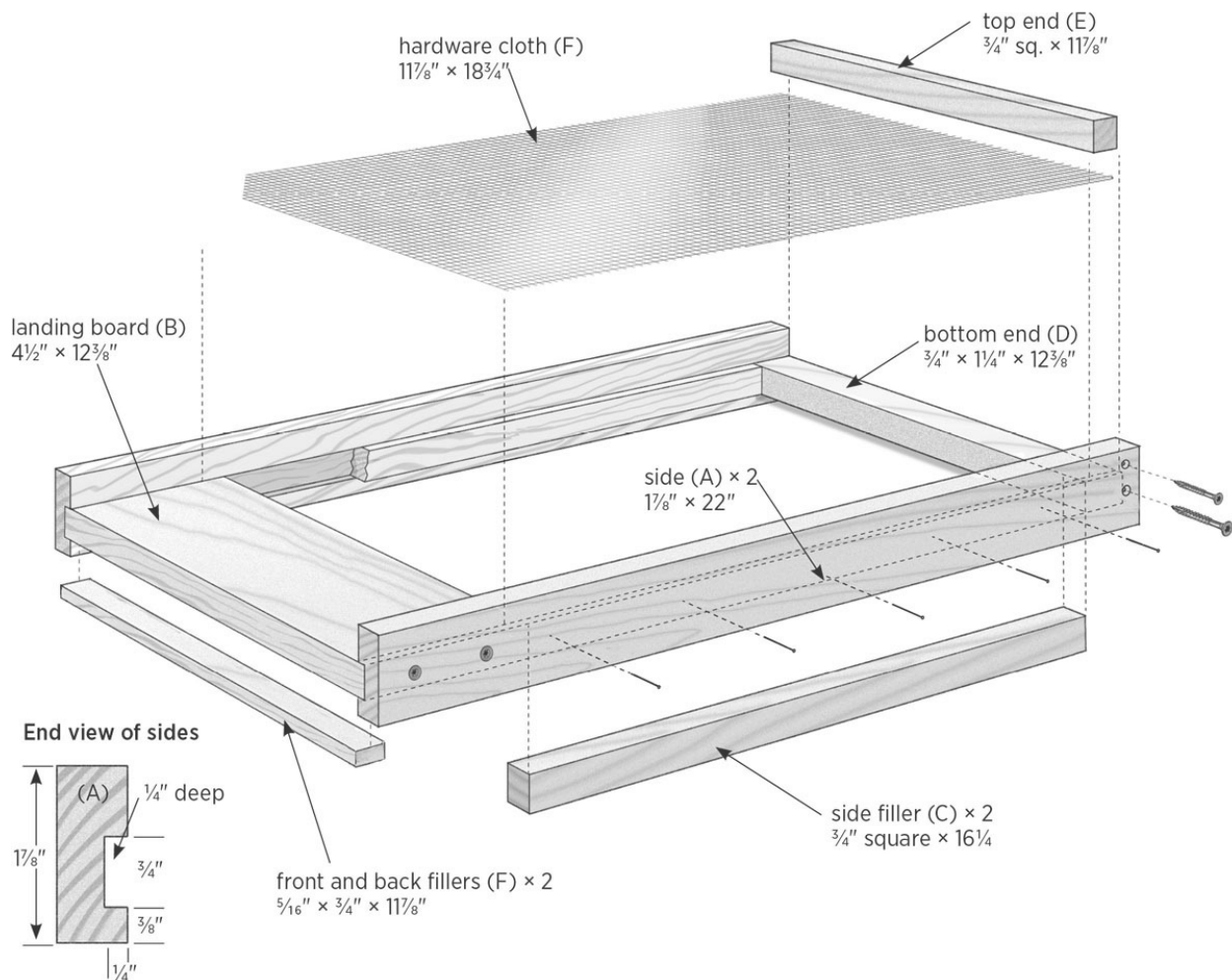
- one bottom end (D) at 1 $\frac{1}{4}$ " wide × 12 $\frac{3}{8}$ "
- two side fillers (C) at $\frac{3}{4}$ " wide × 16 $\frac{1}{4}$ " long
- one top end (E) at $\frac{3}{4}$ " wide × 11 $\frac{7}{8}$ " long
- two pieces at $\frac{5}{16}$ " wide × 11 $\frac{7}{8}$ " long; these will fill the front and back spaces on the bottom (F)

3. Assemble the board.

Apply glue to the side dados and assemble the sides, landing board, side fillers, and bottom end as shown in 8-Frame Screened Bottom Board, on facing page. Fasten the landing board and bottom end piece with 2" deck screws driven through pilot holes. Fasten each side filler with five evenly spaced 1 $\frac{1}{4}$ " brads.

4. Add the screen.

Cut the $\frac{1}{8}$ " mesh to size at $11\frac{7}{8}$ " \times $18\frac{3}{4}$ ", using tin snips. Attach the screen to the landing board side fillers and bottom end piece with four staples each. Attach the top end piece using two $1\frac{1}{4}$ " screws, as shown in 8-Frame Screened Bottom Board, on facing page. Attach the two $\frac{5}{16}$ " filler strips, one to the bottom front of the landing board and one to the bottom of the bottom end piece with glue and 1" nails, and you're done.



ABOVE: 8-frame screened bottom board exploded view.

PROJECT

8-Frame Slatted Rack



Build this slatted rack to give your bees some extra hang-out space on hot days, so they don't feel as crowded, and to keep brood at the bottom of the frames out of the cold on chilly days and nights.

Tools

Table saw

Drill with combination drill/countersink bit

Materials

One 3-foot pine 1×6

One pine 1×5, 13" minimum

One pine 1×8, 16" minimum

Waterproof glue

Eleven 2" deck screws

Eight 3d box nails or sixteen 1 1/4" brads

Sixteen 3/4" brads

1. Cut the ends and sides.

Cut one piece of 1×6 to length at 13^{3/8}" for the ends, and cut one piece at 19" for the sides. Rip each board into two pieces that are 2 1/4" wide.

2. Dado and rabbet the end pieces.

Cut a 3/4"-wide × 1/4"-deep dado into each end piece, 1/4" from one long edge of each end piece. Then, cut a 3/4"-wide × 1/4"-deep rabbet at both ends of each piece.

3. Dado the side pieces.

The sides are a left and right mirror image with a blind dado for the shelf. Cut the dado 1/4" deep × 3/4" wide, 1/4" from the top edge of each piece. The full depth of the dado should extend about 4 1/4" from the

end, as shown. You can do this by setting a stop on your saw fence 4 1/4" from the high point on the blade. Dado the side piece, then move your fence to the other side of the blade to cut the dado on the other side piece.

4. Cut the shelf.

Cut the shelf to length at 12 3/8" from 1x5 pine. Cut a 3/8"-wide x 7/16"-deep dado, centered along one long edge of the board. Then, rip this board to width at 4 1/8".

5. Prepare the slats.

Cut the 1x8 to length at 15 1/4". Cut 3/16"-deep x 7/16"-wide rabbets along both sides of *one end* of the piece. The resulting tenon should be 3/8" thick. Rip the board into eight 3/4"-wide slats.

Note: This process works best if the 1x8 is flat to begin with. If it's not flat, it's easier to rip the slats first, then cut the tenons in each one to maintain the 3/16" depth of cut.

6. Assemble the project.

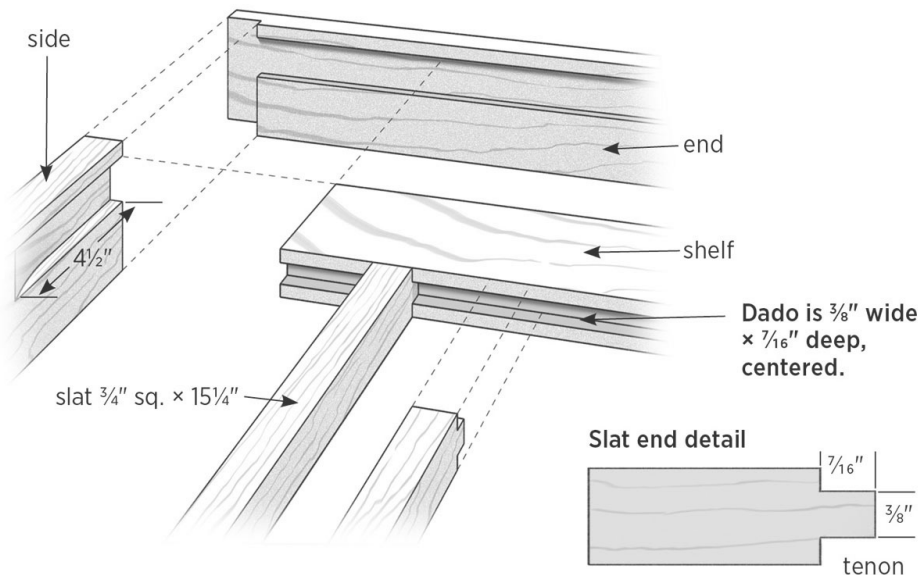
Set one end piece on the workbench with the dado toward the top and facing you. Mark the top of the board at 1 1/16" from the right end. Set the shelf on the bench with the dado facing you. Mark the top of this board at 9/16" from the left end. From these starting points, measure and mark both boards every 3/4" until you reach the other ends. These will be the slat locations.

Dry-assemble the sides, ends, shelf, and a couple of slats to make sure everything fits. Apply glue to the blind dadoes of the sides and to

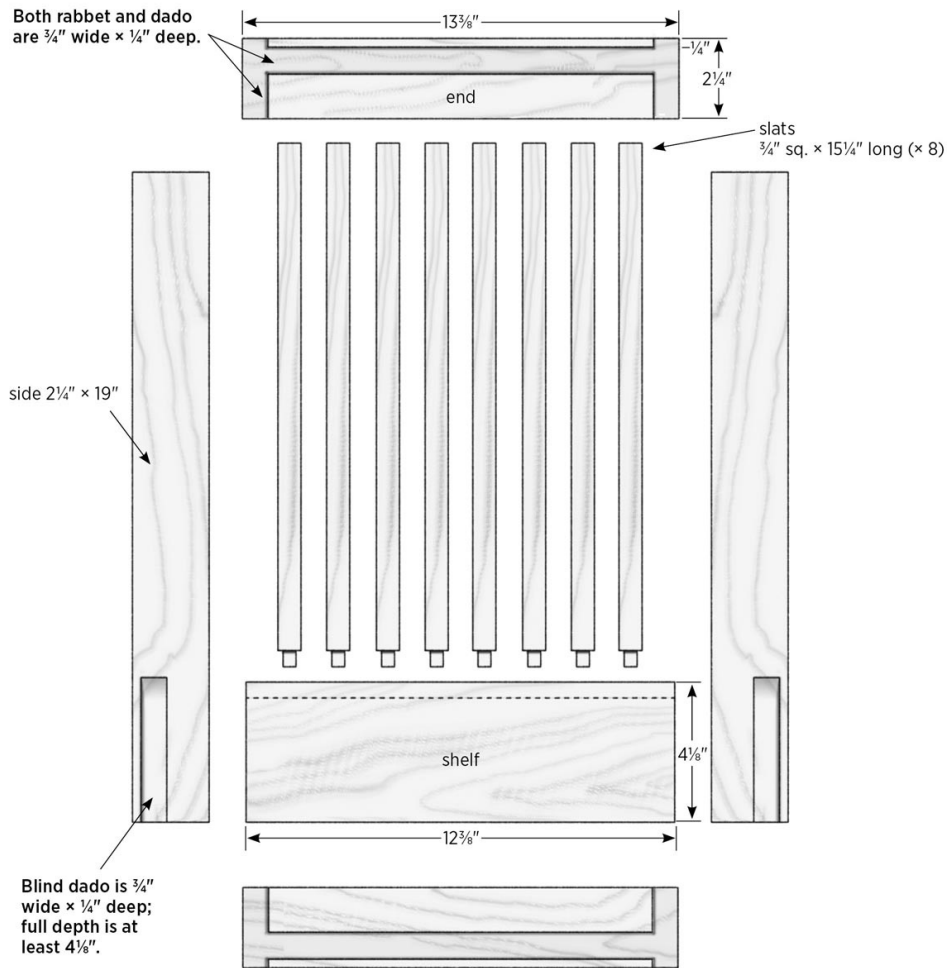
the rabbets and dado where the shelf will fit into the end piece. No glue is needed where the slats will go. Assemble the sides, ends, and shelf, and clamp the frame together. Fasten the shelf and adjoining end with 2" deck screws. Attach the other end, but don't drive the screws all the way in.

Loosen the clamps enough to slide the eight slats into the shelf dado. Set the slats in place on their layout marks, then retighten the clamp and finish driving the screws on the end piece.

On the outside face of the end piece without the shelf, draw a line $\frac{5}{8}$ " down from the top edge, centered over the dado. Nail through the end piece and into the end of each slat with one 3d box nail or two $1\frac{1}{4}$ " brads, nailing on the reference line. On the shelf end, use two $\frac{3}{4}$ " brads to fasten the tenon end of each slat.



ABOVE: *Slatted rack assembly.*



ABOVE: *Slat layout on the end piece and shelf.*

PROJECT

8-Frame Inner Cover

As with any size of Langstroth-style hive, an inner cover keeps the telescoping outer cover from having comb attached to it or being propolized to the box. It can also act as an upper entrance or a sturdy place to rest feeders on, allowing you to check syrup supplies without disturbing the hive.

Tools

Table saw

Drill with combination drill/countersink bit

1 1/4" Forstner bit, spade bit, or hole saw

Jigsaw

Materials

One 3-foot pine 1×4

One 12" × 18" piece 1/4" lauan plywood, minimum

Waterproof glue

Four 1 3/4" deck screws

1. Cut the side and end pieces.

Cut a $\frac{1}{4}$ "-wide \times $\frac{5}{16}$ "-deep dado centered along both edges of the 1 \times 4. Confirm that the plywood fits the slot. Rip the board into two pieces at 1 $\frac{1}{4}$ " wide. From these pieces, cut the two ends (A) to length at 13 $\frac{3}{8}$ " and two sides (B) at 18 $\frac{1}{8}$ ".

2. Rabbet the end pieces.

Cut $\frac{3}{4}$ "-wide \times $\frac{1}{4}$ "-deep rabbets into the *ends* of the end pieces, on the slot side, to accept the side pieces.

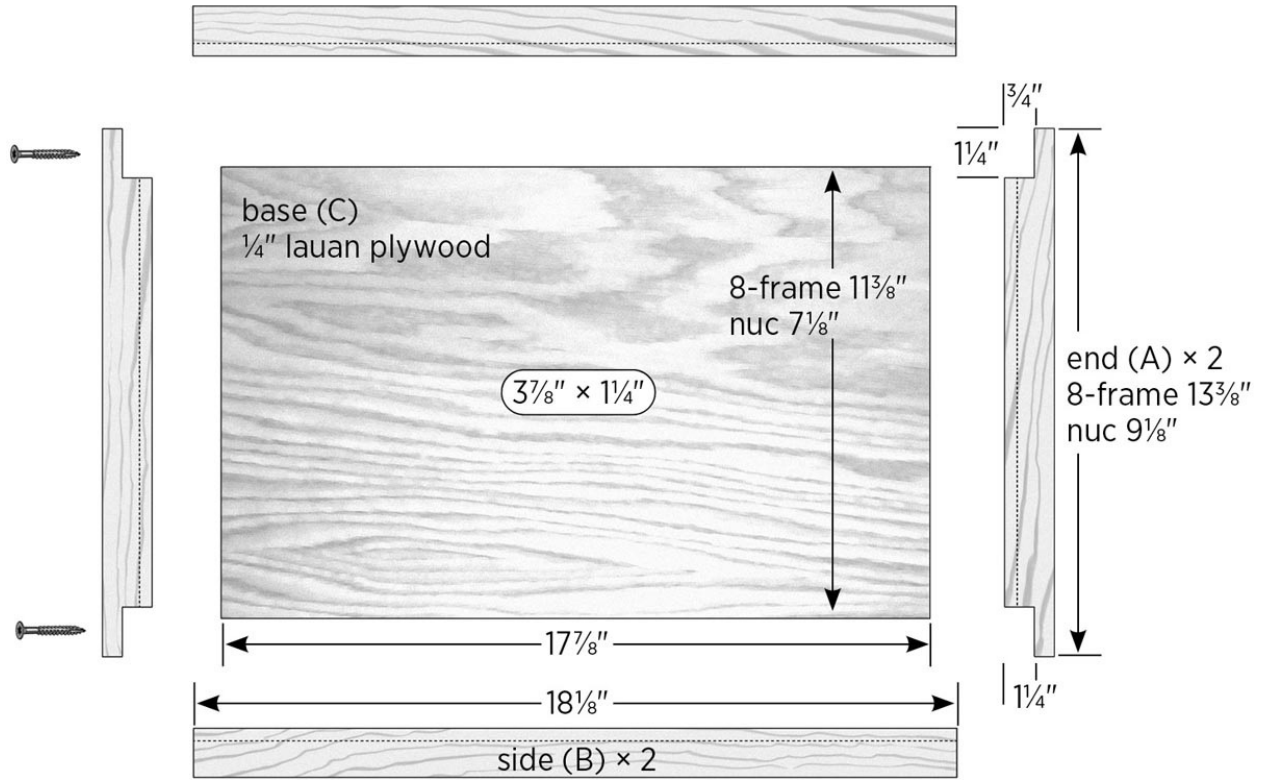
3. Prepare the base.

Cut the plywood base to size at 11 $\frac{3}{8}$ " \times 17 $\frac{7}{8}$ ". Mark the panel's center, then draw a line lengthwise down its center. Measure 1 $\frac{5}{16}$ " up and down from the center, along the line, and make a mark. Drill a 1 $\frac{1}{4}$ " hole at both marks, using a Forstner bit, spade bit, or hole saw. Cut between the holes with a jigsaw to create a slot that is 1 $\frac{1}{4}$ " wide \times 3 $\frac{7}{8}$ " long.

4. Assemble the cover.

Apply glue to the rabbets on the end pieces, assemble the frame around the plywood base, and clamp the assembly. Fasten the ends to the sides with a 1 $\frac{3}{4}$ " deck screw at each joint.

8-frame inner cover parts



ABOVE: Notes: Sides are 3/4"-thick pine. Slots for the plywood are 1/4" wide by 5/16" deep. Use 1 5/8" deck screws.

PROJECT

8-Frame Telescoping Outer Cover

It's time to put a roof on our hive. To make my cover, I used 1×8 boards for the wood top. Another option is to combine boards of different widths or substitute with a single piece of plywood.

Tools

Table saw

Drill with combination drill/countersink bit

Tin snips

Bar or pipe clamps (at least 24" long)

Two scrap boards at least 22" long

Rubber mallet or hammer and wood block

Screwdriver with flat, wide blade

Materials

One 6-foot pine 1×5

One 4-foot pine 1×8 (or equivalent material; see step 3)

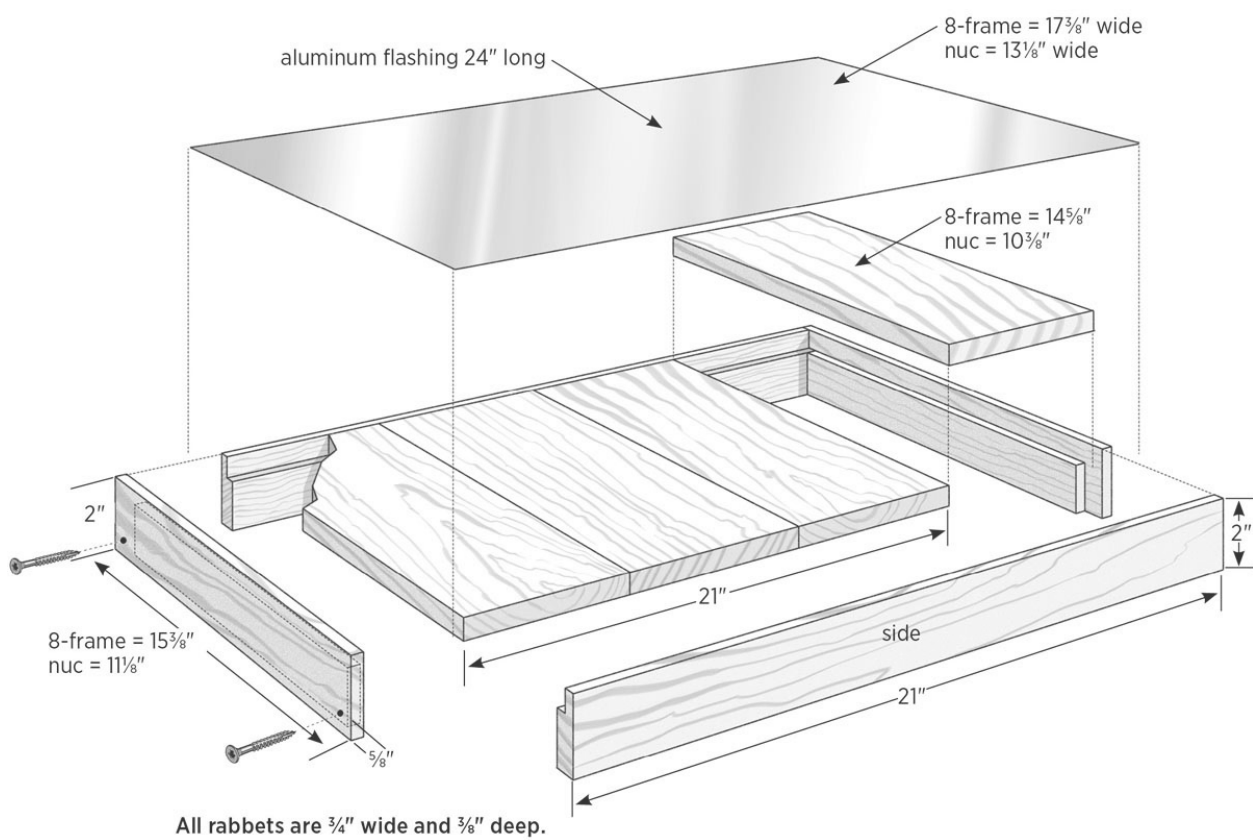
Waterproof glue

Four 2" deck screws

Twenty-four 5d galvanized box nails

One 0.016"-thick aluminum sheet, 18" x 24" minimum

Twenty 3d galvanized box nails



ABOVE: *8-frame telescoping outer cover parts.*

1. Cut the sides and ends.

Cut one piece of 1×5 to length at 13³/₈" and one piece at 21". Cut a ³/₈"-deep rabbet along each long edge of each board (each piece gets two rabbets); the width of the rabbet should match the thickness of the material you use for the wood top.

Cut a ³/₄"-wide rabbet on each end of the 15³/₈"-long board (or 11¹/₈" board if you are making the nuc cover).

Rip a 2"-wide strip from each side of both boards, creating the two side and two end pieces.

2. Assemble the frame.

Apply glue to the end joints, assemble and clamp the frame, and check it for square. Fasten the frame with one 2" deck screw at each joint.

3. Add the wood top.

Cut boards or plywood to fill the 14⁵/₈" × 21" space of the cover frame. Apply glue to the top rabbets and set the wood top into place and fasten it with 5d nails (I used one nail for each board end). You will add additional nails when you attach the metal top.

4. Create the metal top.

Cut the aluminum sheet to size at 17³/₈" × 24". Follow steps 6 through 8 on **page 56** for bending and fastening the metal top to the cover assembly.

Nuc Boxes

I consider nuc boxes to be essential beekeeper's equipment. They can help you increase the number of hives you have, and can also help save the day if you have queen problems with a hive. Keeping a few nuc hives around is like having a free insurance policy.

If you accidentally roll a queen on a frame and kill her, or need a new queen for whatever reason, you have a replacement ready and waiting to go.

You can pull a couple of frames from a hive, and if there are fresh eggs, pollen, nectar, and nurse bees, they will produce a queen. This is a great way to use surplus brood and bees in a colony that is getting crowded. You can also pull a frame that already has queen cells on it and let the new queen hatch in the nuc box. If you are in a hurry, you can purchase a queen and put capped brood in a nuc box and start like that. I've even bought a 3-pound package of bees and an extra queen and split them into two nuc boxes.

Another good practice, learned courtesy of Michael Palmer (an amazing and well-known beekeeper in St. Albans, Vermont), is starting some nuc hives around July by taking bees and brood from your weaker hives that aren't going to produce surplus honey. Split these hives into nucs with new queens and build them up so that they are strong enough to overwinter. This increases your odds of having more hives make it through to spring.

When Michael gave a presentation on this method to our bee club, the Northern Berkshire Beekeepers Association, I was surprised to hear it. I always thought you needed two deeps loaded with bees and honey to get through a Northeast winter. Here was someone telling us a 5-frame nuc box can make it as well.

Well, Mike has the credentials to back up his methods. He runs 700+ hives, raises all his own queens, and produces an average of 40 tons of honey per year. I decided to give nucs a try a few years ago, and it worked. They didn't all survive the winter, but one of

those hives was my best honey producer the following year, yielding 125 pounds of surplus. Believe me, you need to start a nuc hive, even if you only plan on keeping a couple of regular hives.

PROJECT

Nuc Hive Body

You can make nuc boxes to fit any number of frames you want. This box is designed for 5 deep frames. You can use pine or plywood or a combination of both. I've made them out of leftovers by gluing narrow boards edge-to-edge to give me the depth I needed. I've used two different styles of box.

The first is exactly like a full-size hive body, being open on the bottom and using a bottom board. It measures 9⁵/₈" high (see Box Dimensions, on [page 122](#)). The other type is 10" high and has a piece of wood nailed on for a bottom. The width and length are the same for both boxes.

With a 10" solid-bottom box, you can cut an entrance in the front near the bottom, drill a hole, or use a plastic disc entrance; see Entrance Options for a Solid-Bottom Nuc Hive, on [page 137](#). So, let's get down to business and build some nuc boxes.

Tools

Table saw

Drill and combination drill/countersink bit

24" bar or pipe clamps

Combination square

Materials

One 6-foot pine 1×12

Additional 1× lumber for 10" nuc (see step 1)

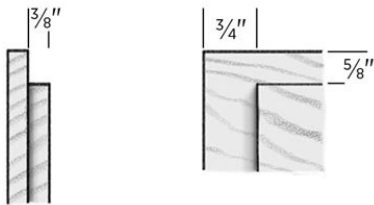
Waterproof glue

Sixteen 2" deck screws

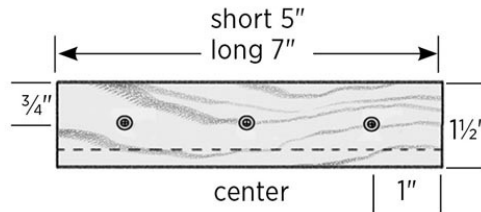
Twelve 1 1/4" deck screws

5-frame nuc parts

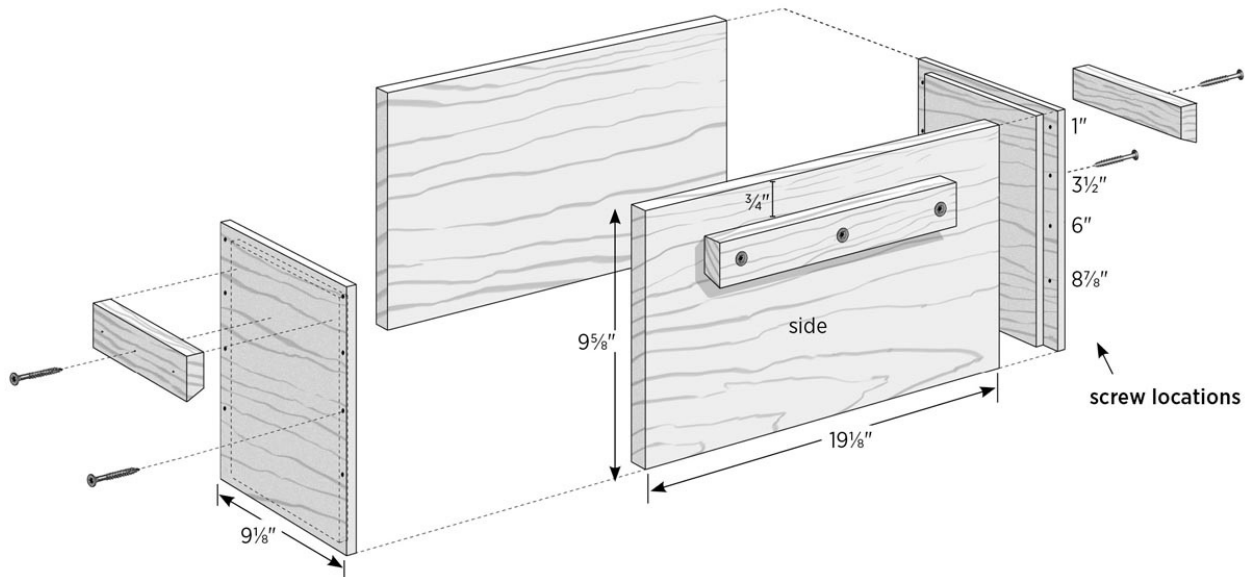
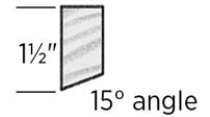
End details



Side view of end



Handle details



ABOVE: Use 9 5/8"-high hive body with bottom board.

1. Cut the box pieces and handle material.

Cut two pieces of 1×12 to length at $19\frac{1}{8}$ " for the sides and two pieces at $9\frac{1}{8}$ " for the front and back.

Now we're going to jump ahead and make the angle cuts for the handles, because it's safer to do this with larger pieces. Tilt your table saw blade to 15 degrees (accuracy isn't critical here). Set the fence so that the blade won't quite cut the full edge of the board. If you're making the $9\frac{5}{8}$ " nuc, cut an angle along one edge of each of the side, front, and back pieces; these are for the handles, and there will be plenty of extra. If you're making the 10" nuc (with attached bottom), cut the angle on a separate board about 20" long that is wide enough to cut safely.

Rip the side, front, and back pieces to width at $9\frac{5}{8}$ " (for a standard nuc) or 10" (for a 10" nuc). The leftover pieces are the handle material, measuring about $1\frac{1}{2}$ " wide. Rip similar strips for the 10" nuc. Set aside the handle pieces for now.

2. Rabbet the front and back boards.

Cut a $\frac{3}{8}$ "-deep × $\frac{3}{4}$ "-wide rabbet along the sides of the front and back pieces, to mate with the sides. Cut a $\frac{3}{8}$ "-deep × $\frac{5}{8}$ "-wide rabbet wide along the top of the front and back pieces to create rests for the frame.

3. Assemble the box.

Check the fit of the box parts, then apply glue to the side rabbets (not the top) of the front and back pieces. Assemble and clamp the box. Drill pilot holes and fasten each joint with four 2" deck screws driven

through the ends at 1", 3¹/₂", 6", and 8⁷/₈" down from the tops and ³/₈" from the side edges.

4. Add the handles.

Using the angled strips you made in step 1, cut two piece to length at 5" and two pieces at 7". Sand the edges and drill countersunk pilot holes in the locations shown in 5-Frame Nuc Parts, on previous page.

Mark the center of each side of the box, ³/₄" down from the top. Use a combination square to extend a reference line about 3" to each side of the center. Apply glue to the back of each handle (the narrower side). Line up the top of the handle on reference line so the center pilot hole is even with the center mark. Screw the handles in place with three 1¹/₄" deck screws.

Work tip: If you're building a 10" solid-bottom nuc, see Entrance Options for a Solid-Bottom Nuc Hive (facing page) for details on creating an entrance and installing the bottom and handles.

Nuc Inner Cover and Telescoping Outer Cover

Just like on the other hives, the nuc inner cover will have a 1¹/₄"-wide frame and ¹/₄" plywood center. The sides will still be 18⁷/₈" long. To build a nuc inner cover, you need one 5-foot pine 1×4 and a 7¹/₈"-wide × 17⁷/₈"-long piece of lauan plywood. Follow the instructions for the 8-Frame Inner Cover (**page**

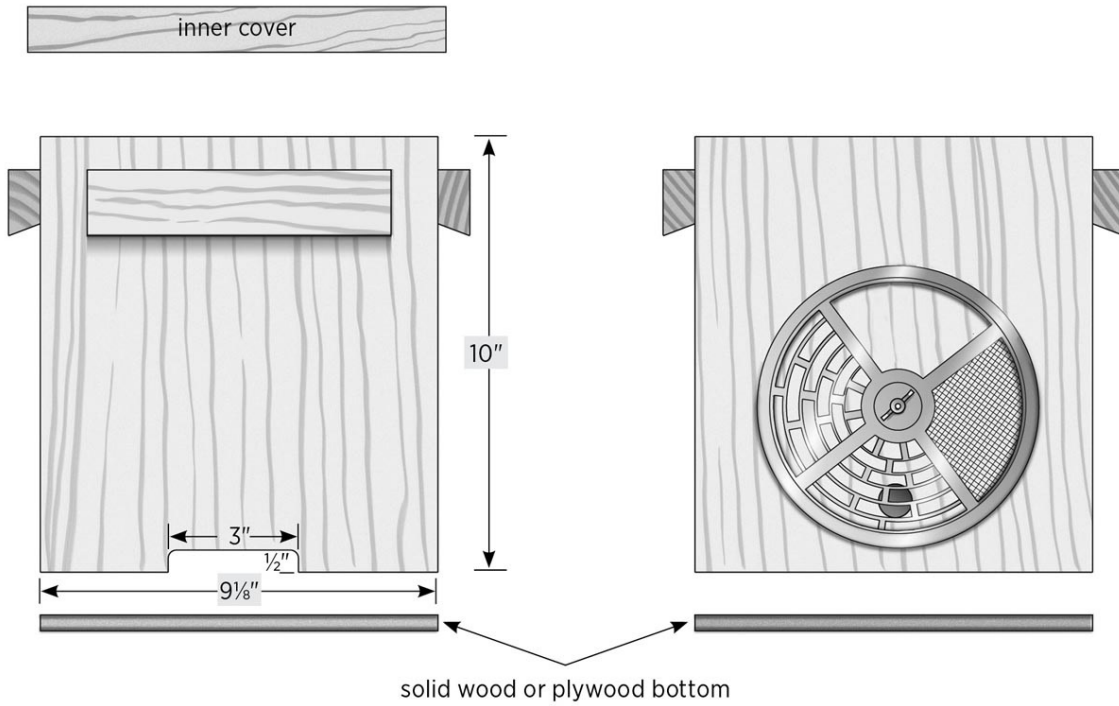
131), making the end pieces $9\frac{1}{8}$ " long. For nucs, I usually just cut a $1\frac{1}{4}$ " hole in the plywood instead of making a slot.

To build a 5-frame telescoping cover, follow the instructions for the 8-Frame Telescoping Outer Cover (**page 132**), but make the ends $11\frac{1}{8}$ " long and the sides 21" long. The top boards are $10\frac{3}{8}$ " long. Cut the aluminum for the metal top to size at $13\frac{1}{8}$ " x 24".

Entrance Options for a Solid-Bottom Nuc Hive

For a 10"-high nuc, cut a piece of wood to size at $9\frac{1}{8}$ " x $19\frac{7}{8}$ " and screw or nail it to the bottom of the nuc box. You have two options for the entrance:

- A)** One is to cut out an entrance (about $\frac{1}{2}$ " x 3") at the bottom of the front board, using a jigsaw, before attaching the bottom to the hive.
- B)** The other is to use a round, plastic disc entrance (available from bee supply houses), which you mount on the front of the hive with the telescoping cover in place, then drill a 1" to $1\frac{1}{4}$ " entrance hole. In this case, you make the nuc box without the front and back handles.



ABOVE: *Height is 10". All other dimensions are the same as the nuc box on **page 135**.*

PROJECT

5-Frame Nuc Bottom Board

This is the bottom board you will use if you made the 9⁵/₈" nuc box that's open on the top and bottom. The following instructions are for using 1×8 boards for the platform. Alternatively, you can make the platform from a single piece of 1×10 pine cut to 8¹/₈" × 22" and adding cleats to the bottom to prevent it from warping.

Tools

Table saw

Drill and combination drill/countersink bit

Materials

One pine 1×5, 24" minimum

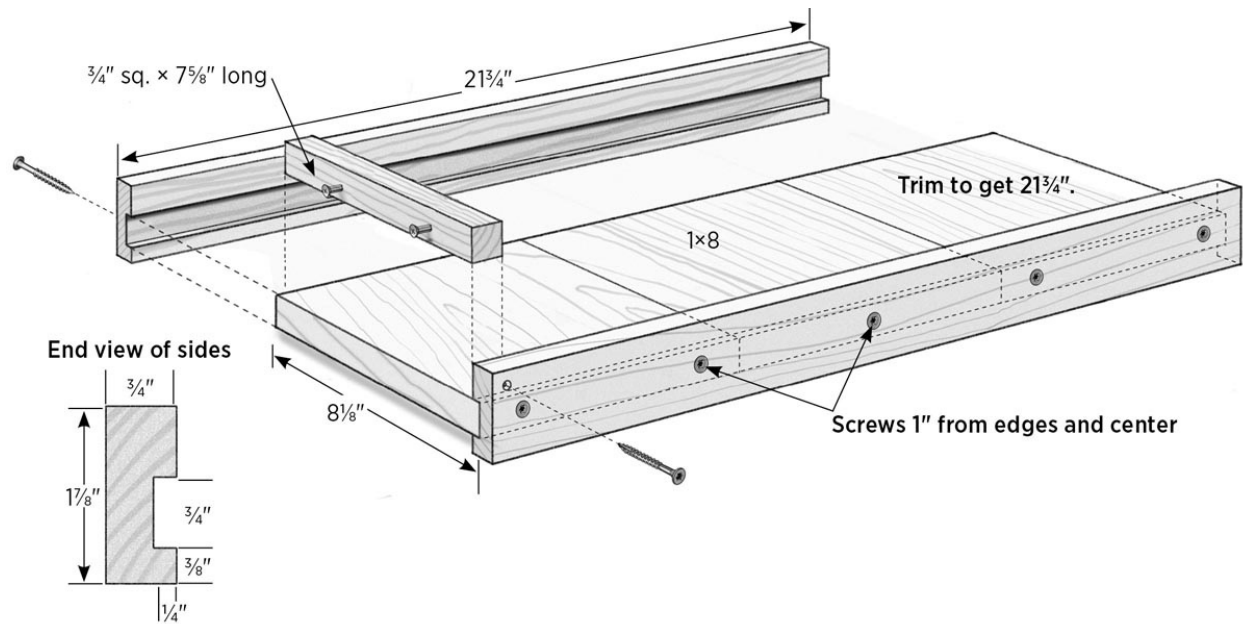
One pine 1×8, 25" minimum

One pine scrap (see step 3)

Waterproof glue

Twelve 2" deck screws

Three 1¹/₄" deck screws or 3d galvanized box nails



ABOVE: Solid bottom board for nuc hive assembly.

1. Cut and dado the sides.

Cut the 1x5 to length at $21\frac{3}{4}$ ". Cut a $\frac{3}{4}$ "-wide \times $\frac{1}{4}$ "-deep dado, $\frac{3}{8}$ " from each long edge of the board. Rip the board into two pieces $1\frac{7}{8}$ " wide.

2. Prepare the platform boards.

Cut three pieces of 1x8 to length at $8\frac{1}{8}$ ". Place them side-by-side and rip the last board as needed so the combined width of the boards is $21\frac{3}{4}$ ".

3. Complete the project.

Apply glue to the side dadoes and assemble the pieces using two 2" deck screws driven through the sides and into each end of the

platform boards.

Cut a strip of scrap pine to size at $\frac{3}{4}$ " wide \times $\frac{3}{4}$ " high \times $7\frac{5}{8}$ " long. Nail or screw the strip across the back platform board so that the bees have only one entrance.

CHAPTER TEN

Specialty Hives

CHAPTER CONTENTS

Top-Bar Hive

Demonstration Hive

There is a growing interest in keeping bees in a top-bar hive, a type of hive that has been around for ages. Like everything, it has its supporters and detractors.

One reason many choose a top-bar hive is the fact that there's no heavy lifting. With a Langstroth hive, the boxes are stacked and you have to remove one box (or several) to get at the ones below for inspection. With a top-bar hive, the whole shebang is contained in one horizontal box, and you lift out one frame at a time.

Those who aren't fans of top bars say they're not for the serious beekeeper, and you don't get much honey. Well, people do raise bees and do get a honey crop from top-bar hives. There may be more manipulating of frames to keep things in order, but they do work. In fact, the current treasurer of our club had me build him a top-bar hive this year. His words were, "I shouldn't knock something if I haven't tried it myself."

I prefer to call the second project a demonstration hive rather than an observation hive. I think of an observation hive as one that is more permanently set up indoors, with four or more frames and outdoor access for the bees, and is used to observe and study their normal behavior. What we build here is similar, in that you can observe the bees, and their behavior will be somewhat normal, but the hive is meant for short-term use and doesn't allow the bees to leave for foraging.

This demonstration hive is useful for giving talks on bees, visiting the classroom, or going to a market to sell honey and related products. It's also a great draw when doing a special sales event, such as a one-day fair. Customers can watch nurse bees feeding larvae; see pollen, stored honey, and capped brood; and may even observe new bees emerging from their cells or a queen laying eggs.

PROJECT

Top-Bar Hive



If you're interested in giving beekeeping a try on more of a shoestring budget, a top-bar hive might be for you. The whole idea behind a top-bar hive is simplicity, so it can be made with the least amount of materials and tools when both are scarce and hard to come by. Not everyone likes simple, but I do. It's kind of like my 1988 Dodge Ram

pickup truck. It has a bench seat and a radio. You have to crank the window down to adjust the mirror by hand and push the buttons to lock the doors, and that's the way I like it.

This hive can be built in a weekend, and you can leave it basic (like my old truck) or fancy it up as much as you want. I'll show you how to add viewing windows, which are optional. We'll also explore a few different roof options. (See photos on [page 165](#).)

Tools

Table saw

Circular saw or handsaw

Combination square with protractor head

Drill and combination drill/countersink bit

Additional Tools for Optional Windows

1/2" and 1/16" drill bits

Jigsaw

Sandpaper

Router with roundover and flat-bottom bits (optional)

Materials

Hive Body

One 4-foot pine 1 × 6

Two 6-foot pine 1 × 12s

One 4-foot 2 × 4

Sixteen 2" deck screws

Twenty-two 1 ³/₄" deck screws

Waterproof glue

Top Bars

One 8-foot pine ⁵/₄ × 6

One 3-foot pine ⁵/₄ × 8

Windows (optional)

¹/₈" Plexiglas (or similar clear plastic glazing; size as desired; see step 4, on **page 142**)

⁵/₈" wire nails

1-by pine material (for door; see step 6 on **page 143**)

Two 2" × 1 ³/₈" hinges with screws

Scrap wood and screws (for door latch, see step 6, on **page 143**)

One 2" window latch with screws

Roof

Three 8-foot pine 1 × 4s

Sixteen 2" deck screws

One 24" x 48" piece $\frac{3}{8}$ " exterior plywood

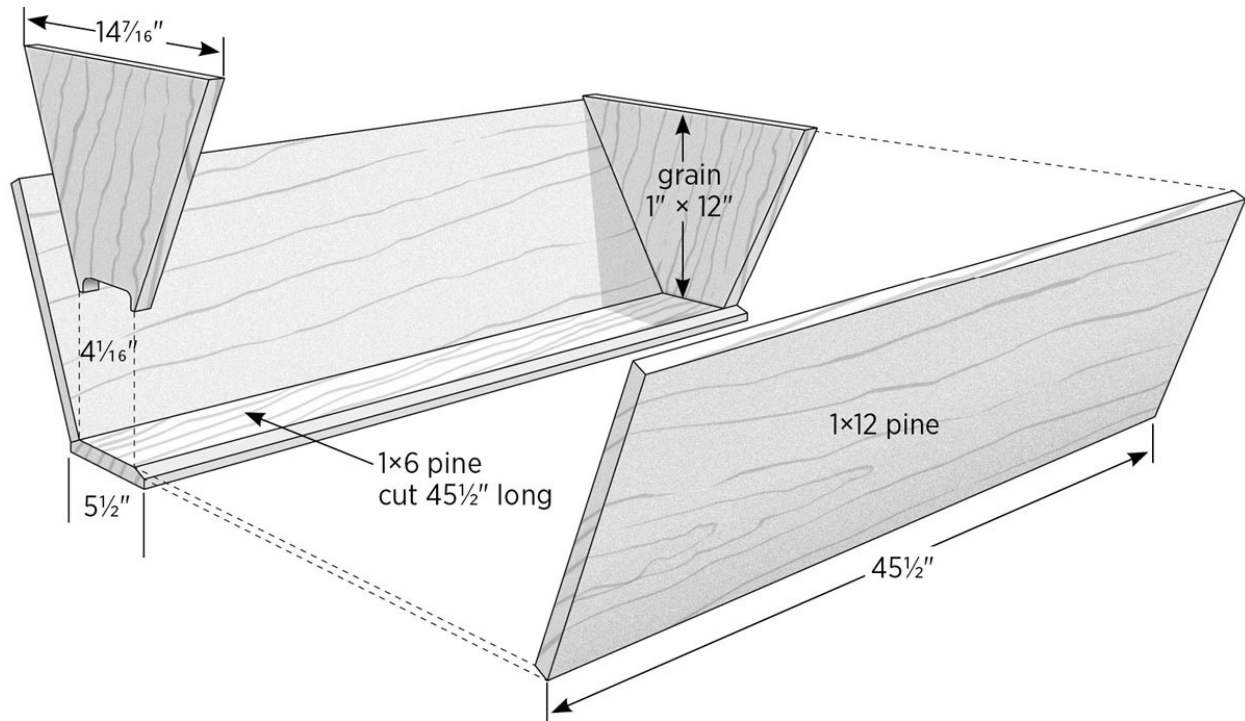
Forty-four 1 $\frac{1}{4}$ " deck screws

One 4" x 48" (minimum) piece of flashing

3d galvanized box nails

Preparing the Hive Body

In this first stage of the project, you will cut and prepare the main parts of the hive body; you'll assemble the body after making the top bars and roof. The body is built around a single bottom board, so be sure to start with a nice, straight piece of 1x6 for the bottom. One side of my hive has two viewing windows made of Plexiglas. These are optional and can be any size that works. I made mine with two scraps of Plexiglas about 5" wide x 12" long; both are about 9" from each end of the hive body. If you'd like to include a viewing window or two, step 4 will help you determine the size and location. You'll also need a door to cover the window(s), and this is outlined in step 5. The reason for the door is twofold: It provides insulation from the cold that the thin plastic can't provide, and it keeps the interior of the hive dark, which is normal for the bees.

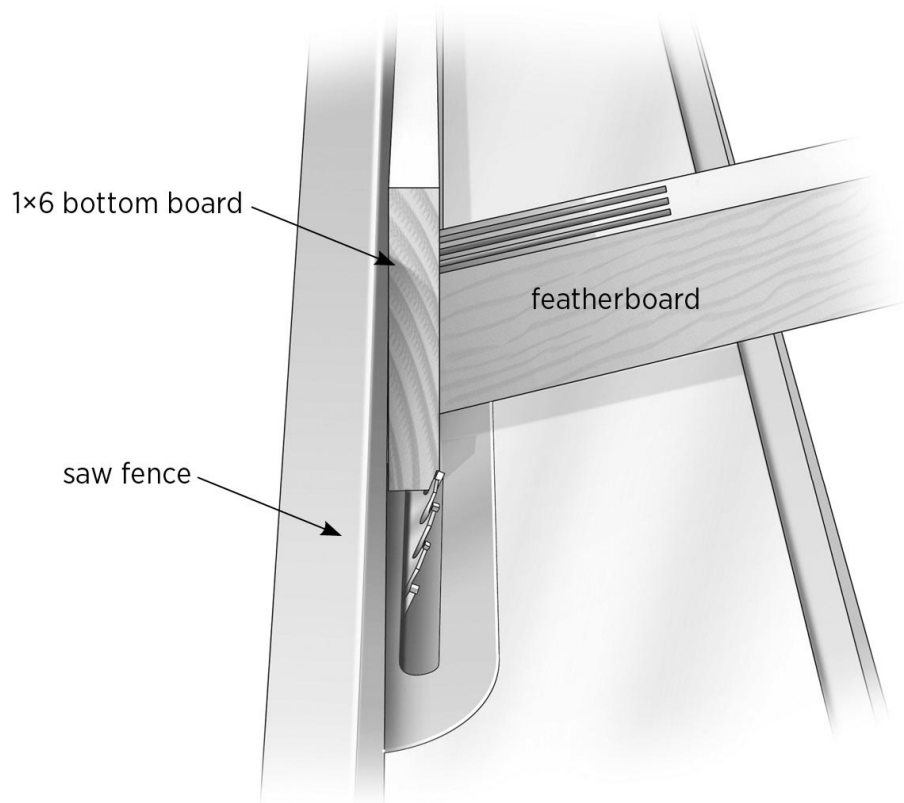


ABOVE: *Top-bar hive body — exploded view.*

1. Cut the bottom.

Cut a 4-foot 1×6 to length at 45 1/2". Tilt the table saw blade at 25 degrees, and set up the saw to cut the 1×6 on-edge; use some scrap pieces to set the fence so that the beveled surface is 3/4" wide. Also be sure to use a featherboard or other method of holding the board firmly against the fence. Cut the angles along both long edges on the top face of the board, as show above.

Cutting the angles



ABOVE: *Using a featherboard to hold work against the fence while cutting a 25° angle (guards have been removed for clarity).*

2. Cut the ends.

The two end pieces are full-width 1x12s cut at 25 degrees on each end (cut one end from each 1x12 board). Lay out each piece by drawing a centerline across the width of the board (perpendicular to the length). Using the centerline to measure, mark the length of the bottom edge at $4\frac{1}{16}$ " and the length of the top edge at $14\frac{7}{16}$ ", as shown in Top-Bar Hive Body — Expanded View, on previous page. Cut along the lines with a circular saw or handsaw.

Work tip: If the angles are off slightly, don't worry. The bees will fix our little mistakes with propolis. Set the end pieces on the bottom, and if the flats match up they should work. Being too narrow is better than too wide because you can trim a little off the bottom edge to make the board wider at that point. Don't fret about the height, because it's going to stick up above the sides anyway.

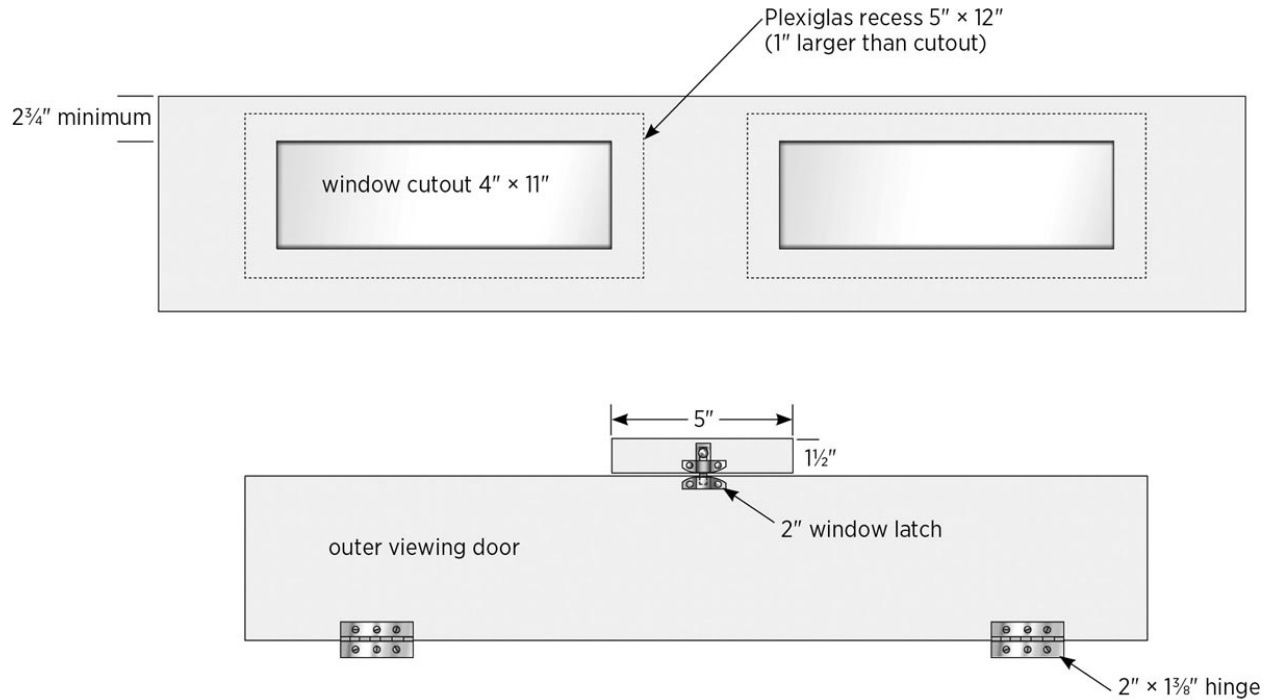
3. Cut the sides.

Cut the two remaining pieces of 1×12 to length at 45 1/2". If you aren't going to include a viewing window, the sides are done.

4. Make the window cutouts.

Determine the size and location of the windows: Each window cutout should be about 1" smaller than the length and width of your Plexiglas. The top of the cutout should be at least 2 3/4" from the top edge of the side board. Keep in mind that the door will overlap the windows all around, and the top of the door should be about 2" below the top of the side, to allow access to the latch when the roof is on.

Use a combination square to measure and mark the cutouts. Drill a 1/2" hole inside each marked outline for inserting a jigsaw blade to start the cut. (I drilled holes in all four corners, making sure to stay within the lines; this makes it easier to turn the corners.) Cut out the window openings with the jigsaw. Clean up the inside edges with sandpaper and round over the outside edges of the cutouts with sandpaper or a router and roundover bit.



ABOVE: *Window and door diagrams.*

5. Install the window glazing.

Place the side board that has the windows facedown on your work surface; the glazing will be on the inside of the hive. Center a piece of Plexiglas over each window opening and trace around the glazing onto the wood. Using a flat-bottom bit in a router, set the bit depth equal to the thickness of the Plexiglas. Clamp some scrap pieces on your board to act as guides for the router, and cut the recess for the glazing, staying inside of the traced outlines.

To mount the Plexiglas, drill $\frac{1}{16}$ " holes in it around the outside edges and fasten the glazing with $\frac{5}{8}$ " wire nails. (I used three nails on the short sides and four on the long sides of each window.) If you use different fasteners, make sure the pilot holes are slightly larger than the fastener's shank; if the holes are too small, the plastic will crack.

6. Create the door.

Cut a piece of pine about 1 1/2" to 2" wider and taller than the outsides of the window openings; one door will cover both windows (I used a piece of scrap wood that was 6 1/2" wide and 30" long).

Lay the board on a flat surface with the "out" side facing up and the bottom edge facing you. Set the hinges so that one side is against the edge of the board and the other is flat on the table, and mark the hinge screw holes. Drill pilot holes and mount the hinges. I mounted mine about 2" from each end.

Center the door over the window openings so the hinges are at the bottom (the door swings down), and mount it to the hive side. Cut a block of scrap wood to size at about 1 1/2" x 5". Glue and screw the block above the center of the door, then mount the window latch to the block so the latch barrel extends down over the door to hold it closed.

Making a Follower Board

Some beekeepers like to use a follower board. This is simply a solid board that replaces one frame to make the space the bees occupy smaller. Some keepers think this encourages the bees to build comb better and makes it easier for a small cluster of bees to heat. Others say a follower board is not needed. I did make and use one on my first top-bar hive, and it seemed to work well. Here's how to do it:

- 1.** Hold a piece of 1/4" lauan plywood over the end of the hive and trace around the hive (plywood is just what I

had on hand, but anything will work, even a cut section of a political sign).

- 2.** Remove the plywood and draw lines inside the traced outline, staying $1\frac{1}{8}$ " inside the existing lines on the sides and bottom. This will provide a $\frac{3}{8}$ " gap that will discourage the bees from propolizing it to the sides of the hive, and also let the bees pass through if you decided to place a feeder on the inside.
- 3.** Cut out the follower board along the inner set of lines. Glue and nail the board to a 15"-long strip of $\frac{3}{4}$ " x 1" pine.
- 4.** Replace one of the frames with the follower board to create the size space you want. As the bees build comb, move the board toward the back of the hive.

Making the Top Bars

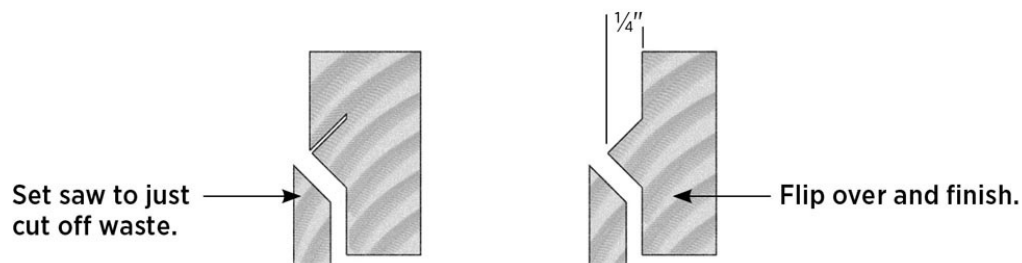
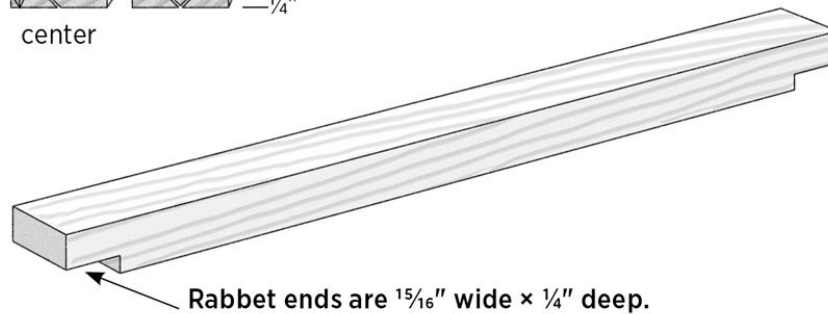
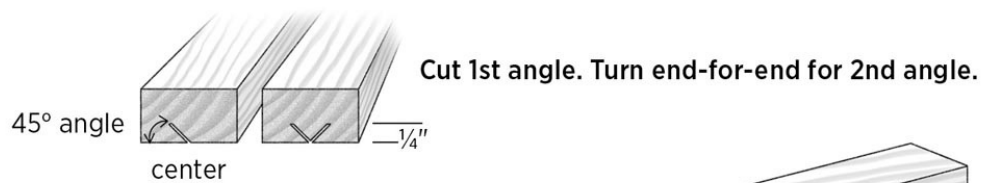
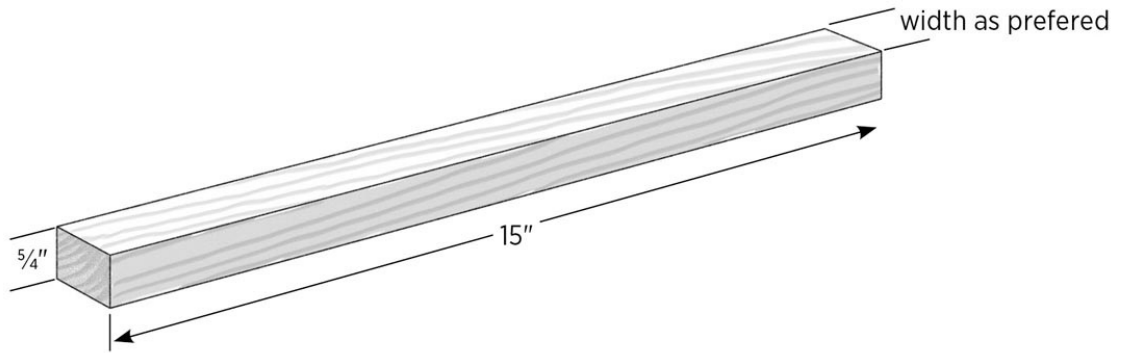
There are many different ways to make top bars. Some beekeepers cut strips of wood with a slot down the middle and attach a strip of foundation, or glue in pieces of Popsicle stick. Others leave a small ridge down the middle and prime it with some beeswax. In the past I've made two-piece frames with a triangular-shaped ridge nailed on, a method I found on Michael Bush's website (a great source of information for all aspects of beekeeping; see Resources).

However, I took this style one step further and made the frames one-piece. I like this because I know from experience that the bees readily take to these frames and mostly build comb where you want

them to. A one-piece design also ensures that the starting edge is centered on the frames.

For this top-bar hive, I made 24 bars at $1\frac{1}{4}$ " wide for brood and 10 bars at $1\frac{3}{8}$ " wide for honey. You can make them all $1\frac{1}{4}$ " if you like. I've also heard of using $1\frac{1}{2}$ "-wide bars for honey frames.

Do some research and decide how you want to make yours. Whatever sizes you go with, make enough to fill the 44" inside space along with some scrap for setting up. The method described here yields four $1\frac{1}{4}$ "-wide strips from a $5\frac{5}{4}\times 6$, and five $1\frac{3}{8}$ "-wide strips from a $5\frac{5}{4}\times 8$.



ABOVE: *Top bar dimensions.*

1. Cut the top bar strips to length.

Cut the 8-foot $\frac{5}{4} \times 6$ into six pieces at 15" long. Set the saw fence to $1\frac{1}{4}$ " and rip a total of 24 strips. Also cut a few extra pieces from scrap material for setup.

Cut the 3-foot $5/4 \times 8$ into two pieces at 15" long and rip 10 strips to $1\ 3/8$ " wide. Again, cut a few extra pieces from scrap material for setup.

2. Cut the triangle slots.

Tilt the table saw blade at 45 degrees and set the blade height so the highest point on the blade is $1/4$ " high (measuring straight up from the table). Mark the center on the end of one of the strips (or use a scrap piece of the same dimensions). Adjust the fence and make some test cuts so the blade just leaves the center mark. It's easier to have the fence a little too far away at first and adjust it closer, taking cuts until it is set right.

Once the fence is set, make the angled cut from both ends of the strip, forming a triangular ridge on the bottom face. The point of the triangle should be even with the surface of the board. If it's lower, your fence is a little too close; if there's a small flat, rather than a sharp edge, on the triangle, the fence is a bit too far away, which is okay. Run all of your strips through the saw from both ends to cut the triangles.

Note: If you make two different-width strips, you will have to set up and run each one separately. The only difference will be the fence being farther away for wider strips.

3. Rabbet the strip ends.

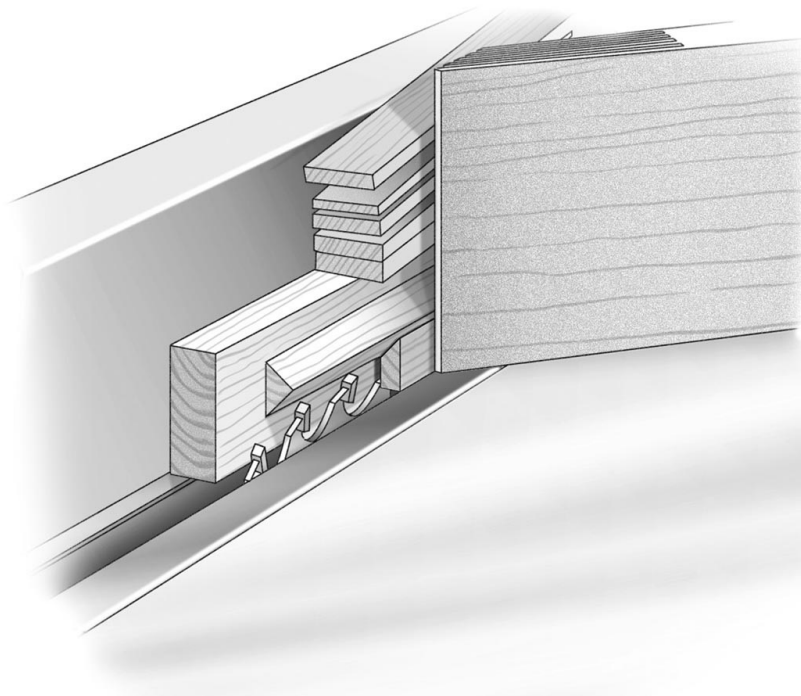
Square up the saw blade and set its height at $1/4$ ". Set the fence at $15/16$ ". Cut a $1/4$ "-deep \times $15/16$ "-wide rabbet on both ends of each strip.

4. Trim the strip sides.

Set the fence to $\frac{1}{2}$ " and set the blade height at $\frac{3}{8}$ ". Set up one featherboard clamped to the fence to apply downward pressure on the work as it passes through the blade. Mount a second featherboard on the table to push the work against the fence. This allows you to feed the parts through the saw safely. Run the strips through on-edge to remove the material to both sides of the triangular center, as shown.

Note: If you have top bars of more than one width, cut the narrow ones first, then raise the blade to cut the wider ones. You'll have to raise the featherboard to accommodate the wider top bar, but the fence remains in the same position.

Featherboard setup on table saw



ABOVE: *Make the final cuts using a featherboard to hold your work in place.*

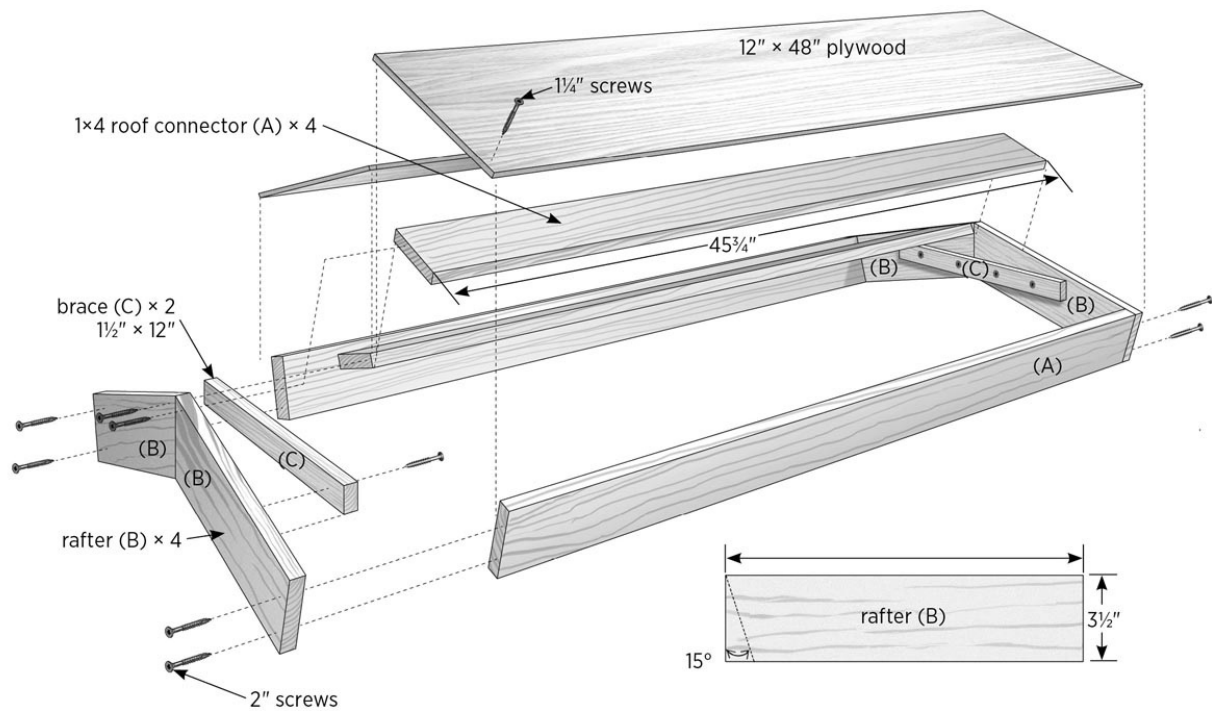
Constructing the Roof

You can find all sorts of roof designs for your top-bar hive. The simplest is a flat piece of exterior plywood big enough to overhang the sides, with strips nailed around the edge and a few in the middle to hold it off the top bars (to create an air space). This keeps the hive from getting direct sun on top.

You could also make a similar frame with the plywood, and attach a curved piece of flashing for the top, giving the flashing just enough curve so you can nail it to the sides without kinking.

The roof we're going to build here calls for more material than some simpler designs. It's on the fancy side, but the process is quite simple. Don't be afraid to gather a few ideas and change or combine them to make your own design. That's half the fun of building this stuff.

This roof is heavy enough that it might not need to be held on by any means other than its weight. To fancy it up, you could add strips of wood for decoration or even use cedar shingles. Use your imagination.



ABOVE: *Parts for roof with 15-degree pitch.*

1. Cut the roof connectors.

Double-check the length of your hive sides; they should be $45\frac{1}{2}$ " long. The roof frame will overhang the ends. Set up a stop and cut four pieces of 1x4 to length at $45\frac{3}{4}$ "; these are the roof connectors. Set them aside for now.

2. Cut the rafters and braces.

Cut a 15-degree angle on both ends of a 1x4, then cut off each at 11" from the longest point. Repeat the same process so you have four rafters total. Cut a piece from the remaining 1x4 at 12". Rip this into two $1\frac{1}{2}$ "-wide strips for the peak braces.

3. Assemble the rafter pairs.

Set the two pairs of rafters on a flat surface with their angles together to form peaks. Mark the center of the peak braces, spread glue on one side face, then lay them across the rafter joints as shown in Roof with 15-Degree Pitch, on facing page (the braces face inside the hive in the finished roof).

Use the head of a combination square to position each brace perpendicular to the rafter joint. The bottom of the brace should be flush with the point where the bottom edges of the rafters come together. Fasten each brace to the rafters with four 1¹/₄" deck screws.

Note: It's important that the two assemblies are identical because the braces will rest on the ends of the hive when the roof is in place, and it might not sit right if the assemblies don't match.

4. Complete the roof frame.

Drill two pilot holes through the outside faces (opposite the braces) of each rafter end, spacing them 2¹/₂" apart as shown in Roof with 15-Degree Pitch, on facing page. Drill two more holes near the tops of the rafters, on each side of the peak.

Apply glue to one end of each of the four roof connectors (cut in step 1) and fasten them to one rafter assembly with eight 2" deck screws. Flip the whole thing over and install the other rafter pair the same way (I found it easiest to start all of the screws in the rafters and stand up the connectors on the floor for fastening).

5. Add the plywood roof panels.

Cut two pieces of exterior plywood to size at 12" x 48". Draw two guidelines for screws along the length of each panel, 1 1/4" down from the top and 1" up from the bottom. Set one panel on one side of the roof frame, overhanging each end of the frame equally (the panel edge should be at the peak of the roof). Starting from the center, drill pilot holes and drive 1 1/4" deck screws in the top and bottom of the panel and into the 1x4 roof connectors, working your way back and forth about every 6" toward the ends. This will take any bow out of the plywood (you can also clamp the plywood down on the ends while you work). Drive four screws on each end. Repeat with the second piece of plywood on the other side of the roof.

6. Construct the ridge.

You can use metal flashing for the ridge or create a glued-up ridge cap using two pine boards. Another option is simply to fill the joint between the roof panels with exterior silicone caulk. To use flashing, cut a piece of flashing at 48" long and at least 4" wide, to cover the peak. Fasten the flashing with 3d galvanized box nails, bending over the nails on the underside of the roof panels.

Assembling the Hive Body

So let's get that hive body assembled. The first part — attaching the sides and ends — is easier with a helper. Once the body is complete, you simply set the roof on the body to complete the project. You might want to try using a follower board with your hive, so I've included instructions for that (see Making a Follower Board, on **page 143**).

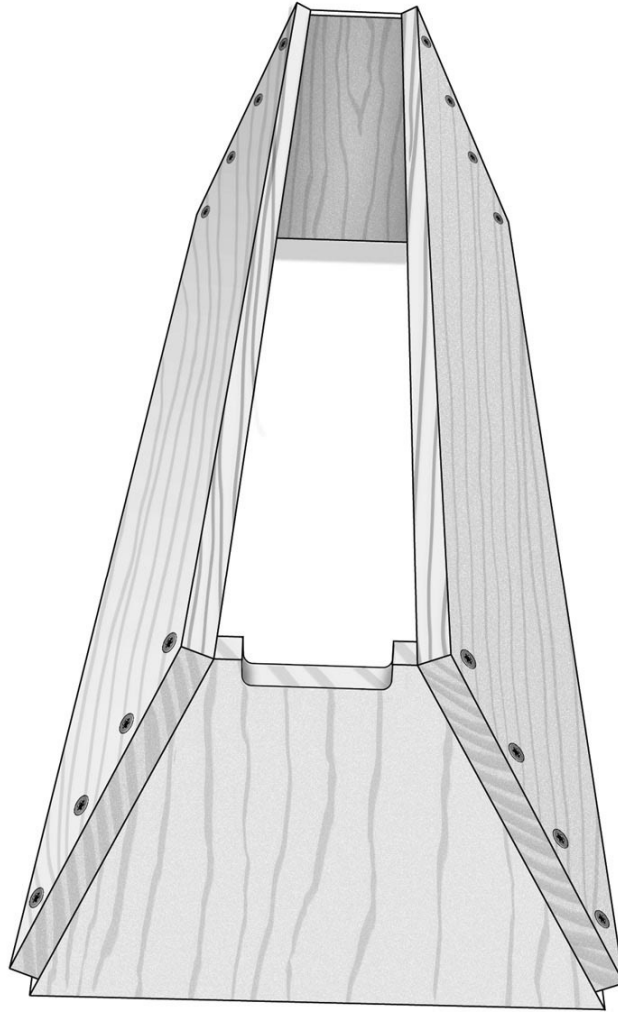
When it came to making a stand for my hive, I thought about building a cradle-type stand, like a sawbuck. But Doone's Double-Hive Stand (**page 65**) is the perfect height (and it's inexpensive), so why

try to reinvent the wheel? Instead, I cut two pieces of 2×4 to length at 19" and set them 34" apart on the crosspieces of the double-hive stand. Then I set the hive on top and drove two 1 3/4" screws into each 2×4 from inside the hive. This makes the hive steady, and you can shim up the 2×4s if needed to get the hive level.

If you don't have any bees ordered, consider setting up the hive outside and putting a vial of swarm lure inside. You just might be surprised one day to look out and see bees buzzing in and out of your new top-bar hive.

1. Assemble the sides and ends.

Drill pilot holes 3/8" from the ends of both side pieces at 1 1/4", 4 1/4", 7 1/4", 10" down from the top edge. Apply glue along one angled side of one end piece, and line up its bottom edge with the bottom edge of the side as shown, making sure the edges line up so the bottom will fit properly. Note that the end will be higher than the sides. Fasten through the side and into the end with four 2" deck screws. Repeat with the other side piece, then add the other end piece in the same way.



ABOVE: *It's easier to assemble with the sides and ends upside down.*

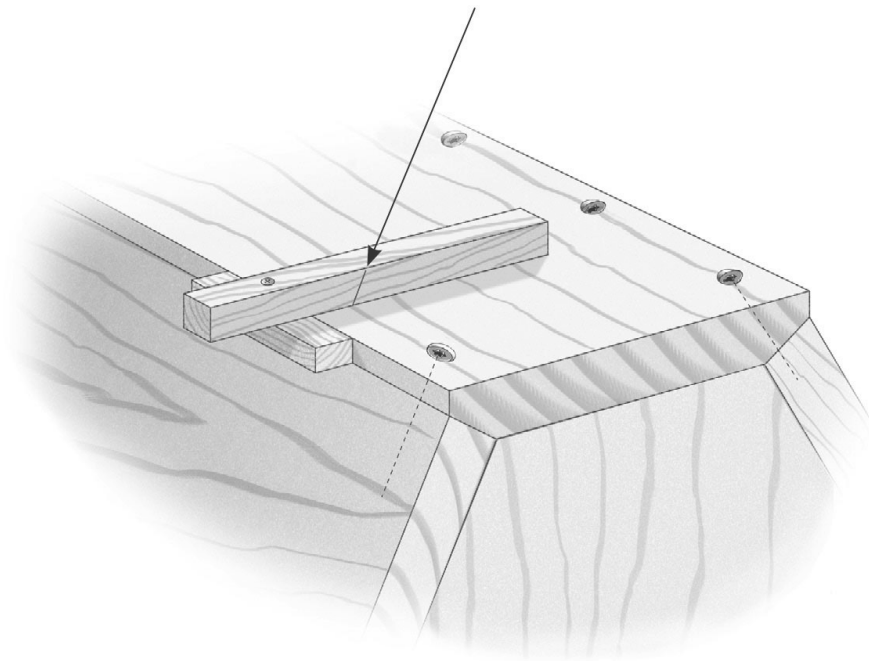
2. Install the bottom.

Check the bottom for fit. The bottom is fastened with screws (you can add glue if desired, but I just used screws), and they must go in at an angle. Make the little jig shown by screwing together two scraps of $\frac{3}{4}$ " material at a 90-degree angle. Place the jig on the hive bottom, set your protractor to 25 degrees, line it up with the center of the

side's bottom edge, and draw a line on the jig. Use the line as a guide for driving 1 3/4" screws about every 6".

Turn the hive right-side up, add the top bars, then the roof, and your hive is complete.

Use a mark to drill holes and drive screws. Hold the jig on end of the hive; draw a line to match the center of the side.

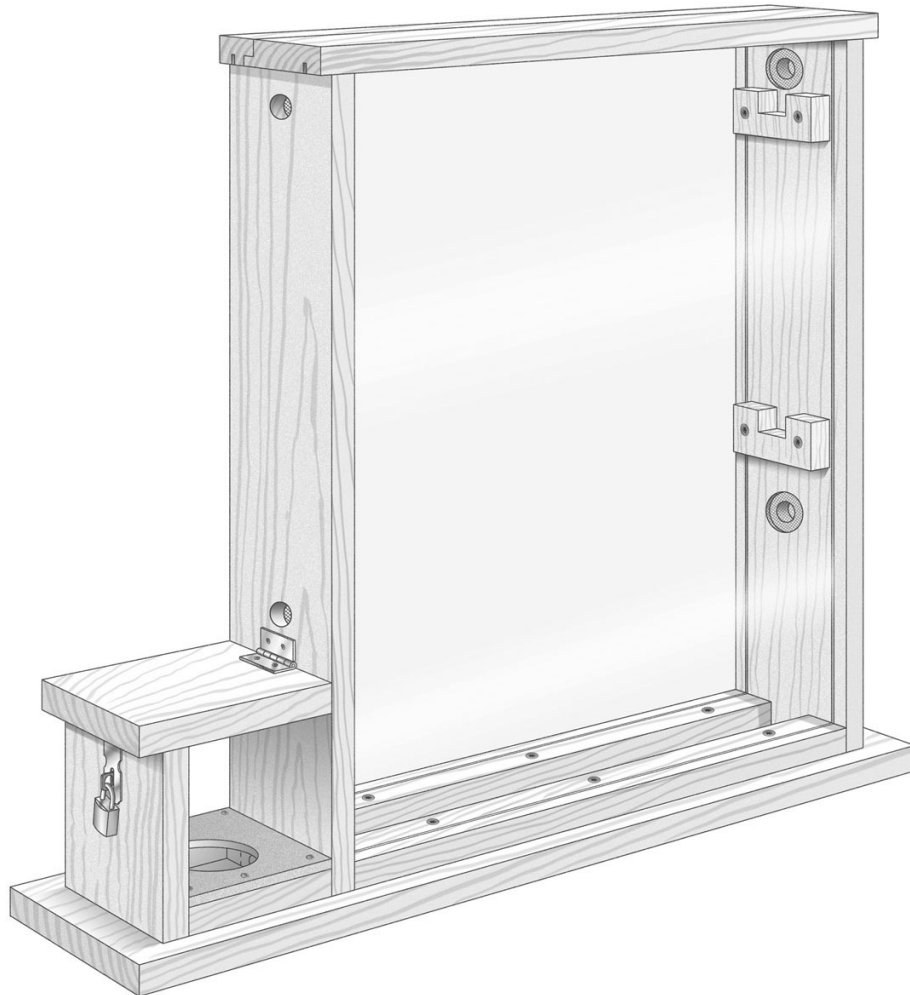


ABOVE: *Jig for locating screws at 25° angle.*

Beekeeping advice: If you want extra security from wind, install a few eye hooks on the peaks and ends of the hive and use bungee cords to hold down the roof.

PROJECT

Demonstration Hive



Even people who are normally afraid of bees seem to be attracted to a demo hive, and it's a great opportunity to let them get close to honey bees without the fear of being stung. It also gives you a chance to educate them about the value of honey bees and the role they play in our food chain. Many of my best beekeeping memories are of my

annual visits to the first-grade class in one of our local schools. After a few weeks of hearing stories, studying, and keeping a journal about honey bees, the kids finally get to see them in person, and their excitement is contagious.

This demonstration hive doesn't necessarily follow the rules of bee space. It's made for pulling a couple of frames from a regular working hive, bringing them to an event, then returning them to their original hive on the same or next day. (See color photo on [page 158](#).)

Tools

Table saw

Drill and bits:

- Combination drill/countersink bit
 - 1/2", 5/8", and 3/4" drill bits (preferably brad-point)
 - 1 1/2" Forstner bit (optional)
-

Sandpaper

Router with roundover bit (optional)

Compass

Jigsaw

Combination square

Materials

One 6-foot 1×6

One 6-foot 1×5

One 4-foot 1×4

Two pieces 1/8"-thick Plexiglas, 20" × 21 3/16" minimum

#8 hardware cloth (1/8" mesh) or metal window screen, 6" × 6" minimum

Sixteen 1 1/4" deck screws

Fourteen 1 3/4" deck screws

Twenty-four 1/2" or 5/8" wire nails

Waterproof glue

Wood finishing materials (see **page 15**)

Additional Materials for Optional Feeder

1/4" lauan plywood, 4 1/2" × 8" minimum

One jelly or canning jar

Eleven 3d nails

1 3/4" deck screws

1 1/4" deck screws

One 1 1/2" × 1" hinge with screws

One 3/4" × 2 1/4" hasp latch with screws

One small padlock

Design Considerations

This hive was designed with a few critical goals in mind: Getting the frames in and out of it must be fairly easy, it must offer a good view of the bees, and the bees and their viewers must be fully protected from one another; that means no bees can escape, and if someone pushes on the Plexiglas sides, it won't squish the bees.

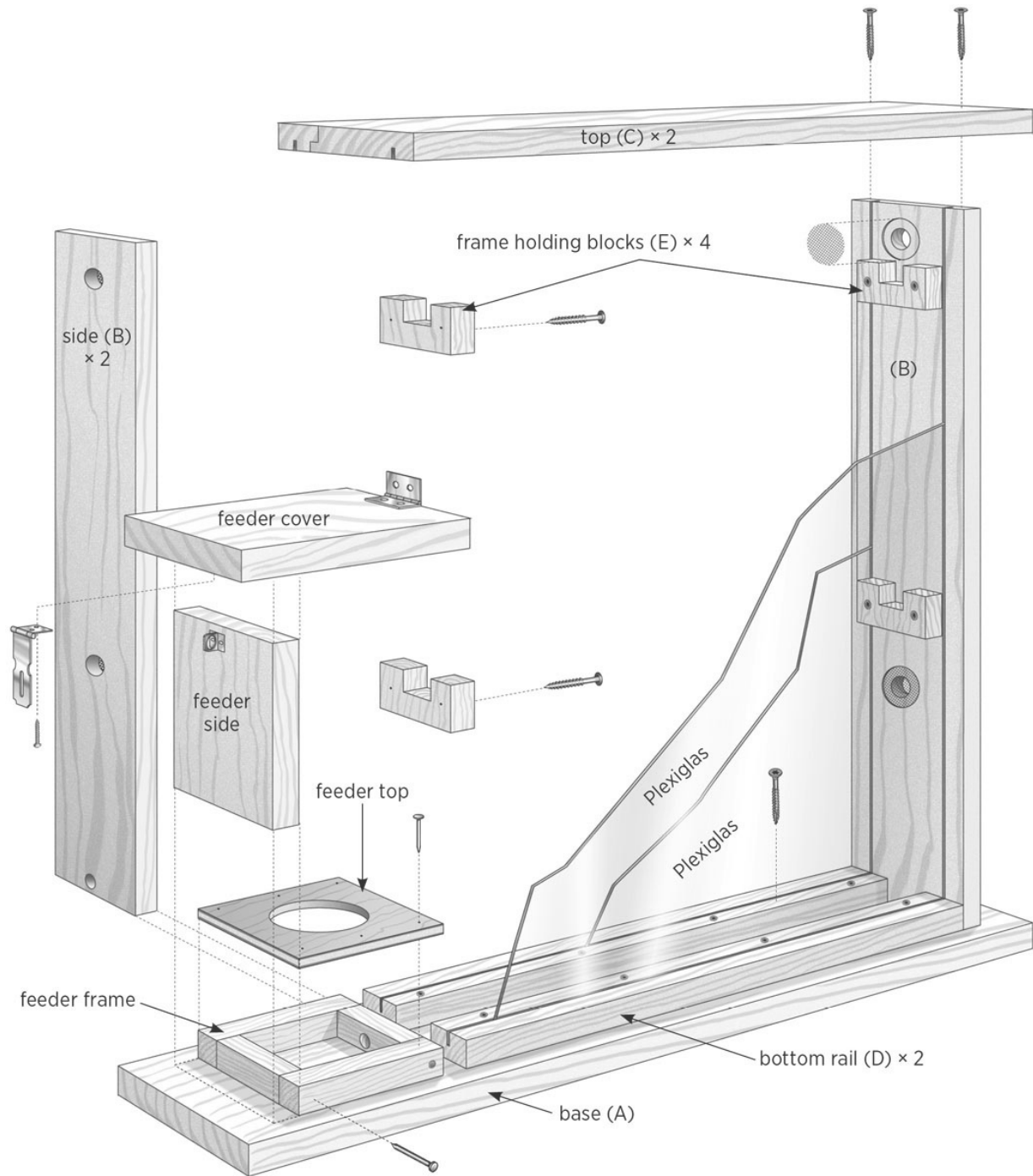
I recommend using hardwood for the project, if available. It can better withstand the inevitable bumps that will occur during transport, it will be stronger overall, and it will look nicer. I used ash for my last hive. If you do choose hardwood, be aware that you definitely need to drill pilot holes for all screws and nails to prevent splitting, and to countersink the screw heads.

The project as shown includes a small feeder, which is optional, and the top is made with two pieces connected with a half-lap joint. One piece can be removed regularly for putting the frames in and out, and the other can be removed as needed for cleaning or replacing the Plexiglas. The feeder must be attached so that the jar can't be removed during a presentation and allow bees to escape. The whole hive must be stable so it can't tip easily. People will be getting up close, so be sure to finish the wood with a varnish or paint to make it easy to keep it clean. The hive holds two deep or medium frames, or a combination of the two.

Cutting and Grooving the Wood Parts

Remember to use good, solid straight boards for the best results. Once the main lumber pieces are cut, we'll cut grooves into the side, top, and rail pieces for holding the Plexiglas panels. By design, one piece of Plexiglas is removed every time you put frames in the hive or

take them out. I feel this is the best way to ensure the bees won't find a way out.



ABOVE: *Demonstration hive parts.*

1. Cut the wood parts to length.

Cut a 1×6 to length at 28" for the base (A). Cut another piece of 1×6 at 21⁷/₈" for the top (C). Cut two pieces of 1×5 to length at 21¹/₄" for the sides (B). Finally, cut a 1×4 to length at 19³/₈" for the bottom rails (D); this will be made into two pieces.

Beekeeping advice: A friend purchased a demo hive that had a hinged door, and due to some warping and poor-quality workmanship, he had to put tape around the edge of the door to keep the bees in. With our design, your bees and people are safe and sound.

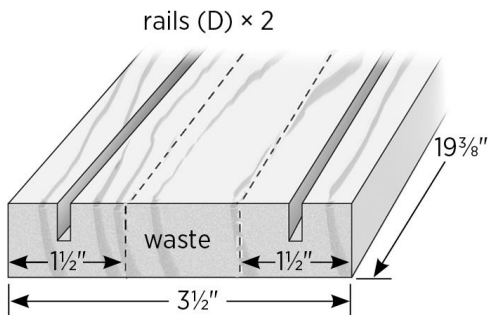
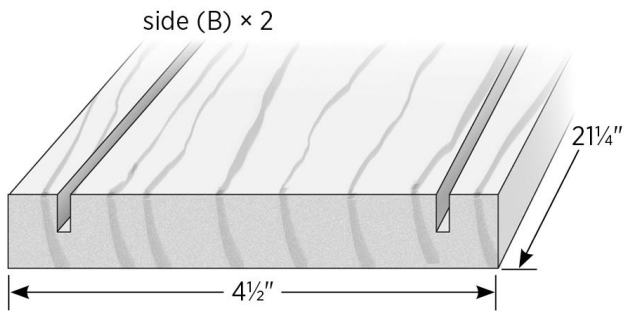
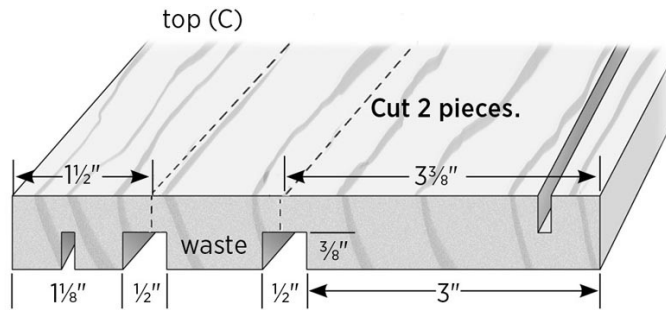
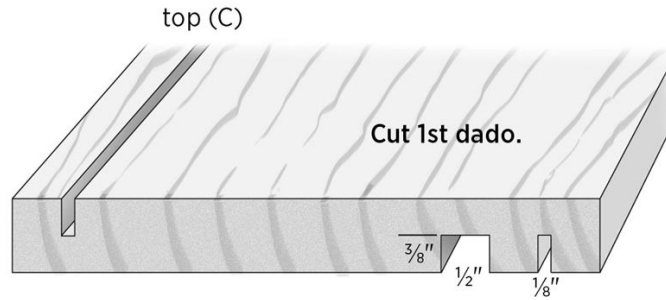
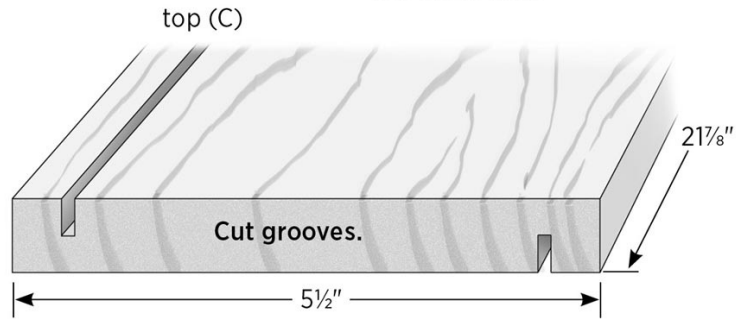
2. Cut the Plexiglas grooves.

All of the grooves are ¹/₂" from the edges of the boards and ³/₈" deep. Set the table saw blade height at ³/₈" and set the fence at ¹/₂". Make a test cut in a piece of scrap and fine-tune the setup as needed. Also test-fit the Plexiglas in the groove: It's okay if the fit is a little loose; if it's a little tight, make the initial cuts in all of the pieces, then move the fence slightly to widen the groove.

Cut two grooves in each side piece (B) and two in the piece that will become the bottom rails (D), as shown. In the top piece (C), cut a groove in one face, then flip the board over and cut another groove in the other face, near the opposite edge.

Cutting grooves for plexiglas

Top piece cuts



ABOVE: *Note: All grooves for Plexiglas are $\frac{1}{2}$ " from edge of boards and $\frac{3}{8}$ " deep.*

3. Complete the top pieces.

Set the saw fence at $1\frac{1}{8}$ ". With the groove nearest the fence facing down, cut a $\frac{1}{2}$ "-wide \times $\frac{3}{8}$ "-deep dado, as shown in Cutting Grooves for Plexiglas. Turn the board around so the groove closest to the fence is facing up. Set the fence at 3". Cut another dado at $\frac{1}{2}$ " wide \times $\frac{3}{8}$ " deep.

Reset the saw blade and fence and rip the wide side of the top piece to $3\frac{3}{8}$ ". Rip the narrow side to $1\frac{1}{2}$ ". Each should now have a $\frac{3}{8}$ "-wide rabbet. When the rabbets are overlapped, the two-piece top will be the same width as the sides. The grooves for the Plexiglas will be on the bottom and line up with the grooves on the sides.

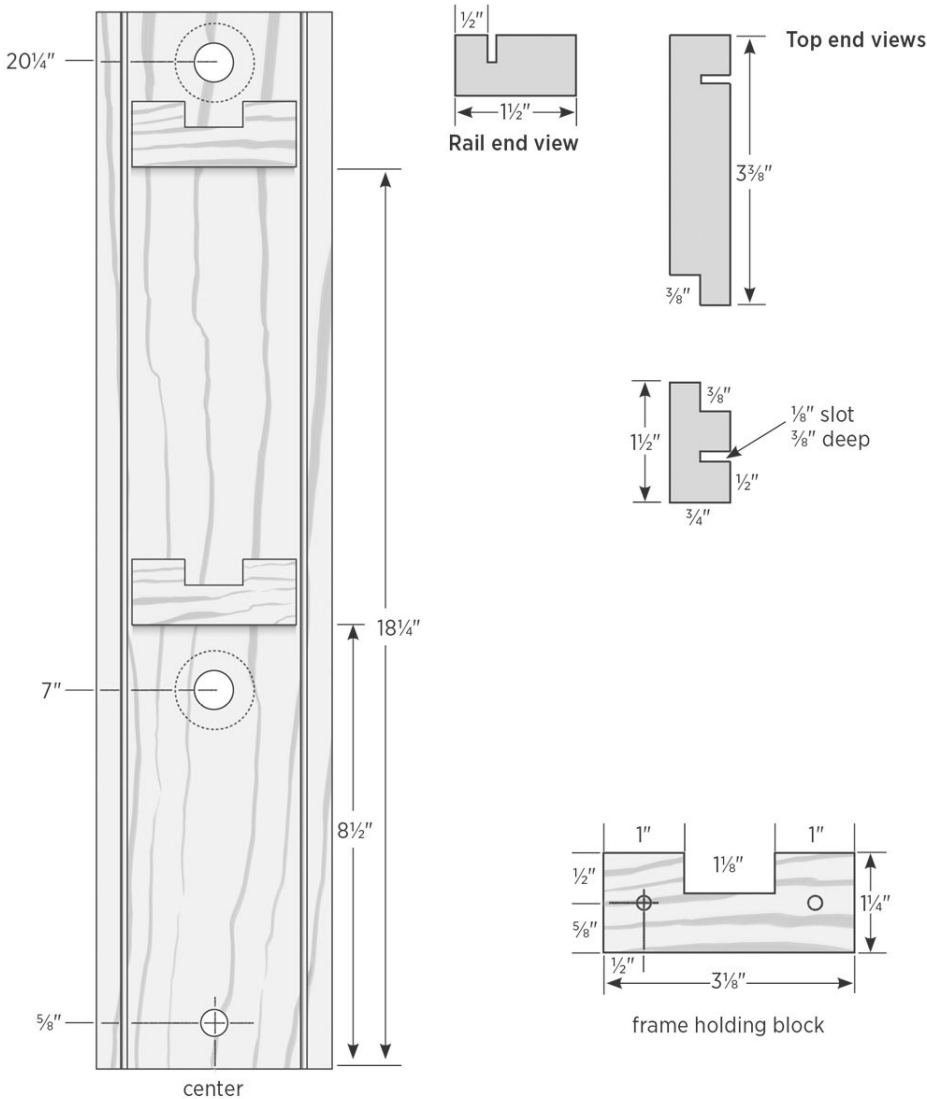
4. Prepare the bottom rails.

With the saw fence still set at $1\frac{1}{2}$ ", rip the 1×4 with the two grooves into two strips to create the two bottom rails (D). Drill one countersink pilot hole 3" from each end, and one hole in the center, centering these holes in the $\frac{7}{8}$ "-wide solid section of each strip.

5. Cut the frame holding blocks.

From the remaining piece of 1×4 , cut two strips at $1\frac{1}{4}$ " wide. Set the saw fence at 1" and the blade height at $\frac{1}{2}$ " (you can use a dado blade if you have one). Using a miter gauge, position the strips on-edge, and cut a dado in both ends of the strips, $\frac{1}{2}$ " deep \times $1\frac{1}{8}$ " wide. Cut two

blocks to length at 3 1/8" from each strip, for a total of four blocks. Drill two countersunk pilot holes in each block as shown.



ABOVE: *Demonstration hive details.*

Making the Ventilation Holes

The hive needs holes in the sides for ventilation and one hole for the bees to access the feeder, as well as a couple of vent holes in the top.

Ventilation is always a tricky thing to judge, but bees know how to regulate the temperature. Too much cold air, and the brood will be chilled. Too much heat, and the bees won't be able to handle it. If you will be showing your bees in a very warm place, you can add more vent holes. It's easy enough to block them off if necessary.

I covered my vent holes with screening of #8 ($\frac{1}{8}$ ") galvanized hardware cloth (the same stuff used on the Screened Bottom Board, on **page 22**). I used a $1\frac{1}{2}$ " Forstner bit to bore a recess for the screens so they look a little better. This is an optional step; the screens will be on the inside. Here's how I did mine:

1. Drill the ventilation holes.

Make marks on the grooved side of each side piece (B) at 7" and $20\frac{1}{4}$ " from one end and centered side-to-side. Mark the wider top board 6" from each end and $1\frac{3}{4}$ " from the edge on the grooved side. You should have a total of six holes marked. Use a nail or screw tip to make an indentation on each mark. This will keep your drill bit from walking off the mark as you start the hole.

Note: If you want to cut a counterbore for the screens with a Forstner bit, do that before drilling the vent holes. A depth of $\frac{1}{16}$ " is plenty.

Drill a $\frac{3}{4}$ " hole through the board at each marked location. To prevent tearout (splintering) as the bit exits the wood, drill only until the tip of the bit breaks through the other side, then turn the board around and finish the hole from the other side. Clean up the edges of the holes with sandpaper or a router and roundover bit.

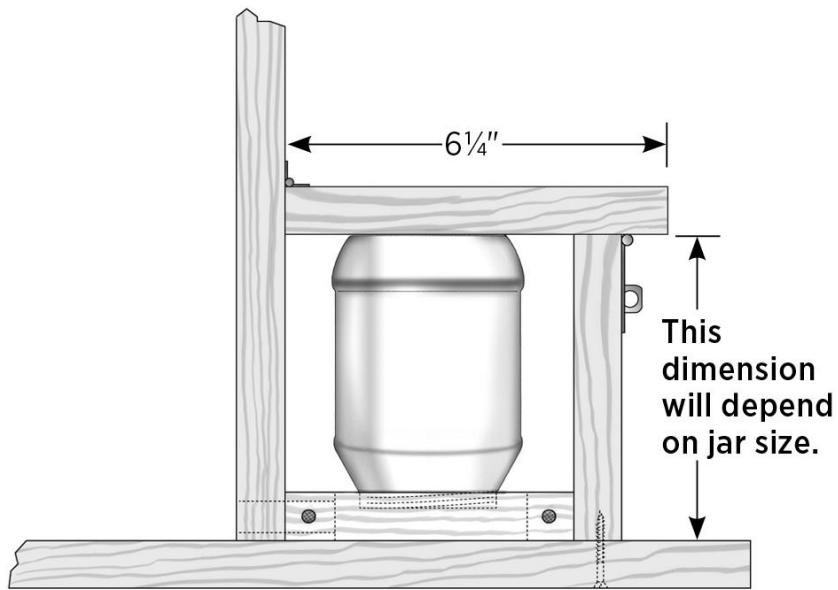
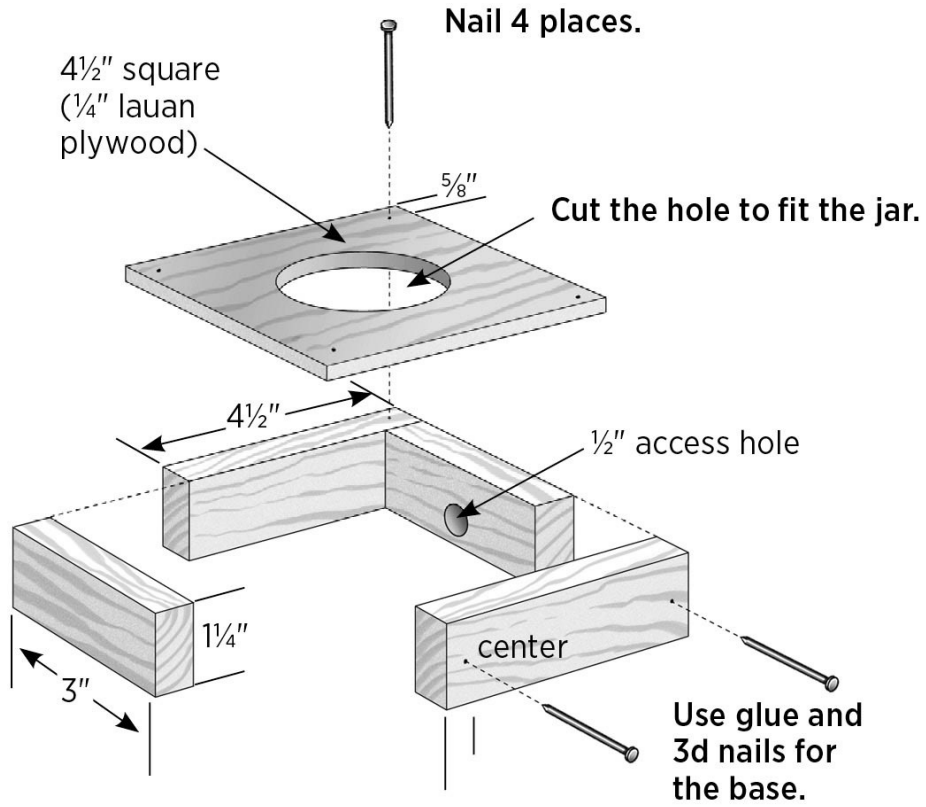
2. Make the screens.

Cut out a cardboard circle that's a little smaller in diameter than the Forstner bit, if you used one, or about 1 1/2". Place the circle on the screen material and trace around the cardboard with a permanent marker; draw six circles total, then cut them out with tin snips. Set the screens in the recesses or over the holes and use four 1/2" or 5/8" wire nails to fasten them in place, being sure the nail heads secure the wires on the screen.

Adding a Feeder

As mentioned earlier, the feeder is optional. I didn't put one on my first demonstration hive, and I gave many talks to school and civic groups. I always made sure there was some honey in the frames I put in, and gave the bees water through the screens. I often used a full frame of honey kept in the freezer as a top frame. If you do this, be sure to thaw it out a day ahead of time.

The bees were always put back in their hive on the same day or early the next morning. The size of your feeder will depend on what you are using for a container. I used a mason-type jelly jar. It holds 1/2 pint, or 1 cup. I made my initial feeder like the entrance feeder on **page 79**, minus the step, but I realized you could also use plywood for the top instead of sheet metal. The choice is yours.



ABOVE: *Demonstration hive feeder.*

1. Build the feeder frame.

Using the leftover $1\frac{1}{4}$ "-wide strips from making the frame holding blocks, cut two pieces to length at 3" and two pieces at $4\frac{1}{2}$ ". Use glue and 3d nails to create a frame measuring $4\frac{1}{2}$ " square, as shown.

2. Drill a feeder access hole.

You need only one hole in one of the sides (B) for the bees to access the feeder. Drill a $\frac{1}{2}$ " hole centered $\frac{5}{8}$ " from the bottom edge of the side piece. A Forstner or brad-point bit works best.

3. Cut the feeder top.

Cut a strip of $\frac{1}{4}$ " lauan plywood to size at $4\frac{1}{2}$ " wide and long enough to clamp it while you cut out a hole for the jar. Mark a mark $2\frac{1}{4}$ " from one end and centered width-wise, then draw a $2\frac{13}{16}$ "-diameter circle centered on the mark, using a compass.

Note: This diameter was for the jar I used. Yours may be different. Cut according to the jar you have.

Drill a $\frac{1}{2}$ " starter hole inside the circle, then cut out the hole with a jigsaw (clamp the strip for safety when drilling and cutting). Test-fit the jar, making sure it fits snugly enough so that the jar can't be pushed down through the hole; it must prevent the bees from getting out. Sand the edges of the hole smooth, then cut the strip to length at $4\frac{1}{2}$ " so the hole is centered on the finished square.

4. Assemble the feeder.

Drill a $\frac{5}{8}$ " hole centered horizontally in one of the 3" pieces of your feeder frame. This should align with the feeder access hole you just

drilled through the hive side piece. Using glue and four 3d nails, attach the feeder top to the frame so all sides are flush.

Place your feeder jar in the top and measure the overall height. Cut a piece of 1×5 to this dimension, then cut another piece of 1×5 to length at 6¹/₄"; these will become the hinged lid and side piece that hold the feeder jar in place.

Assembling the Hive

Much of the hive assembly is done with the hive lying down. The flat cast-iron table of a table saw makes a great work surface and offers the bonus of using the fence for a backstop. I unplugged my saw, lowered the blade, and set the fence about 23" from the edge of the table.

1. Mount the frame blocks.

Lay the sides (B) on a bench with the grooves facing up. Measure up 8¹/₂" and 18¹/₄" and use the combination square to draw lines across the face of each board, perpendicular to and between the two Plexiglas grooves. Apply glue to the frame holding blocks (E). Position the blocks on the sides with their bottom edges on the lines and centered between the grooves, and fasten them with 1¹/₄" deck screws.

2. Begin the box assembly.

Set the two sides on-edge with the frame blocks touching in the center so the open ends of the frame blocks are facing you. Slide the bottom ends of the sides against the fence and spread them 19³/₈"

apart. Place one bottom rail (D) on-edge between the sides and against the saw fence. The Plexiglas grooves in all three pieces should be lined up. Set the other bottom rail on-edge between the sides and flush with the ends closest to you; for now, this will act as a spacer while you secure the top. Square up this box and add a pipe or bar clamp on each end to hold it together.

3. Install the wide top piece.

Drill two countersunk pilot holes into the 3^{3/8}"-wide top piece (C), 7/8" from each end and 1" and 2^{1/2}" from the edge that's not rabbeted. Place this top piece on-edge with the rabbet up and facing you, and center it in place against the sides. There should be 1/2" hanging over each side, and the groove for the Plexiglas should line up with the grooves in the sides. Drive one 1^{3/4}" deck screw at each end, through the top and into the side. Confirm that everything is square and flush, then drive the remaining two screws.

Work tip: Don't use glue to attach the top. It must be removable for inserting the Plexiglas.

4. Fasten the bottom rails.

Loosen the clamp near the top enough to slide out the temporary bottom rail "spacer." Stand the assembly upright, put the spacer in its proper position on the bottom, and reclamp the assembly. Check the box again for square and make sure the joints are flush, then screw through the sides and into the bottom rails with 1^{3/4}" screws.

5. Install the narrow top piece.

Line up the narrow top piece and drill two countersink pilot holes $\frac{7}{8}$ " from each end and $\frac{7}{8}$ " from the outside edge. Attach the piece with a $1\frac{3}{4}$ " screw at each end — again, don't use glue.

6. Check the fit.

Things should be looking pretty good right about now. Hopefully you have a lower and upper vent hole and a hole near the bottom of one side for feeder access, and your frame blocks are facing up. Now is a good time to take a couple of frames and be sure they drop into the grooves nicely. There should be plenty of room to get the frame in and out, and they should be secure once they are in place.

If all is well, and you just happen to have a router and a roundover bit, now is the time to make things look pretty.

Work tip: I don't recommend using a handheld router unless you have some experience. It takes quite a bit of practice to hold the router flat on the narrow edges, but it makes for very nice inside corners. If you don't have the experience, use a router table or simply sand the edges to round them over. I went around the insides of the box, and around the top surfaces of the top and base. I also did the sides of the feeder holder parts, except where they would be attached to the side and base.

7. Attach the box to the base.

With a combination square set to 1", draw a light line on one end of the base. Run a narrow bead of glue down the center on the bottom of the bottom rails; you don't want so much that it will squeeze out. Set the finished box on the base (A), positioning the side that *does not* have the feeder access hole on the line, and centering the whole thing side-to-side. Clamp the base in place and screw through the mounting holes in the bottom rails and into the base with 1¹/₄" screws.

Installing the Feeder

Refer to Demonstration Hive Feeder, on **page 154**, for positioning the feeder and the two pieces that hold it in place.

1. Install the feeder frame with top.

Place the feeder on the base, against the side, and line up the access holes. Lightly clamp the feeder in place, drill pilot holes up through the base and into the feeder frame, and fasten the parts with 1¹/₄" screws.

2. Add the "holder" pieces.

Apply glue to the bottom edge of the vertical piece of 1×5 that holds the feeder in place. Hold it in place on the base, against the end of the feeder frame. Drill pilot holes, and screw up from the bottom of the base with 1³/₄" screws, making sure it remains square. Set the horizontal feeder-holder ("lid") piece in place. Position the hinge, mark the mounting holes, and install the hinge with the provided screws.

3. Mount the lid hasp.

Install a hasp on outside of feeder holder as shown in Demonstration Hive Feeder, on **page 154**. Be sure to have a small lock to hold the hasp closed.

Finishing the Job

Now it's time to cut and test-fit the Plexiglas panels and finish the wood parts. Apply the finish only to the outside, or exposed, wood surfaces. You can use varnish to retain the natural look of the wood, or give it a decorative paint job if you're feeling creative. You might even want to paint it a solid base color, then use a liner brush to write interesting bee facts on the sides.

1. Cut the Plexiglas panels.

Cut the two Plexiglas panels to size at 20" × 21^{3/16}" (see Work Tip at right). Remove the hive top and slide the panels into their grooves. Replace the wide top piece and make sure the free panel slides in and out easily; this is the one you will be removing when you load and unload the hive. When all looks good, remove the panels.

2. Finish the wood.

Apply the finish of your choice to the exposed wood surfaces, making sure not to clog the panel grooves with paint or other thick finish material. Let the finish dry completely, then reinstall the Plexiglas and make sure it still moves up and down easily. You're ready to go. Follow the tips below to get started using your hive.

Work tip: You can cut Plexiglas on a table saw with a regular carbide-tipped wood blade. Use a fairly slow feed rate to prevent cracking along the cut edges. The plastic must also be well supported; if the slot for the saw blade is wide, it helps to set the Plexiglas on a scrap piece of lauan plywood for additional support, cutting through the plastic and plywood at once. Alternatively, you can have the panels cut for you at any shop that repairs windows.

Tips for Using Your Demonstration Hive

Plan ahead. I always tell people I will try to bring an observation hive, but it depends on the weather, and that the queen may have to stay home with the big hive. You don't want to be pulling frames in the rain. For my elementary school visits, we always have a rain date; it's better than showing up without bees. If you have a 5-frame nuc, it's easier to find the queen and bring her along.

Choose good frames. I honestly can't believe how many times I've seen beekeepers with "observation hives" that consisted of two empty frames with 50 to 100 bees wandering around aimlessly. If you are going to talk about eggs, larvae, and capped brood, including worker and drone cells, and explain how the bees store honey and pollen around the brood, pick frames that have all of these things. This may seem like common sense, but I can't emphasize it enough.

Keep things tidy. Load the frames in your hive carefully. Try not to squash any bees in the observation hive. It will be the first thing that children notice, and the workers will drag a dead bee around trying to take it out, which they won't be able to accomplish. Also keep the Plexiglas clean.

Set some rules. If you are talking to young people, be sure to set ground rules before you show the bees. There are only two rules I find necessary to mention. The first is *No pushing or tapping on the glass*. Bees are delicate creatures and can be easily injured. The second is *Keep fingers out of the vent holes*. Although I've never seen it happen, bees could sting through the screen.

Talk first. Give most of your spoken presentation before you bring out the bees. Once they see the bees it will be almost impossible to hold their attention.

A few additional tips: Allow plenty of time for looking at the bees. Have children come up in small groups. Have a few magnifying lenses available for their use. Know your material; you will be asked a million questions.

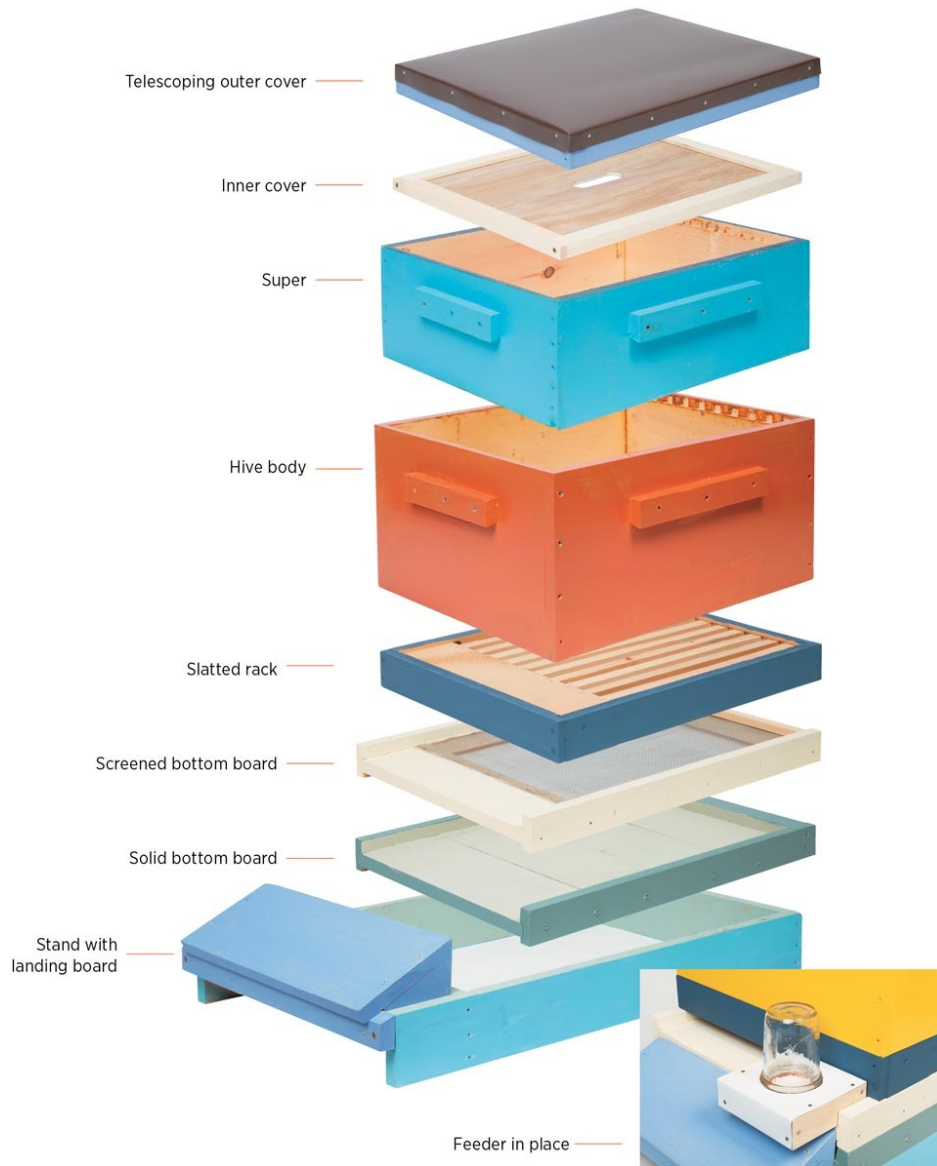
Finally, I would say *have fun*, but I don't think I have to tell you that. There's no way you can avoid it.

Appendix: Finished Projects

A finished hive, ready for bees



ABOVE: *A finished hive.*



ABOVE: *Exploded view of a hive.*

Escape boards in use

The escape board is easy to use. Place it under your full honey supers with the screen side facing down. Be sure there are no openings where robber bees can get in. Come back the next day and remove the supers from the hive.



ABOVE: *10-frame escape board set on top of super.*



ABOVE: *Underside of escape board.*

Demonstration hive

The demonstration hive is a great teaching tool in the classrooms and for presentations. It's also nice when you are promoting honey sales. (See tips on **page 157.**)



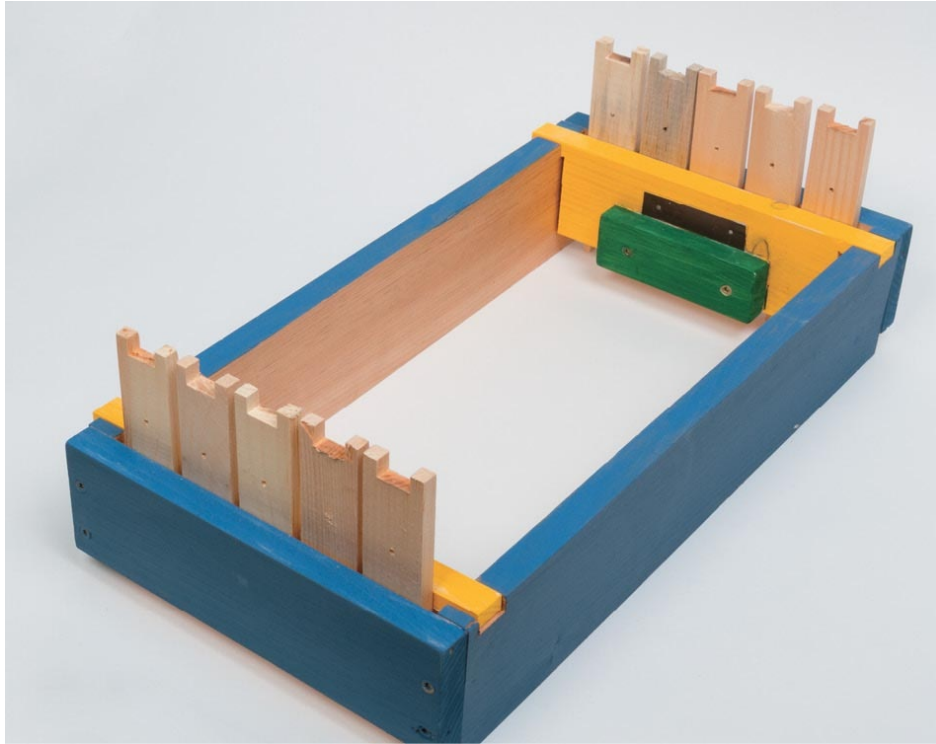
ABOVE: *A brand-new observation hive (without a frame in place, it's hard to see the Plexiglass sides).*



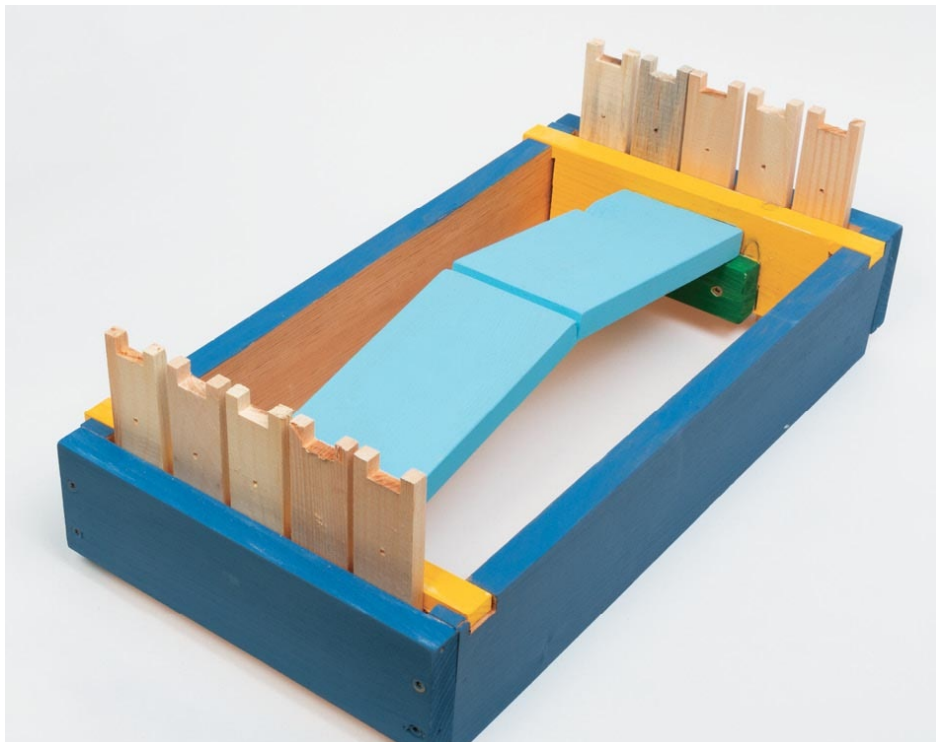
ABOVE: *An observation hive in use.*

How to use the frame-assembly jig

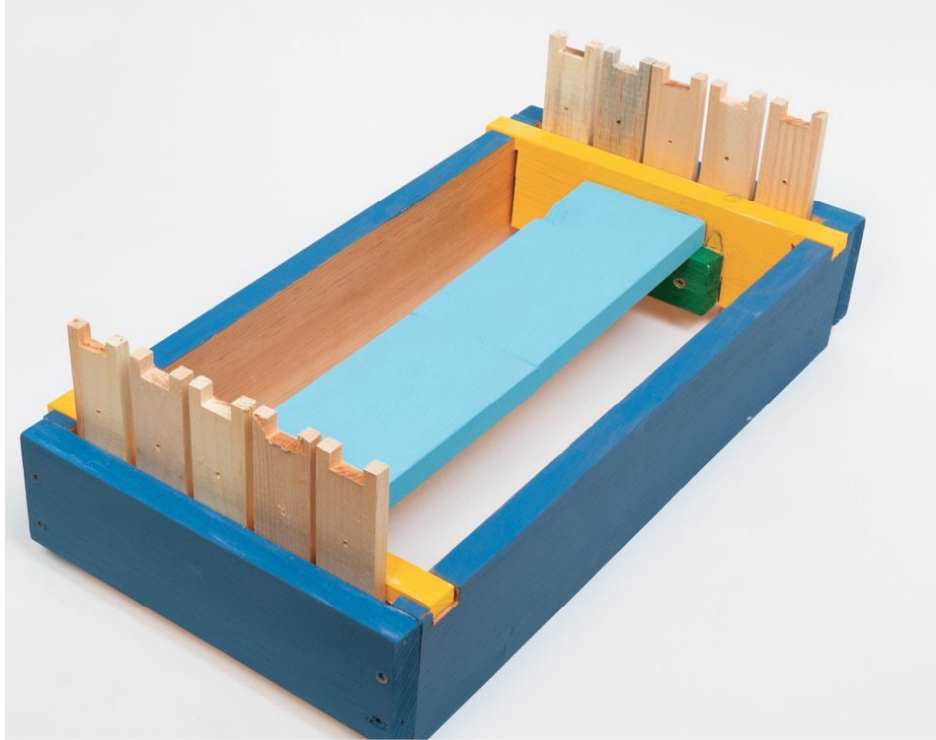
The frame-assembly jig frees up both hands for gluing and nailing frames. You can put together a whole hive's worth of frames in no time, without having to mess with screw clamps or rubber bands to hold the parts in place.



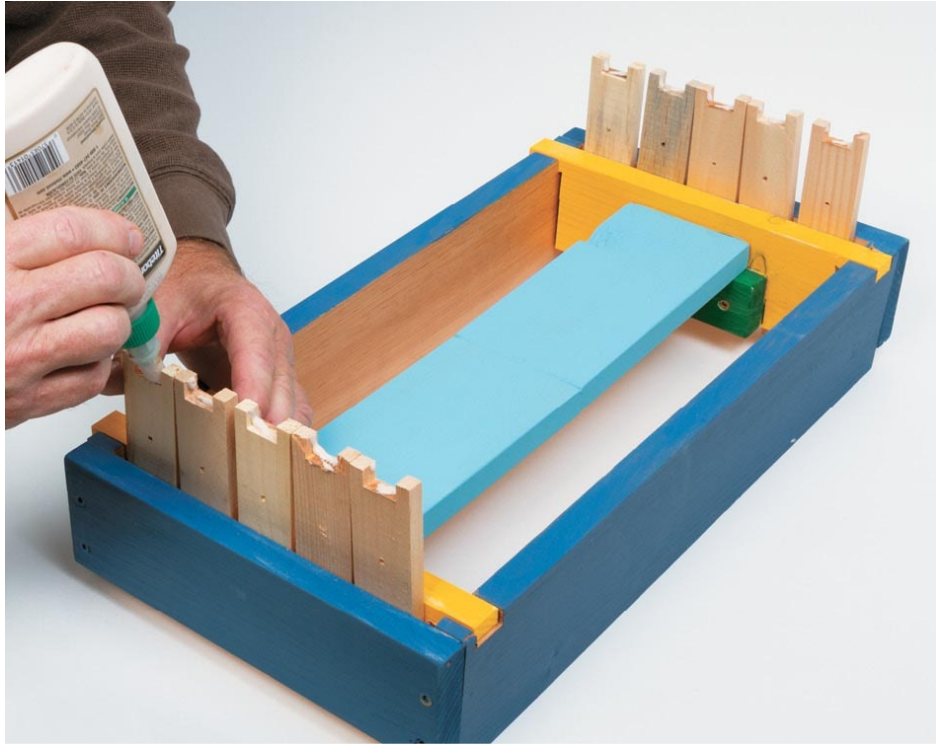
ABOVE: **1.** Set the frame ends in the two ends of the jig.



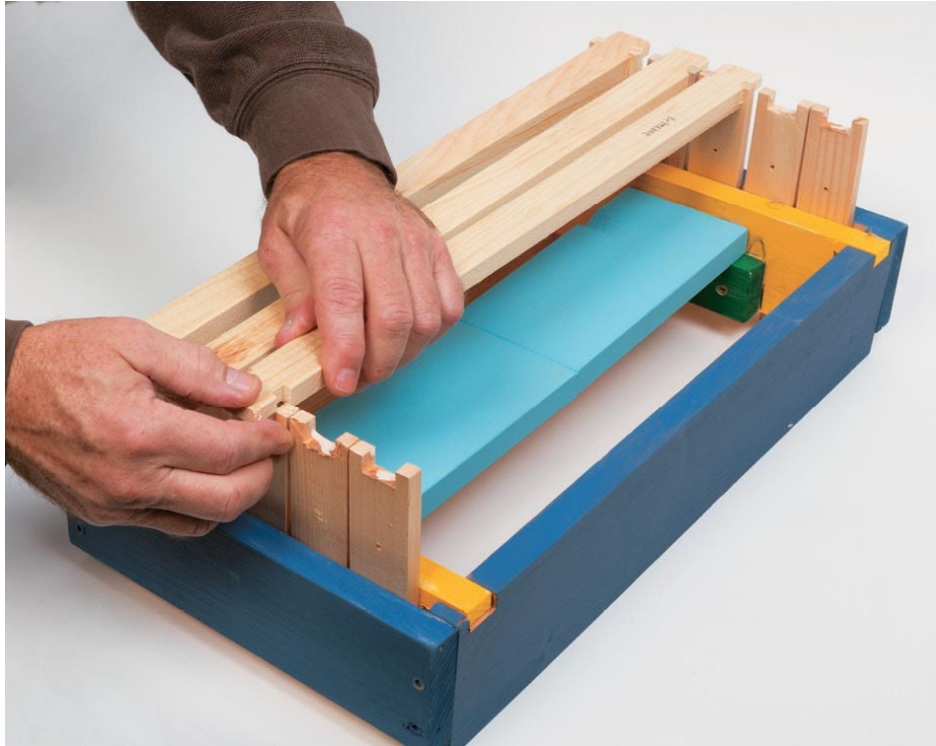
ABOVE: **2.** Set the clamp in place on the clamp rests.



ABOVE: **3.** A simple push with one hand locks the clamp, holding the frame ends in place.



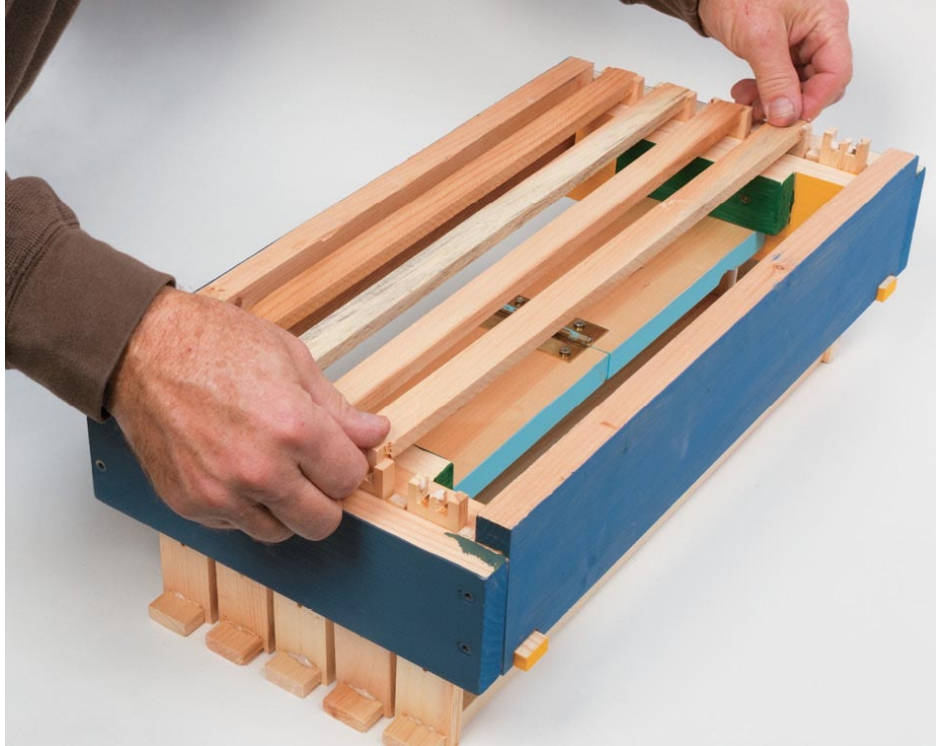
ABOVE: **4.** Put a small amount of glue in the cut-out section of each frame end.



ABOVE: **5.** Put the top bars into place in the slots.



ABOVE: **6.** *Nail each bar to its end piece using two brads.*



ABOVE: **7.** *Flip the whole thing over, apply glue to the end pieces, and put the bottom bars in place.*



ABOVE: **8.** *Nail in the bottom bars, and ta-dahh, you have 5 new frames for your hives!.*

How to use the foundation-assembly jig



ABOVE: **1.** Here the jig is set on a tabletop for photographing. For normal use, you'll want to clamp it to the edge of your workbench or even screw it into place.



ABOVE: **2.** Fit the frame on the jig. This is a simple matter of slipping the slot in the bottom of the frame over the metal guide.



ABOVE: **3.** Slide the foundation into the bottom of the frame. Press down on the top bar, and the foundation slides right into the

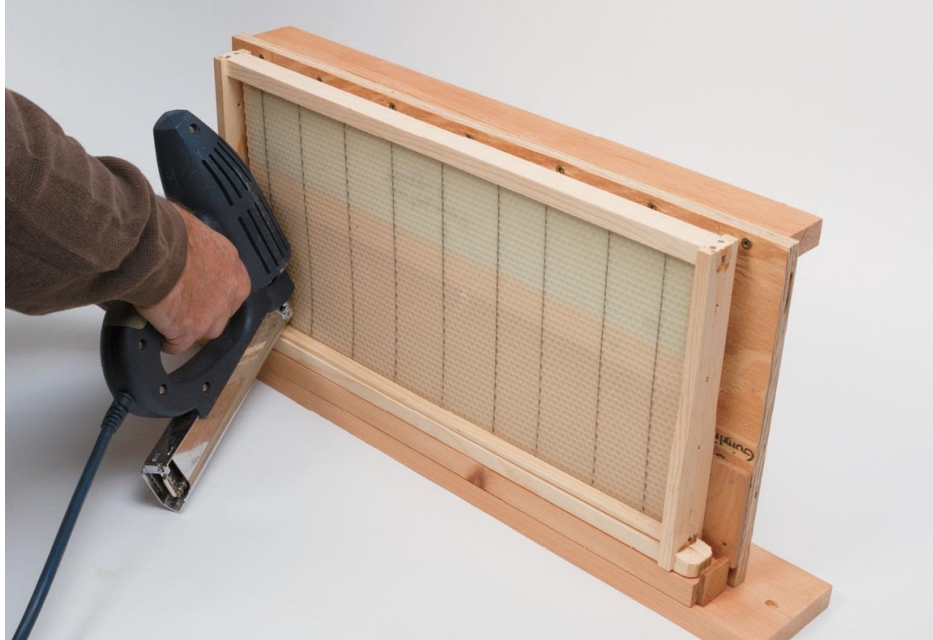
bottom of the frame.



ABOVE: **4.** *Tuck the foundation into the top of the frame.*



ABOVE: **5.** *Fit the slat into the top of the frame.*



ABOVE: **6.** *Staple the slat into place. The jig pivots into a vertical position, making it easy to nail the wedge in place with an electric brad nailer or by hand.*

Top-bar hive and details



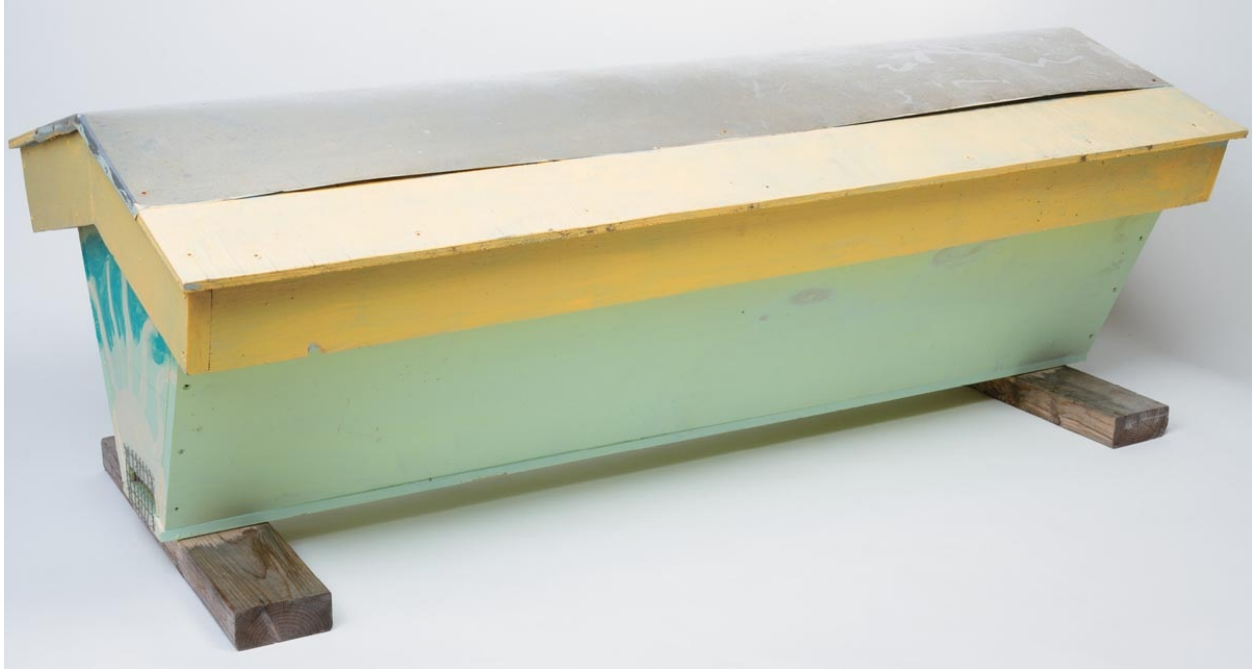
ABOVE: *Observation windows.*



ABOVE: *Top-bar hive with the roof off and top bars in place.*



ABOVE: *A few top bars in place.*



ABOVE: *End view with roof on (note mouse guard).*

Resources

Recommended Reading

American Bee Journal

217-847-3324

www.americanbeejournal.com

Bee Culture Magazine

800-289-7668

www.beeculture.com

Bush, Michael. *The Practical Beekeeper: Beekeeping Naturally.*

X-Star Publishing, 2011

<http://bushfarms.com/bees>

Carlsen, Spike. *Woodworking FAQ: The Workshop Companion: Build Your Skills and Know-How for Making Great Projects.*

Storey Publishing, 2012.

Marshall, Chris. *Woodworking Tools & Techniques: An Introduction to Basic Woodworking.* Creative Publishing International, 2004.

Mehler, Kelly. *The Table Saw Book*, rev ed. Taunton Press, 2003.

Warner, Pat. *The Router Book: A Complete Guide to the Router and its Accessories.* Taunton Press, 2001.

Suppliers

Betterbee, Inc.

8 Meader Road, Greenwich, NY 12834

800-632-3379

www.betterbee.com

Brushy Mountain Bee Farm

610 Bethany Church Road, Moravian Falls, NC 28654

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