Building Plyometric Boxes (Plyo Boxes)

Intro: Building Plyometric Boxes (Plyo Boxes)

Plyometric boxes are a fantastic workout tool and are common sight in Crossfit Gyms. They're quite expensive to purchase but much cheaper to make, and they aren't overly difficult to construct.

At my gym we've got a number of different boxes, several each of 12", 18", 20" and 24" heights. One of the other members told me that she wanted to progress past the 12" box she was using, but wasn't quite ready to move to the 18" box, and asked if I could make her a 15" to bridge the gap. For that reason these instructions will be based on a 15" box, but once you understand the basic construction you can easily make plans for any size that you'd like.

I'm also going to go into depth regarding setting up a workflow that lends itself to churning out multiple units. The woman that asked for this only wanted one, but as soon as I started working through the layout, I realized I could get four boxes out of a single 4' x 8' sheet of plywood. (Almost. I had some plywood laying around that I used to make two of the tops. Everything else came out of one sheet.)

The idea, though, is that if you're going to go through the trouble of making one, you might as well make a bunch, because it's only a little more effort. A lot of the work involves setting up jigs and templates, but once they're done you can just keep cranking them out.

I should also note that I have a pretty wide array of power tools. In most cases these just make things easier or faster, but many of them aren't a necessity. As I work through the instructions I'll try and point out how to adjust things if you don't have everything I do.

Step 1: Tools & Materials

Tools

Circular Saw & Guide - The first step will be to cut a 4' x 8' panel down into all the pieces you'll need to assemble your boxes. The more accurate your cuts, the better your box is going to fit together. At the bare minimum you'll need a good 8' straightedge to guide your saw. I use a guide system which consists of a pair of 50" aluminum extrusions that mate with a plastic base I've got attached to the base of my saw. A channel in the base rides in a raised portion of the guide so it tracks a straight line.

Drill/Countersink - I drilled and countersunk my holes with my cordless drill and then used a smaller pocket driver for my screws. A countersink is a pretty cheap investment to ward off splitting the ends of your plywood. Spend a few bucks to pick up one of these if you don't have one already.

Layout tools - At the very least you'll need a measuring tape. A decent square is handy as well.

Optional

Clamps - I'd almost call these necessary. I've got half a dozen quick clamps and I think I've used them in every single project I've ever worked on. They're almost like having a second set of hands. I could probably find a way to get along without them but it would be a lot harder.

Jigsaw - It helps to have handholds in your boxes to make them easier to move them around. You might get by drilling a couple of holes with a hole saw, but oval handholds are a little nicer.

Router - In my setup I made a template for my handholds, used the jigsaw to rough cut the holes and then used a pattern bit on the router to match them to the template. A faster way to work, but you could just use the jigsaw to cut the holes out.

Biscuit Joiner - A glued butt joint with screws is a pretty typical way to build these boxes, but biscuits add strength as well as keeping the sides perfectly aligned while you're assembling the boxes. If you have one, I'd use it.

Pocket Hole Jig - I used this for the tops so the screws would be hidden. In retrospect, I should have used these to join the sides as well, because then you wouldn't see any of the fasteners. Pocket screws actually make a stronger joint, because you're screwing into the face of the plywood instead of the end grain. If I make any more of these I'll go that route.

Orbital/Belt Sander - Now we're just getting into cosmetics. The boxes would be fine without these, but I'm anal retentive so I couldn't skip the finishing step.

Materials

Plywood - This is going to be your main cash outlay for the project, and the quality of the resulting box will depend on it. Hardwood plywood will get the best results. Particle board, MDF, OSB or any other sort of sheet good maybe be tempting but would be bad choices for this type of application. My local big box store had 4' x 8' sheets of maple ply for only $36, which is a steal. Shop around and you'll probably find a good deal.

Screws - Lots of people like to use drywall screws, but I prefer to use decking screws. I like Torx drive screws, and I've found the decking screws to be a little hardier than standard drywall screws. (Occasionally I'll snap the neck off one of those.) Personal preference, though. Use whatever you like, or already have on hand. I went

with a 2" length.

Pocket Screws - If you've got a pocket hole jig you've probably already got these sitting around. Mine are 1 1/4" coarse thread Kreg screws designed for pocket holes.

Glue - Use a glue designed for use with wood. I like Titebond II.

Biscuits - If you're using a biscuit joiner, you'll need biscuits. I used size 20.

Polyurethane - I used this for a finish on the sides of the boxes. You could leave them unfinished, or put on whatever you'd like. The other ones at my gym were painted, but I opted to just stick with a clear coat. I had a few cans of spar urethane sitting around, so I went with that.

Top Material - You'll probably want something on the top other than smooth, bare plywood. There was some leftover textured paint from the construction of the others at my gym that I used. It's paint with an epoxy additive for wear resistance and a silica sand suspension for texture. When it's dried it's basically like sandpaper. The ones at the gym have seen a couple of years of constant use and they're still going strong, so this is a good choice. You could also get some rubber floor mats and cut those to size for the top and cement them on. If you go that route, make sure you calculate that into your height equation when you're laying out the boxes.

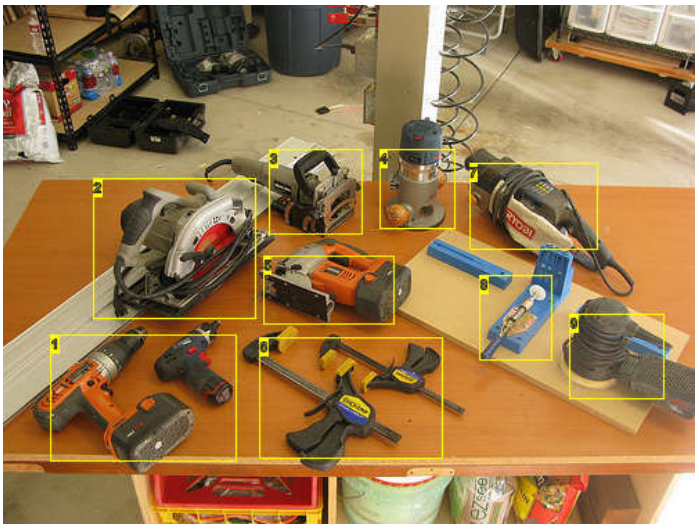


Image Notes
1. Drill and driver
2. Circular saw and guide
3. Biscuit joiner
4. Router
5. Jigsaw
6. Clamps
7. Belt sander
8. Pocket hole jig
9. Orbital sander

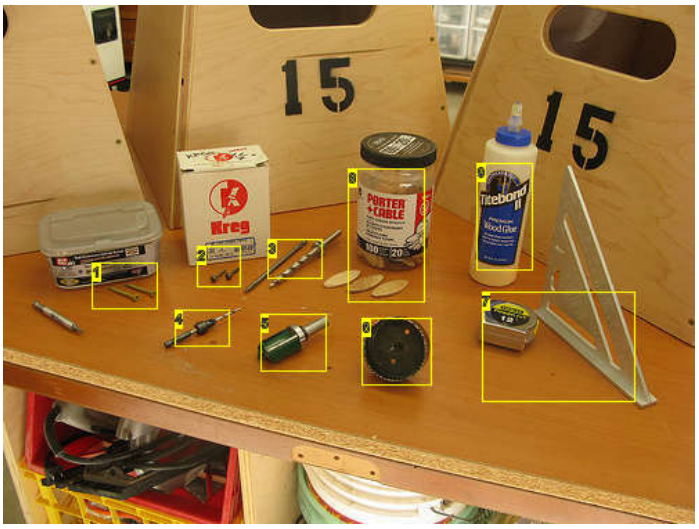


Image Notes
1. Deck screws
2. Pocket screws
3. Pocket screw driver and drill bit
4. Drill and countersink
5. Pattern cutting router bit
6. Hole saw
7. Measuring tape and speed square
8. Biscuits
9. Wood glue

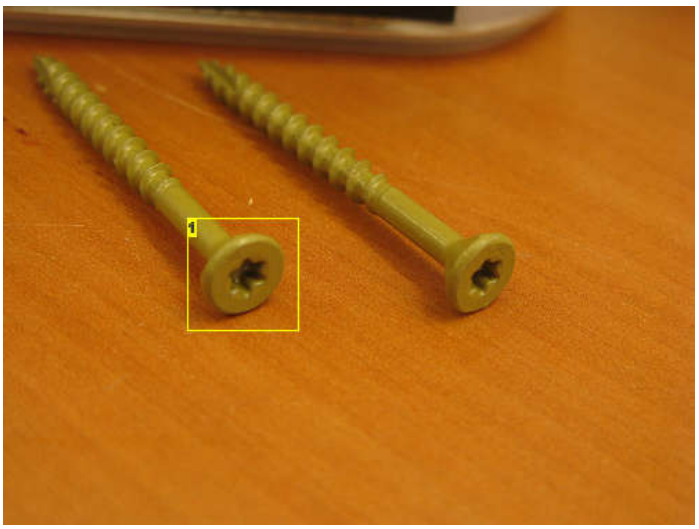


Image Notes
1. Torx drive

Step 2: Design

Before you start you'll want to get your design down on paper and make sure you understand how everything fits together before you start making sawdust. Cutting the angles on this project might look a little daunting at first, but they're really not hard at all.

The beauty of this design is that all the sides are exactly the same size, each one overlapping one of the other sides while being overlapped by the one on the other side. Each side is in essence 'falling down' onto another, but they all lock into one another and form a solid structure.

The sizing of this box was dictated by the existing set of boxes at the gym. I designed this one to match the others while also nesting underneath the existing 18" box. I wanted the box to be 15" high, so subtracting the 3/4" top, each side piece would need to be 14 1/4" tall. The angles are approximately 10 degrees. You can plug these figures into a Side-Angle-Side triangle calculator and you'll get the other sides and angle. You'll end up with some decimal values that you can round to something easier to work with as I've done. This will change your 10 degree angle by a hair, but it won't matter, since you can't really set the bevel on your circular saw with any great amount of precision anyway.

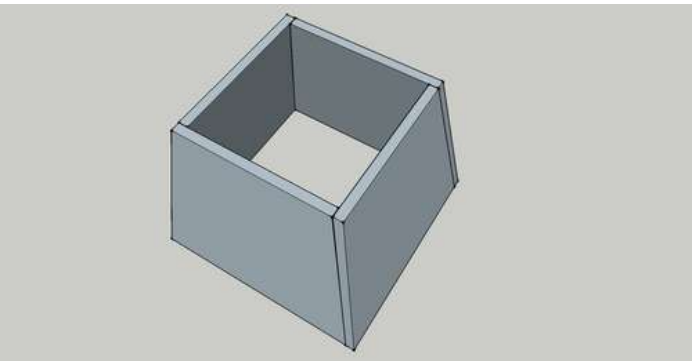
Our 18" box had 20 1/2" of space across the bottom of the inside, so I left a little wiggle room and ended up with sides that were 18 1/2". Remember that 3/4" of each of those sides is the width of the plywood of another side, so the pieces I need to cut are 17 3/4" on the bottom. Checking our triangle diagram, we see that the side opposite our 10 degree angle is splayed 2 1/2", so doubling that we know the top edge will be 5" shorter, or 12 3/4".

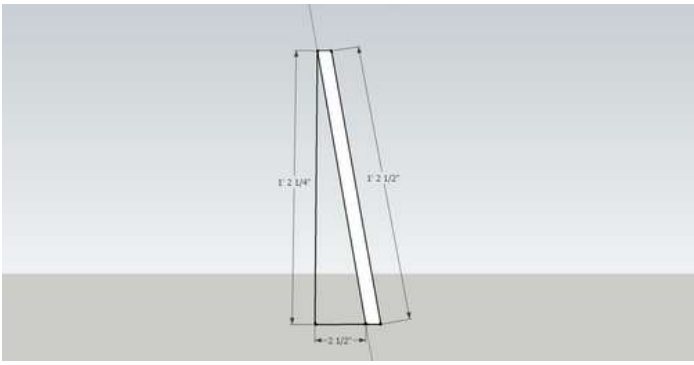
Since these cuts will make all the sides angled inwards, we'll also need to put a bevel of the same angle on the top and bottom to make sure that the bottom rests flat on the ground, and the box top has a flat surface to sit on.

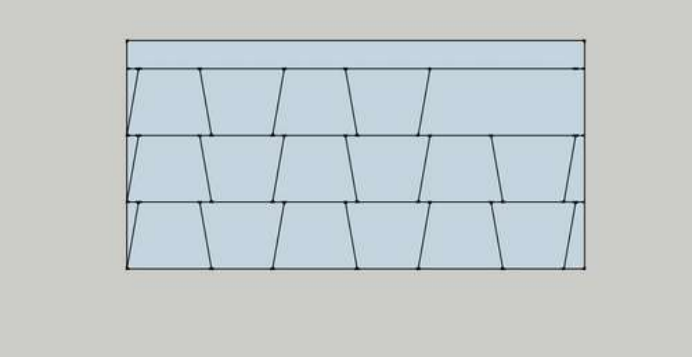
If you plan on making other sizes of boxes, you'll want to try and plan out everything during this step to make efficient use of your sheet goods. A great tool for this is Google's Sketchup, which is an easy to use 3-D modeling program. I used it for all the images on this page.

Since I was only making a single size, I drew out a 4' x 8' sheet and started plunking down pieces and found I could get the sides for 4 boxes, as well as 2 tops. If I didn't have any spare plywood and didn't want to buy an extra sheet I could have gone with just 3.

If you're really squeezing pieces in, don't forget that your saw kerf will eat up a small bit of the sheet. Mine is only 1/16", so those 7 cuts aren't even going to remove 1/2", but if your layout brings you right up again the edge it might make a difference.







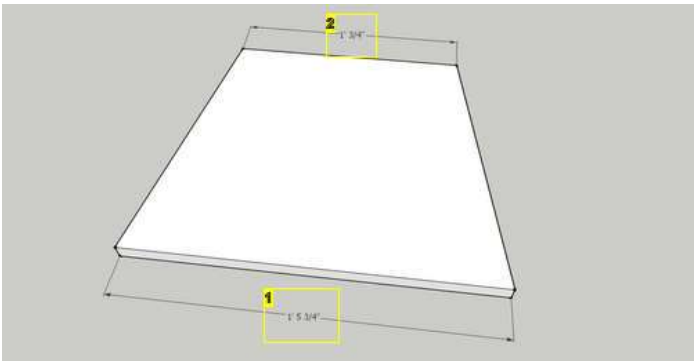


Image Notes
1. 1' 5 3/4"
2. 1' 3/4"

Step 3: Cutting the Top and Bottom Bevels

Now it's time to break down that 4' x 8' sheet into something easier to work with. The first thing I'll be doing is cutting my sheet into 3 strips lengthwise. These cuts are going to be along the tops and bottoms of the sides, and as such need to be beveled to match the angle of the sides.

Start by setting the bevel angle on your circular saw. This was the lack of precision I mentioned earlier. You can get close, but obviously it's not going to be perfect. Luckily close is all we need.

When you layout your cuts, you'll need to know exactly where your blade is going to enter the stock. An easy way to do this is to grab a scrap piece of wood, put your straightedge on it. Then put your saw against it and make a short cut. Now measure the distance from the straightedge to the edge of your cut. You'll need to offset your measurements by that much.

Since my saw rides on top of my straightedge this only ended up being about 3/16" an inch. If you're running the base of your saw along the side of a straightedge, it's more likely something like 3" or so, the distance from the edge of your saw base to the edge of the blade. If you're having trouble making this work, test things out on a piece of scrap (if you have one) before cutting into your sheet.

When I use my circular saw, I rest whatever I'm cutting on some pieces of 3/4" MDF I have just for that purpose. If you don't do that, then you're either cutting into your tabletop, or you've set things up somehow so your sawblade has clearance on the exit side of the cut. Cutting on the MDF sheets is nice for a couple of reasons. First is that nothing moves during the cut. The strip I'm cutting off isn't going to flop onto the floor. If you're cutting a bigger piece off, you don't have to worry about the weight of the piece breaking it off right at the end of your cut. Secondly you don't need to worry about tearout on that side of the sheet, since it's resting on the MDF.

Make sure that when you're making these cuts you cut in the same direction. If you don't, the sides won't be parallel, and that would mess things up.

I cut my three strips and then moved to the next step.

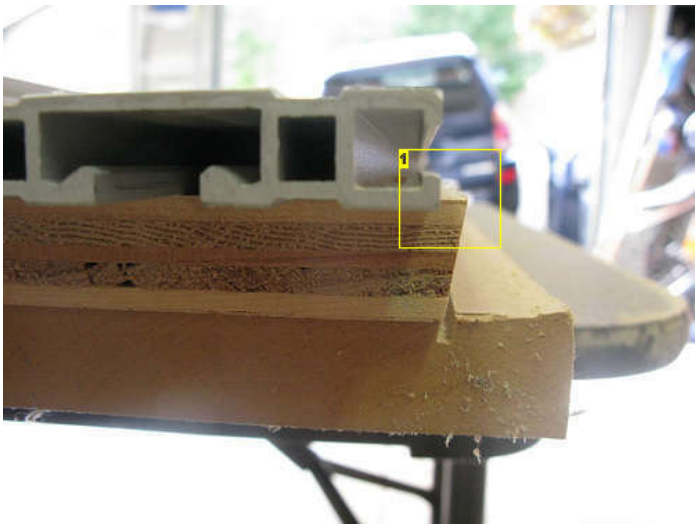


Image Notes
1. Need to offset measurements by this much.

Step 4: Cutting the Sides Part I

You could cut your sides one at a time, remeasuring and setting up the straightedge each time. That would be a bit of a hassle, but doable if you were making only a single box. Since I needed to cut 16 side pieces, I spent maybe an hour setting up a simple production layout so I only had to do all the measuring and layout work once.

The first thing I did is take the 5" or so wide 8' strip I had left over and cut it into 2 4' pieces. I put one down along the bottom edge of my table and secured it with a bunch of clamps. (I told you they were handy.)

Next I took one of the larger strips I'd cut and butted it up against the clamped strip. I kept the bevels facing each other, otherwise they'd only meet along the edge instead of the whole face. Then I put the other strip down along the other edge. I spaced this out with some plastic shims I had. Overlapping a pair of shims makes a simple expanding spreader. As you push them across one another, their added height will increase while the top and bottom stay roughly parallel.

The clamps in the picture pull everything snug. The kettlebell is there because without it the clamping force would be pulling the outer edge of the strip off the edge of the table.

With this layout, the top and bottom strip should now be parallel to one another. Since there's no way to clamp the upper strip down in this position, I elected to screw it down. I've still got my MDF strips on the table, so my screws are going into those, not my tabletop. The MDF strips are also securely clamped down to the tabletop, so nothing will move.

Image Notes
1. Pair of shims filling the gap.

Image Notes
1. Lots of screws to hold this piece in place.

Step 5: Cutting the Sides Part II

Next up is to layout the 10 degree angle we'll be cutting. I started by using a T-square to scribe a line perpendicular to the two parallel strips now secured on my table. I made a mark 22" from the bottom strip. (Nothing special about this length; anything would have worked.)

I plugged those numbers into my handy dandy iPhone app that calculates triangles and I get the short bottom leg being 3.879". I have another handy app that converts decimals to fractions, and I find this is about 3 3/8".

Then it's just a matter of measuring that distance out on the bottom rail, and then scribing a line between it and the mark at the top.

One thing I should add in here is that if you're setting things up just like me you might want to shift your straightedge placement further to the left. Later on you'll be setting up a stop block so you don't have to measure each piece, and it'd be easier if you had more space than I did. So leave space along the top rail. For me, I should have had the length of the bottom of the pieces (17 3/4") plus a few inches extra. This way when I cut the pieces they'd be completely on the top of the table instead of half hanging off. The setup in the pictures still works, but if I'd thought it through I would have left more space.

Now all you need to do is lay your straightedge down along this line and secure it. My saw guides have low profile clamps that slide into the bottom track, so you can't see them. Before clamping this down, you might want to use something to raise this up just a hair. I didn't, and early on found it was difficult to slide the strips underneath it. I ended up adding some thin cardboard that added maybe 1/32", and it helped.

Note that if you're doing this just like me, you might need to take out a screw or two along your top rail, or move a clamp on the bottom to make room for your straightedge. Also make sure your saw isn't going to run into any screws or clamps, either.

Since this cut is going to go completely through the bottom rail you want to make sure the smaller cut off portion is secured. You can see that I shifted one of my clamps over as well as added a couple of screws.

Once that's done you can make a cut. Make sure you ditch the bevel on your saw and bring it back perpendicular to the base. All the cuts along the sides are straight.

This cut will let you see exactly where your blade is going to go so you can make your next measurements. When you're satisfied that everything is in place, you can go ahead and make the first cut on your larger strips.

I started by sliding one piece in from the left until the lower right edge was just a hair past the guideline I'd just cut into the bottom rail. Then I slipped two pairs of shims into the bottom gap and overlapped them until they filled the void and pushed the top edge of my strip against tightly against the top rail.

Once everything was tight, I went ahead and made my cut.

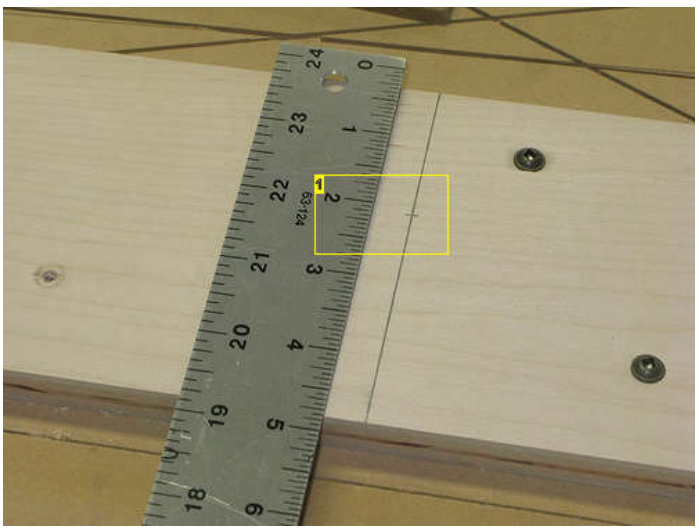
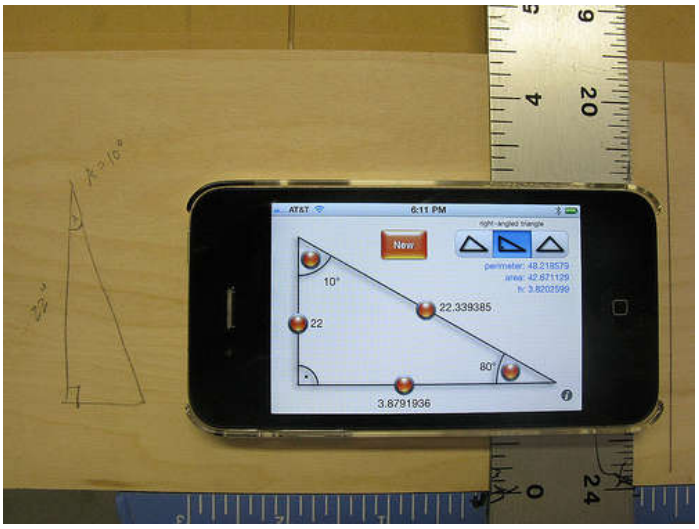


Image Notes
1. 22" from the edge of the bottom strip.



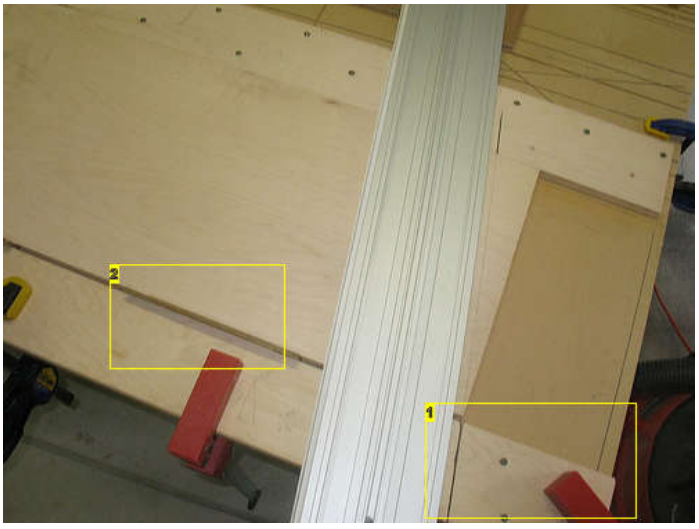
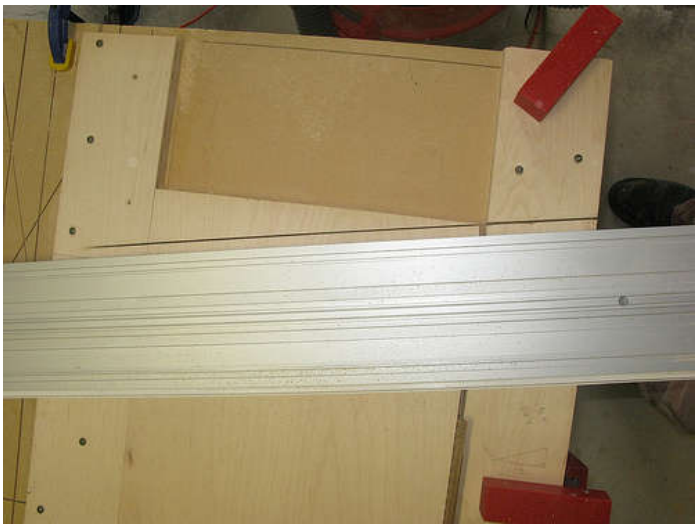


Image Notes
1. I ended up shifting this clamp out of the way so the saw base wouldn't hit it, and I added a couple of screws.
2. Shims in place to keep stock pushed tightly against the top edge.



Step 6: Cutting the Sides Part III

With the first angle cut into your strip, you can now set up the stop block that will measure out all your successive cuts. A stop block is basically something that you can just slide your stock up against to stop it at the right point, rather than having to measure each single piece.

I started by taking a small piece of scrap, butting it against the top rail and cutting the 10 degree angle into the side of it. Then I screwed it to another longer piece making the resulting piece in first picture below.

You can see how it works in the second picture. I took the long piece of stock I'd just trimmed the end off of and pulled it back out to the left and flipped it face down so that the next cut would result in correct shape for the box sides. (Not flipping means you'd end up with a parallelogram.) Take your tape measure and mark off the 17 3/4" or whatever the length is for your bottom side. Then slide the strip back in and underneath your straightedge, lining up the mark you just made with the right side the saw kerf on your upper rail. Now when you make this cut you'll have one completed side piece.

Before you do that, though, you want to get the stop block into place. Slip your shims in along the gap in the bottom to wedge the strip into place, then put the stop block into position. I made mine overlap the strip just a little, and slid it until it butted up tightly against the right edge. I threw a few clamps on it to hold it in position and then locked it in place with several screws.

I goofed up something else at this point. The face of the stop block was flush against the top rail, and thus very snug against the strip underneath it. So much so that it was very hard to move the strips. I ended up backing off my screws and slipping a couple tiny washers between the stop block and the rail as spacers, like I'd done with the strips of cardboard under the straightedge.

The third picture shows the entire setup finished and ready to go. Cutting the blocks probably took half the time that setting up the cutting jig took.

After each cut, the strip needs to be pulled out, flipped, and then reinserted and butted up against the stop block. Insert shims to clamp, cut, repeat. Start the second and third strip by trimming one end just like the first one.

When you're done, you should have a stack of identical pieces like in the fourth image. One thing I did at this point was to get all the bevels running the same direction and then ran a black line across the lot of them at one corner. That's so that during later steps I could make sure my black mark was oriented at a given spot and I'd know the bevel was facing the right way, because it's an easy thing to goof up. 'Black mark this corner' with a big arrow makes it harder to turn something incorrectly.

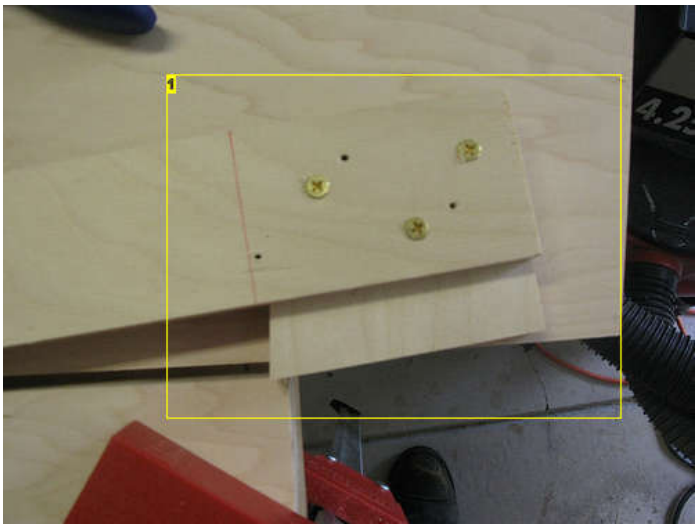


Image Notes
1. Angled stop block screwed to another piece of scrap.

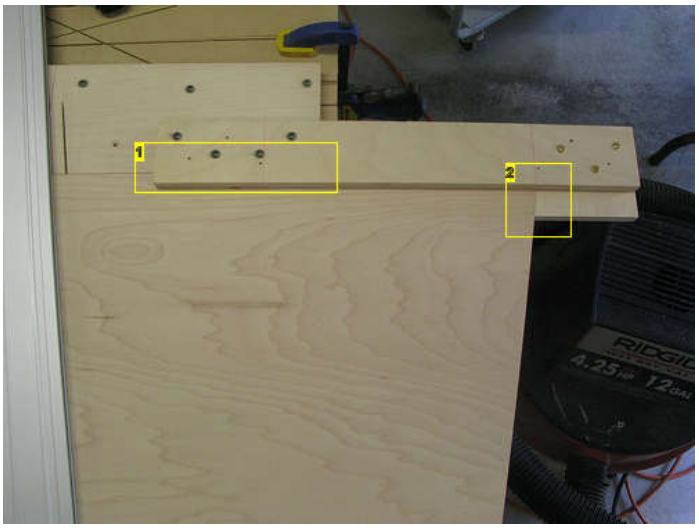
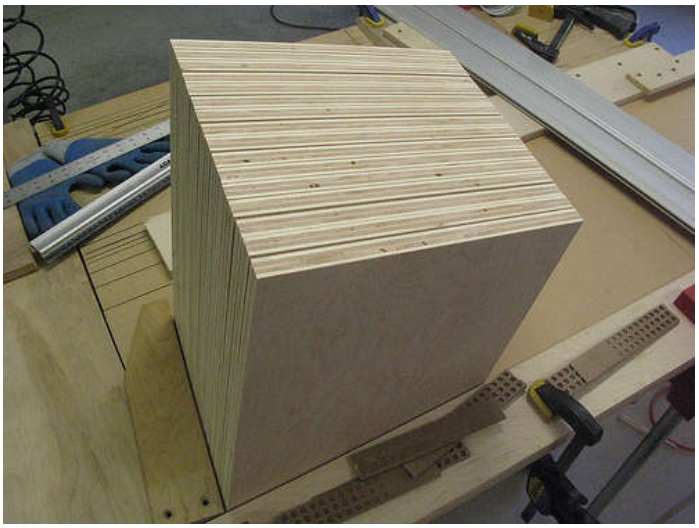
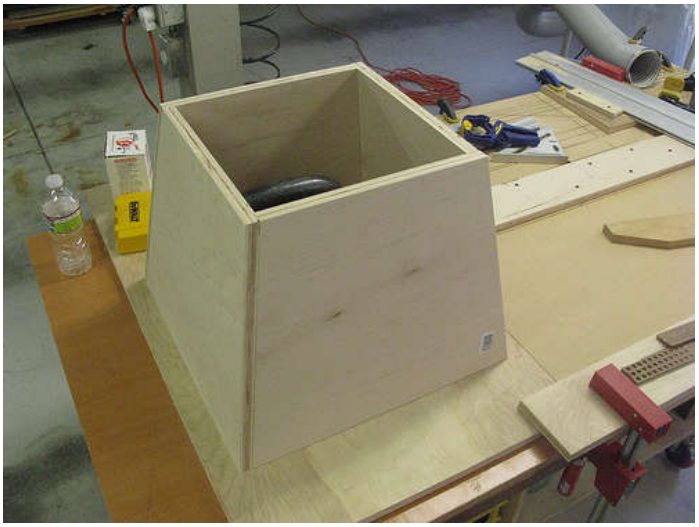


Image Notes
1. I slipped a couple thin washers between the stop block and the rail underneath so the strip could move freely underneath.
2. Push until your stock makes contact here.





Step 7: Making the Handhold Template

If you want quick and dirty handholds and you've got a decent size hole saw (maybe 2 1/2" or bigger) you can just use that. If you're just going to cut them out with a jigsaw, then making a quick marking template out of cardboard is probably the way to go. I used mine not only for drawing the outline, but also as a template for routing, so I had to spend a little extra time making it. If you're not planning on routing, then you can skip this whole step.

I started with a piece of 1/4" MDF I had laying around and cut it big enough to hold one of the pieces, along with extra room on either side. I raised it up off my table with more scrap pieces so the heads of my larger clamps would fit on under the edge.

I put one of my cut pieces down, aligning the bottom edge with the edge of the MDF and held it in place with a couple of spring clamps. Then I took a couple of pieces of scrap and butted them against the outer edges. (These were leftovers from each strip after I'd cut the 6 side pieces out. Just a few inches wide, but perfect for this.) I clamped each of those down tightly.

Then I flipped the entire thing up so I could get at the back side and put in maybe half a dozen 3/4" screws to hold each piece. I countersunk all these since the underside of the template would be riding on my router table and I didn't want any protruding screw heads.

That done, I turned to the layout of the handhold cutout. I scribed a line across the tops of the pieces and measured the gap. Remember that the ultimate width of each side of the box will be the width of the side pieces plus the thickness of the side it butts against. So when you measure for your center line, make sure you shift it half that width (or 3/8") to one side.

I wrote a note on my template regarding where to orient the black mark I'd made earlier. If one side got put in upside down it wouldn't be the end of the world, but the handhold on the resulting side would be slightly off center, and since I'm anal retentive it would cheese me off.

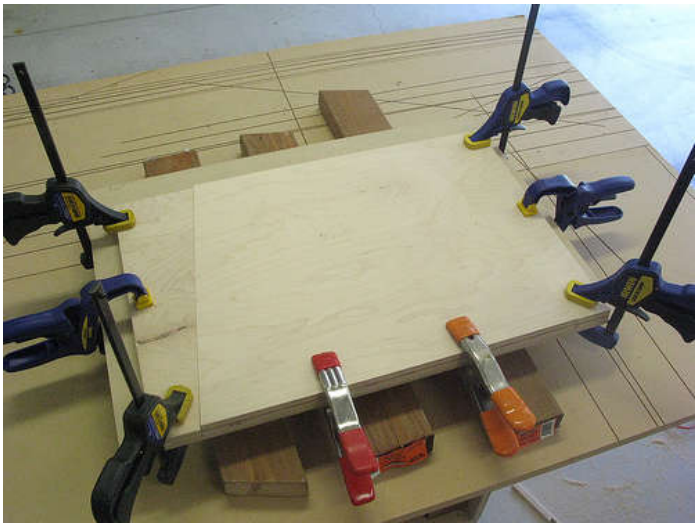
I knew I would be cutting the rounded portions out of the template with my hole saw so I worked out where I wanted the centers and marked them both. I used my drill press to cut them both, then removed the bulk of the waste with my jigsaw.

Next I found a wood scrap with as straight an edge as I could and aligned it with the edges of the circles, securing it with spring clamps. I flipped the board over so the underside was facing up, and then grabbed my router. I used a flush cut bit with a top-mounted bearing and cleaned up one side of the handhold. The bearing rides against the straight piece of scrap and makes a clean, straight line on the template. Even using a jigsaw riding on a straight edge isn't quite as good as doing it this way.

I got another piece of scrap and did the same thing for the other edge, leaving me with a nice, smooth handhold cutout.

I added a couple more things. I screwed a piece of scrap along the top edge just to help keep the side pieces in place. (Notice that piece of scrap? I salvaged it from the stop block!) Based on my earlier experiences, I spaced it with a couple small washers to make sure the pieces didn't get stuck.

Lastly, I had this face mounted toggle clamp sitting around so I threw it on for good measure.



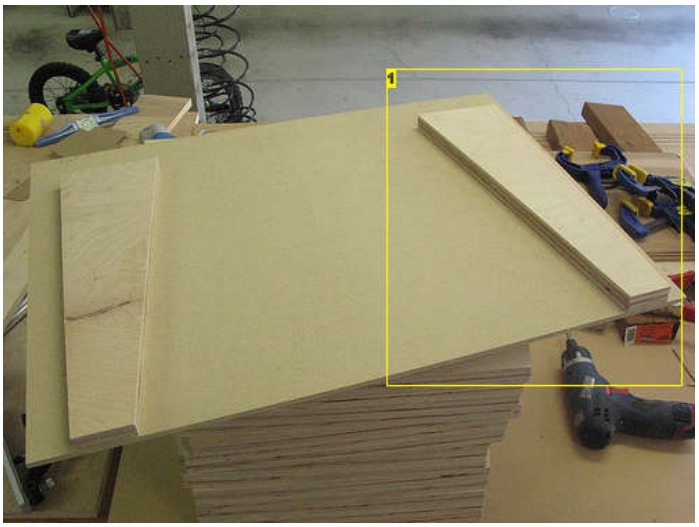


Image Notes
1. Each side is held in place with screws from the underside.

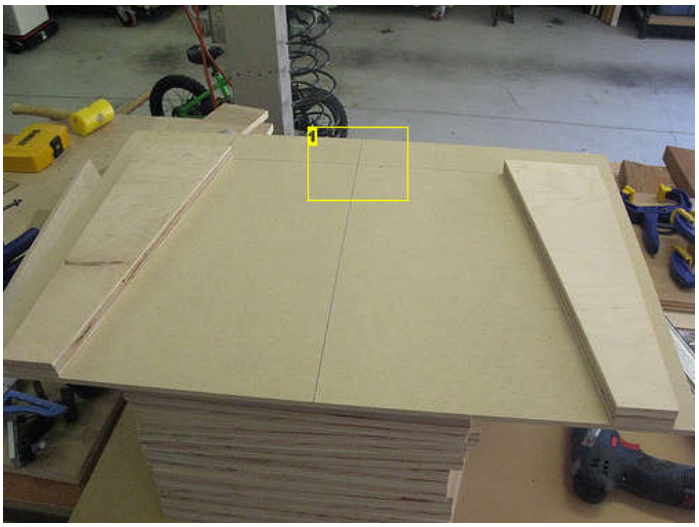
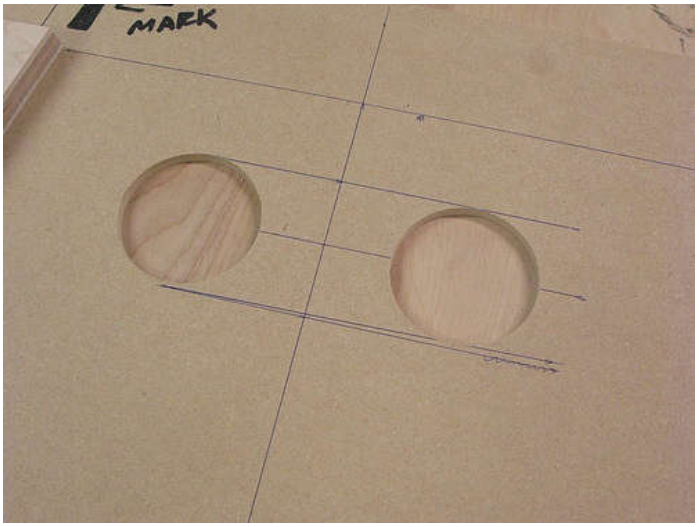


Image Notes
1. Shift 3/8" off of center to account for the width of the other side that will be butted up against this one.



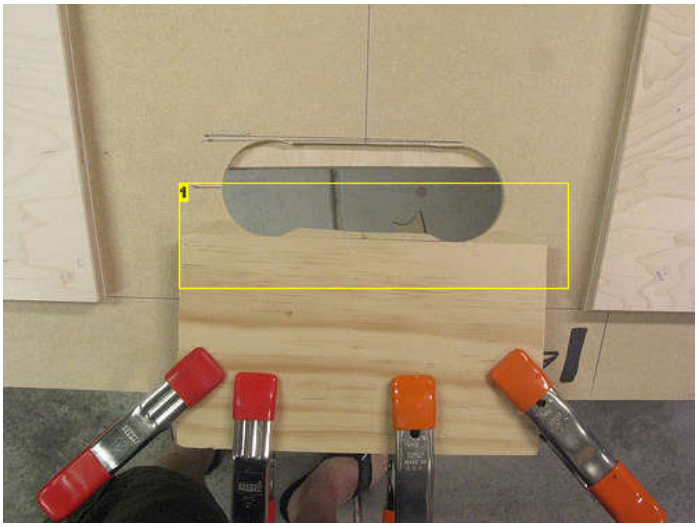
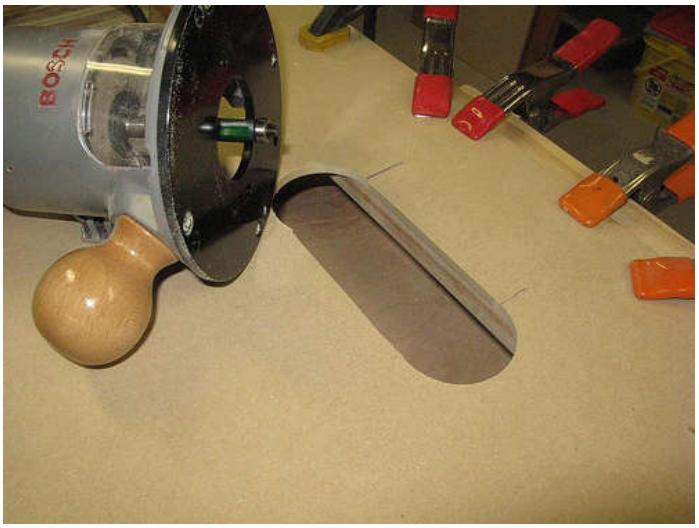
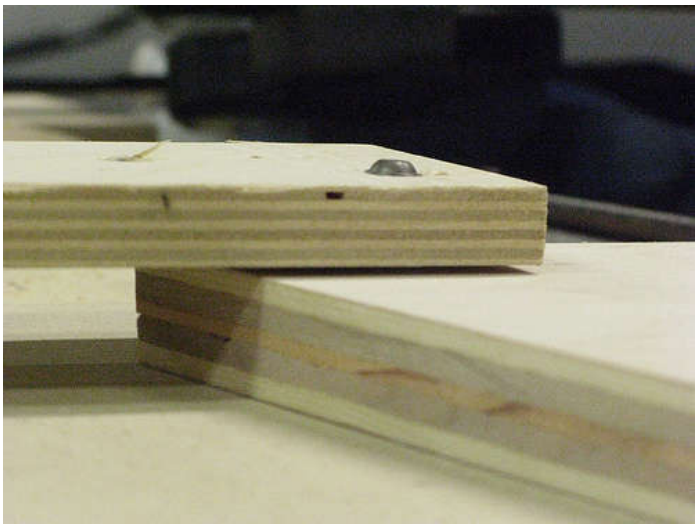


Image Notes
1. Edge of this piece of wood is lined up to the edges of the holes.





Step 8: Cutting the Handholds

As before, a lot of the time spent on the handholds went into making the template. Now that it's done, cutting the handholds is a pretty trivial endeavor.

I'd slide a piece into the template, throw the toggle clamp, then flip the whole thing up on its end so I could see the back. With a thin Sharpie I'd trace the oval onto the piece, then flip it back over, pull it out and go to the next piece.

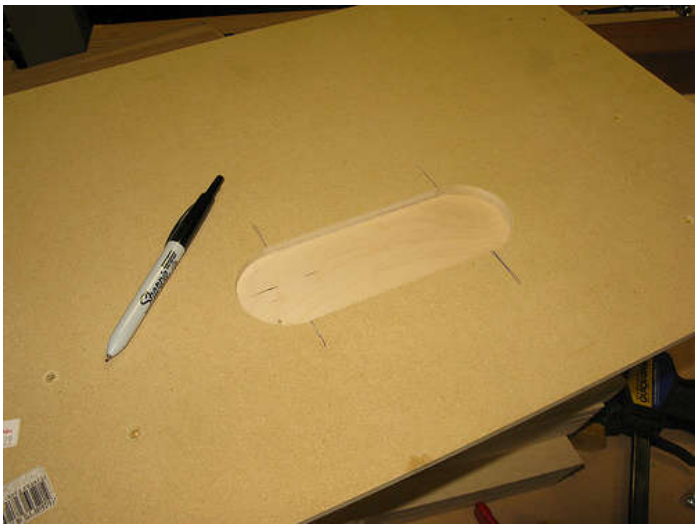
After a couple minutes I had all the pieces marked. Next I got a drill bit a little larger than my jigsaw blade and drilled some starter holes in each piece.

That done I whipped out the jigsaw and rough cut all the ovals. You don't need to worry about getting these cuts closer than maybe 1/4" from the line, since the router will clean up everything you leave. Once or twice I was sloppy and didn't make my turn fast enough and had some nicks that were too far over the line to get routed out. I'm over it, though.

To finish the pieces I turned to my router table, this time switching to a pattern-cutting bit with a bottom mounted bearing. The bearing references the template under the piece, so one pass around makes a perfect handhold. Running all 8 pieces through only took a few minutes.

I forgot to take pictures of the final step, which was to switch out the pattern bit for a roundover bit and run that over both sides of each handhold piece, getting rid of the sharp angle.

With the handholds finished I turned to laying out a jig for the biscuits.



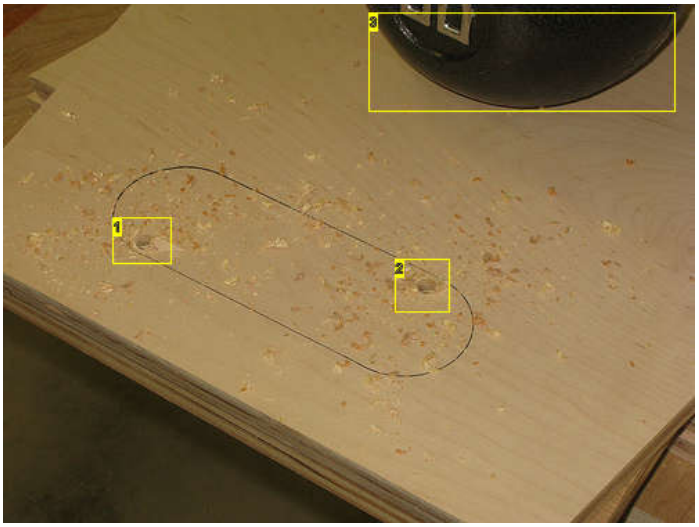


Image Notes
1. Starter hole
2. Starter hole
3. Getting a lot of mileage out of this kettlebell. Makes a handy clamp.

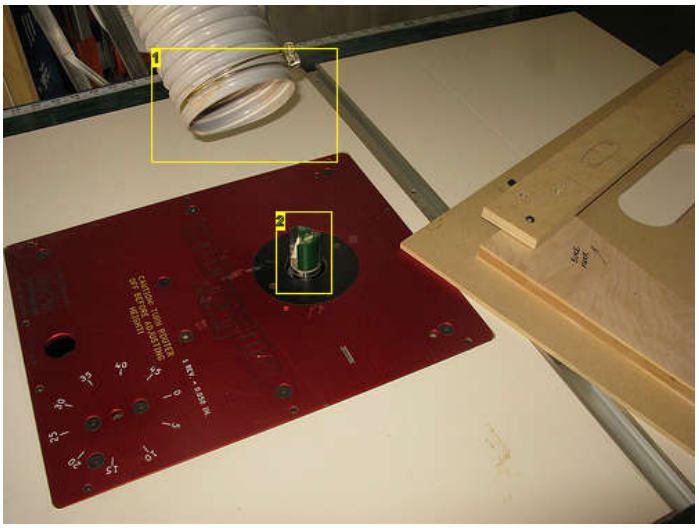
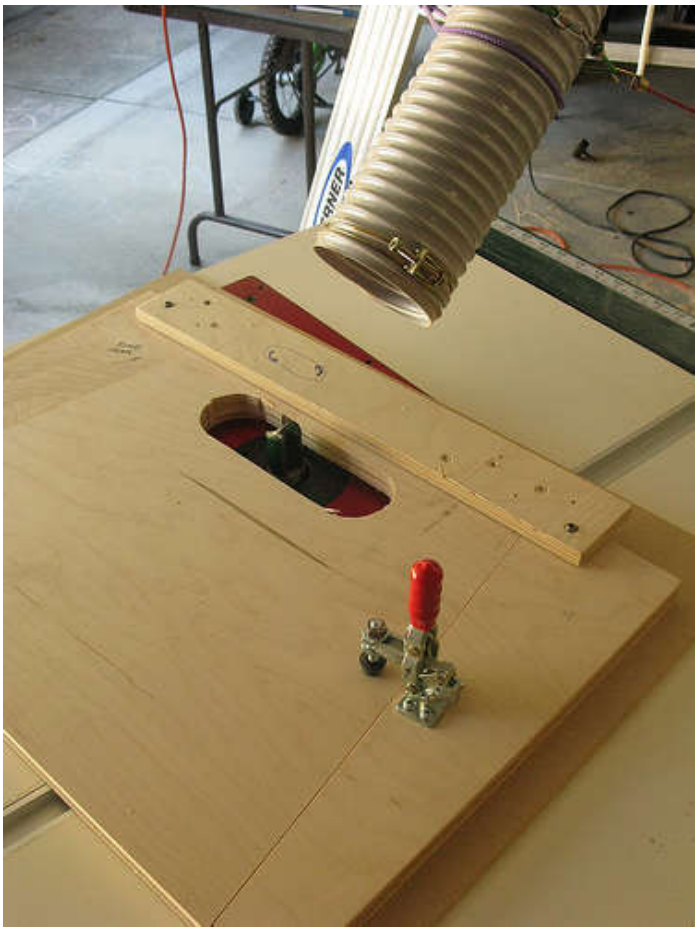


Image Notes
1. This thing sucks.
2. Pattern cutting bit.



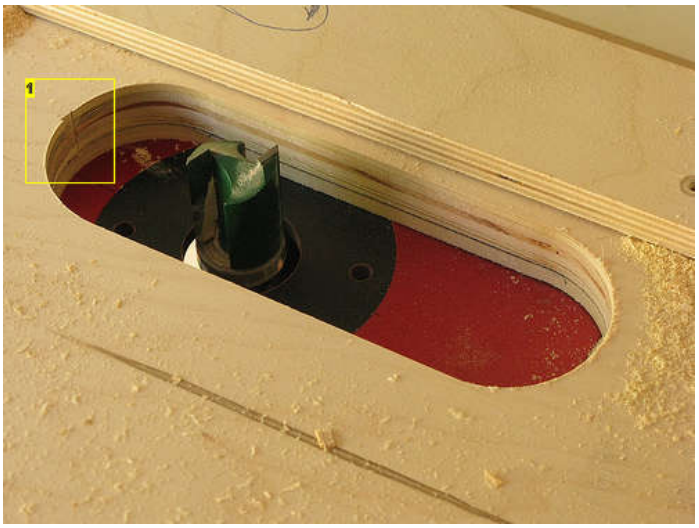


Image Notes
1. Jigsaw fail

Step 9: Setting up the Biscuit Cutting Jig

If you're not using biscuits, you can skip this entire step.

The beauty of biscuits is that not only do they strengthen the joint, they keep things aligned so your sides don't slip a quarter inch out of place while you're trying to drive in a screw.

When I cut biscuits I generally skip using the flip up fence and reference everything to the bottom of the joiner. Each corner of the completed box will have one plywood face that mates to the end of another piece. For the end grain biscuits the piece being cut will be flat on the table like the first picture. The face biscuits are cut with the sides flipped up 90 degrees and held tight against a vertical fence, like the second picture.

Make sure that in both cases you've got the outer side of the piece against the table because this is the reference side. You couldn't cut the face biscuits with the wrong side down, but you could conceivably set up your jig cutting the edge biscuits upside down. If the cutter is centered perfectly then it doesn't matter. More likely, though, it's a tiny bit off center, and if you're not referencing the same sides then the edges won't be flush.

I didn't get a great shot of the entire setup, but the third picture shows most of it. Everything is sitting on a piece of MDF on the end of my tablesaw, and I'm using the saw fence to hold another piece of plywood in a vertical orientation. I used my speed square to make sure the vertical and horizontal were square, and ended up shimming the vertical face just a bit. When you're cutting slots like this your stock needs to be clamped down or you need to be pushing it against something that won't move, hence the need for the fence.

I put one of the sides flat on the table, oriented the way I wanted to cut it, and then screwed down some pieces of scrap on the right and left sides. I couldn't fit the biscuit joiner on the table in the correct spot to cut the leftmost face biscuit with the scrap screwed flush to the left side, so I put a spacer block in. I measured out where I wanted the biscuits, keeping in mind I needed space on the ends and between them for screws later on. I ended up with three biscuits, one in the center and two a couple inches in from the ends. I marked the biscuit locations directly on the MDF where the pieces would be sitting so I wouldn't need to do any further measuring.

So the workflow went like this: I'd take a piece from the stack and lay it flat on the table, making sure my black mark was in the right spot. I'd push the piece against the back fence and slip in the spacer block to keep the piece tight between the two guide rails. I'd grab my little piece of scrap wood and transfer the marks from the tabletop to the top of the workpiece. Then I'd cut the three edge slots.

Next I'd pop out the spacer block and flip the piece vertically, again aligning my black mark. I'd make sure the bottom edge was flush against the table and the right side was touching the right edge guide, then I'd toss on a spring clamp to hold it upright. I'd use my wood square again, scribing short lines for each slot up the face of the piece, then I'd cut the three face slots.

Total time was maybe two minutes for measuring and cutting all six slots in each piece. Lather, rinse, repeat until all the slots are cut.

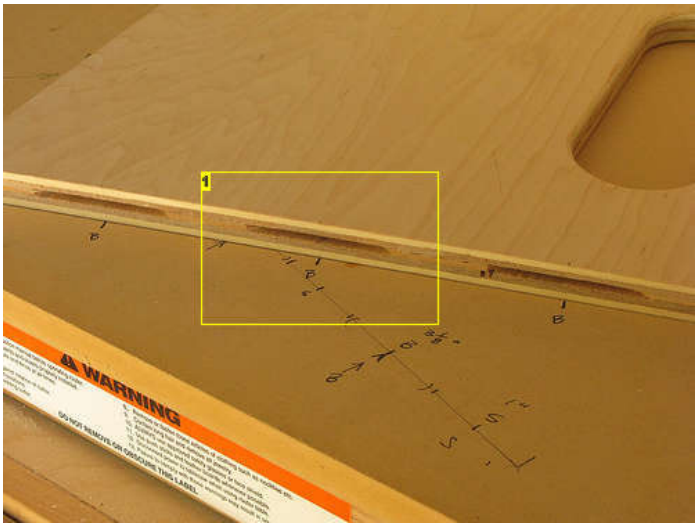


Image Notes
1. End grain biscuit slots

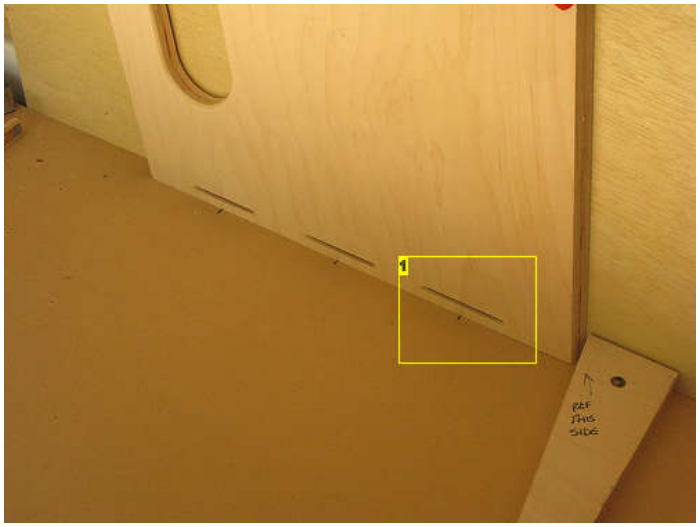


Image Notes
1. Face biscuit slots

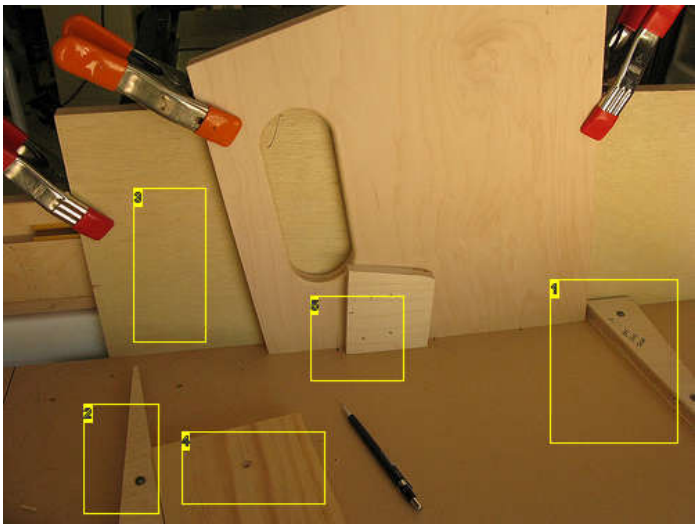


Image Notes
1. Right edge guide for pieces lying flat. Also serves as a reference for the right side of the pieces being held vertically.
2. Left edge guide for pieces lying flat
3. Rear fence to hold pieces vertically to cut face slots
4. Spacer block
5. Scrap piece being used as a square to extend the lines further up the piece.

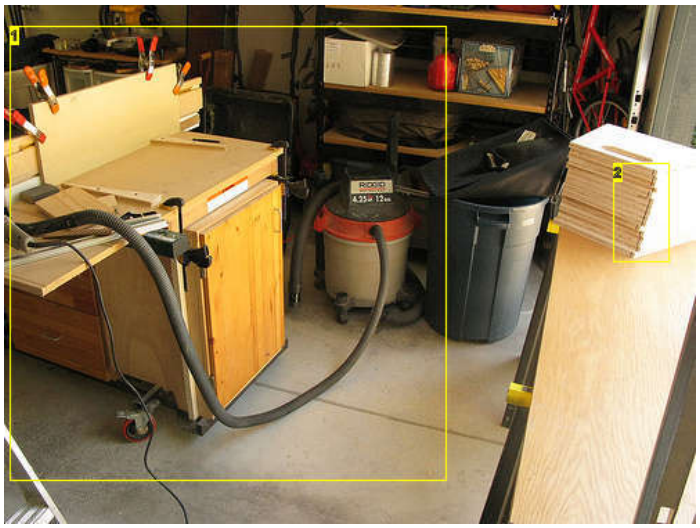


Image Notes
1. Complete setup, ready to go.
2. Reference marks to make sure each piece is oriented correctly

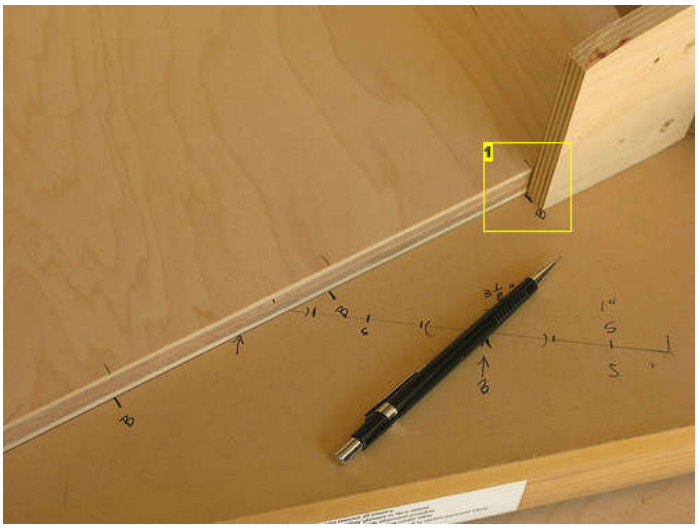


Image Notes
1. Transferring marks from the MDF onto the edge of the workpiece

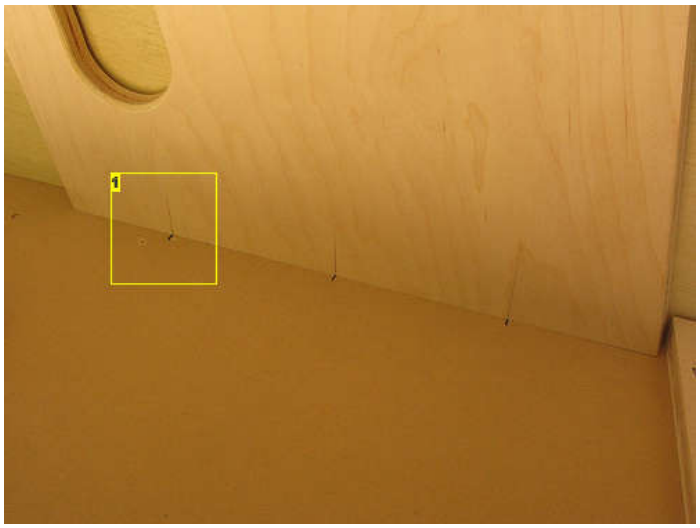


Image Notes
1. Marks for the face biscuits transferred from the MDF to the workpiece

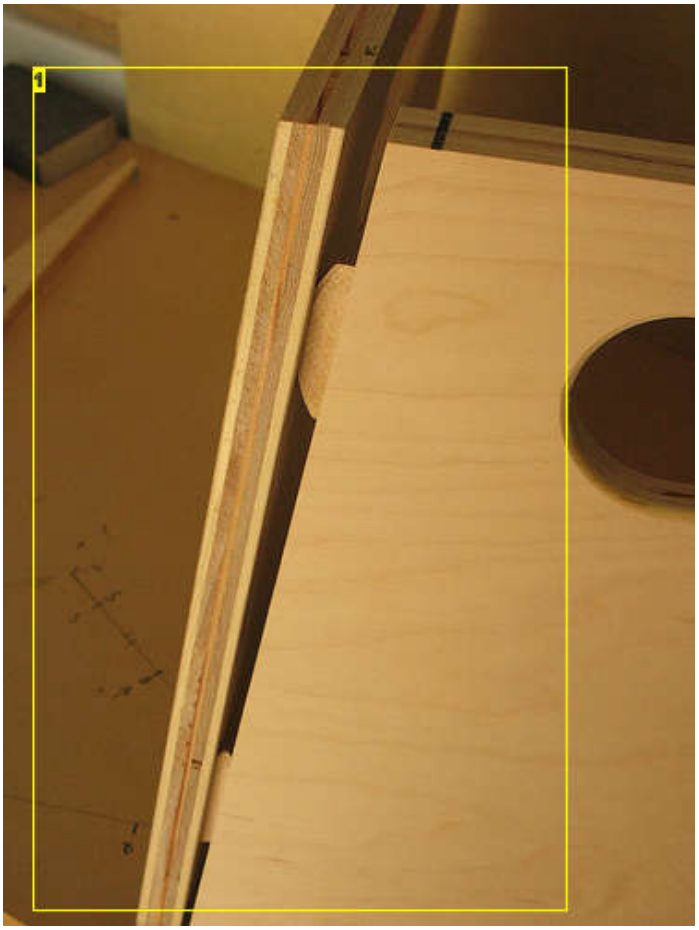


Image Notes
1. Cut a pair of slots into a face and an edge to make sure everything was working before going through the whole stack. They fit perfectly.

Step 10: Drilling and Countersinking Screw Holes

We're in the home stretch now. Generally at this stage of assembly I prep all my pieces by drilling and countersinking everything first, and then actually assemble the pieces with glue, biscuits and screws in a second step.

You could just put the glue and biscuits in and then drill, countersink and drive all at once, but I prefer not to do it that way. The glue doesn't have a very long open time, so it's setting up while you're running around trying to get all the holes drilled. If you screw something up, you might not have a lot of time to fix it.

Case in point: While I was dry fitting each box, before I got to actually drilling the holes, I realized twice that I'd assembled the box with the handholds adjacent to one another rather than opposite. Oops. Not a big deal at that point, but if I had glue and biscuits in already, it would have been more of an issue.

So I started by using a couple straight edges and some wood scraps, all clamped down to make a square on my tabletop just slightly larger than the bottoms of each box. I used the shims again as expanding clamps in the voids to keep things locked together.

I measured out where I wanted my screw holes and marked the locations on a story stick. For each piece I scribed a line 3/8" from the edge, then transferred the marks from the stick to that line. At each location I used a screw as a crude punch and left a slight depression so the tip of the drill bit wouldn't slide out of place. I repeated this step for all 16 pieces.

Then I assembled each box with the top and bottom biscuits and put it in place on the table in the square I'd set up. For good measure I threw a clamp through the handholds to help keep everything locked together while I went around and drilled all the holes.

Another thing you want to do at this point is label your pieces. I numbered each box 1 through 4, and wrote that number on top of each of the 4 pieces. You'll also want to do something to designate how the pieces go together. All you need to do is pick one corner, and draw a circle that goes across the line where the two pieces join. As long as you know that particular corner goes together, there's only one other way for the other two pieces to fit. (If you didn't have handholds or made handholds on all four sides, this wouldn't be the case.)

The reason this is important is that no matter how carefully you measure and drill your holes, they aren't perfect. If the pieces were cut and drilled by a CNC machine, they'd all be identical. Your holes, however, will be a tiny bit different from piece to piece, and the angle at which you held the drill will vary slightly.

If you don't keep track of your pieces, and you switch a pair of your sides then it's possible that you'll end up with holes that don't quite line up. When you go to put in your screws, they'll pull the side slightly out of alignment. I goofed and forgot to label two of my sets of four. The first one had one corner that got maybe 1/16" or so out of whack, but it wasn't horrible. When I got to the second, I spent a few minutes pushing a nail through the holes until I was certain I'd found the pieces with matching holes. Don't go through the frustration, and label your pieces the first time around.

If you aren't using biscuits, you'll want to be careful with this stage. Without them, it's possible that your piece will want to wiggle out of alignment while you're drilling the holes. You might want to use masking tape to hold the pieces together temporarily while you drill.

Next up, putting it all together.

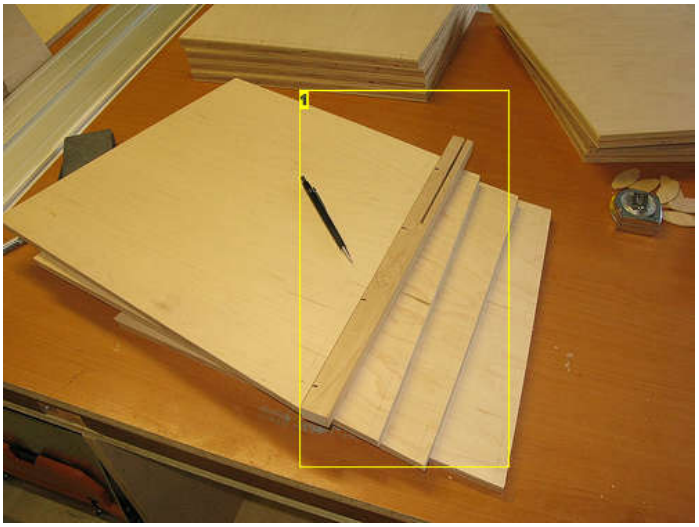


Image Notes
1. Using a story stick to mark screw locations

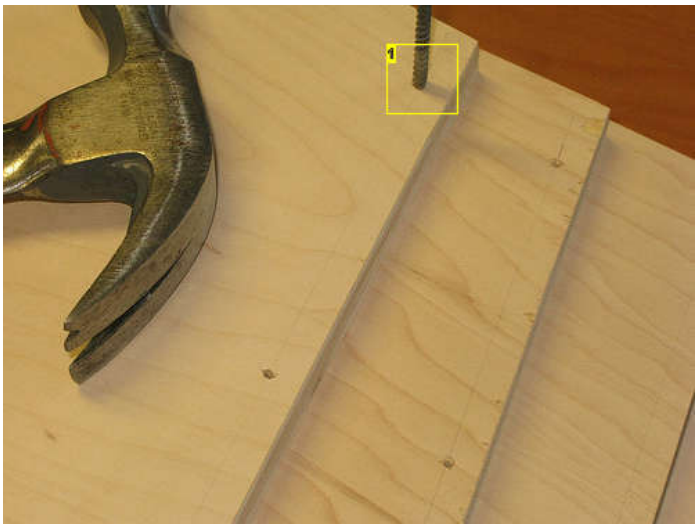


Image Notes
1. Ghetto punch

Step 11: Assembly

Finally! Time to start screwing everything together. I must have been a little worried about glue setting while I was futzing with the camera because I didn't really take any pictures. Things are pretty simple at this point, because each box has already been assembled and the holes are drilled. If there were going to be any issues with fit they would have reared their head before this point.

Before pulling out the glue I get my 'mise en place'. I get a bucket of water and a rag to take care of cleaning up glue squeeze out. I make sure I've got my screws at hand, along with my driver and a fresh battery. I get my biscuits, and a small brush to get the glue down into the slots. Then I get to gluing.

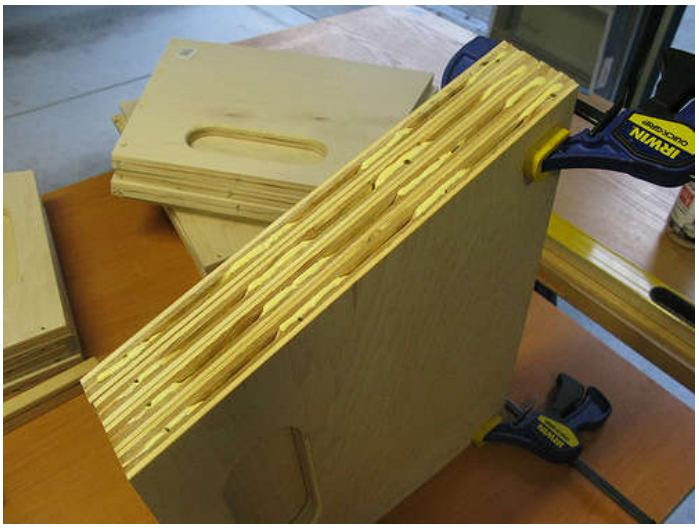
I took each stack and set them on end with a clamp to hold them together, then ran a bead of glue down the center of each edge. After that I'd pick up my brush and spread the glue out, making sure I got down into each biscuit slot. Then each slot would get a biscuit.

Next I'd pull off the clamps and fan the pieces out like in the second photo and repeat the gluing and spreading process. No second round of biscuits, of course.

Then it's just a case of reassembling the boxes, making sure that you follow your notation and get the correct corners lined up. I made sure each piece was sitting flat on the table, then slip my shim clamps into place and throw the final clamp through the handholds.

All that's left to do at that point is to drive all the screws. Be careful not to overtorque them. Once the glue in the joint squeezes out you know it's snug. Get the rag and clean up all the glue squeeze out. If you don't take care of it now, you'll have to sand it off later.

Don't be lazy and skip the glue step. It's doing as much, if not more, of holding the box together than the screws. Screwing into end grain like we're doing actually isn't a great joint. The screws are more to keep the joint tightly clamped than anything, since trying to clamp non-parallel surfaces is a pain. Don't skip the glue.



Step 12: Cutting the Tops

Sizing the tops doesn't require any fancy measurement techniques since we'll work off of the bases themselves. To carry on the labeling tradition, I made one heavier black mark on one corner of the top of each box, and then labeled the 'black mark' on the underside of each top. This way I would know that it was oriented the same direction each time I set it down to scribe a new line. The top of your box should be a perfect square, but it's always possible that it's a hair off. Best to keep track of which corner is which just to be sure. Also number the tops for the same reason. You don't want to mix them up after they're cut.

So grab the piece of stock you'll be using and flip one of your boxes onto it upside down. I used one of the leftovers from my original strips, so I had one beveled side already done.

You'll want to make these bevel cuts of the same 10 degree angle so they're flat with the sides. If you're lazy and use straight cuts people will make fun of your box. (I know I would.)

So I flushed up one edge of my top with one side of my stock, then scribed a line on the opposite side. My piece of stock was large enough that I cut one strip large enough for two tops. Remember that when you're cutting with your straight edge to take into account the bevel. Cut a scrap and remeasure if you have to.

Once you've got the width cut, set the box back down and scribe the other two sides, then cut them. Make sure you orient your box correctly each time you move it.

Repeat this process until you've made all your tops.

Step 13: Attaching the Tops

I used pocket joinery to attach the top. If you have a kit, this is a great way to go. (I'd think about completely assembling the boxes with pocket screws, actually.)

If you don't, you've got lots of options. Straight glue would work fine. Just use clamps or pile a decent amount of weight on the top. Kettlebells, paint cans, whatever you have lying around. If you feel the need to add fasteners, you can use the same screws you used on the body, predrilling and countersinking them first. If you've got a small nailer, like an 18 gauge, that would work fine as well. Make sure you use glue with whatever you're using to make things bombproof.

Before you put the tops on check to make sure the top edges of the boxes are flat. If you goofed at some point and you've got maybe one out of joint this would be a great time to knock it down with the a belt sander if you've got one.

If you do have an imperfect top and don't have any way to flatten it out, make sure you go with the glue and fastener route. Glue is great for tight joints, but it'll only fill skinny voids. If you'd got a hefty one the fasteners will help back up where the glue is weak.

My assembly was pretty quick after the pocket holes were drilled. I just ran a bead of glue around the edge, set the box on top with my marked corners aligned, and clamped it to the table top. Then I drove in all my screws, cleaned up my glue squeeze out, and that box was complete. Repeated the process for the rest and they were done in no time.

Image Notes
1. One side is raised up a few inches to make the angled side 90 degrees to the jig.

Step 14: Finishing

Once your glue is dry you've got a functional box. The only thing it really needs at this point is something grippy to make sure you don't slip off the top when you're jumping.

I've seen other box designs where people use rubber floor mats. You can usually pick those up at hardware stores, or farm stores (horse stall mats). Those would need to be cut to size and then fixed into place with something like contact cement. If you decided to go this route (and you don't fully read directions before you start) hopefully you worked the height of your mat into your calculations, or you might be off by an inch.

I've also seen adhesive backed no-slip strips that are meant to be put on stair treads. Those would also be a good choice.

I went with a textured paint, since it was what they used on the other boxes at our gym, and the gym owner still had half a gallon lying around. This is a heavy duty paint with an epoxy additive and a suspension of little silica sand particles. When it's dry it's a lot like sandpaper. I put two coats of that on my top and called it good.

I also did some other optional final finishing. I started off with my belt sander and took down a few of the sides of my tops that weren't perfect and made them flush with the sides. Then I used my orbital sander and gave a quick once over to all the edges; bottom, sides and tops. Nothing overboard, I just basically knocked off the sharp edge of the cut plywood.

I got some stencils and spray-painted the box height onto two of the sides. When that was dry, I put on a couple of coats of some polyurethane I had sitting around. When that was dry I went ahead and masked the sides and painted the texture on the top.