Tool Tip...

Shell Builder's Workbench

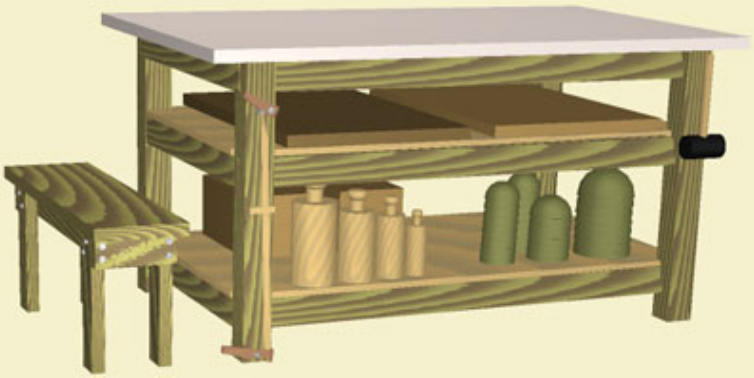


Table:

- (4) 35" long 4x4s
- (6) 60" long 2x4s
- (6) 36" long 2x4s
- (2) 72" x 42" x 3/4" thick particle board
- (1) 72" x 42" Formica laminate
- (2) 63" x 40" 1/2" plywood
- (24) 3" long 1/4" lag bolts w/washers
- (16) 1-1/2" long #8 wood screws
- (1) quart contact cement

Optional Bench:

- (4) 16" long 2x4s
- (2) 9-1/2" long 2x4s
- (2) 32" long 2x4s
- (1) 40" long 2x12
- (16) 3" long 1/4" lag bolts w/washers
- (4) 2" long 1/4" lag bolts w/washers

Introduction:

Every pyro workshop where shells are to be built should include a large, central work table. The size of this table will dictate the size of the shells that can be built in the shop, so starting with the biggest table you can comfortably fit in your shop will ensure you have the capacity to handle more ambitious projects as you develop your shell building skills.

A shell building table needs to have two key characteristics: 1) a solid frame that absorbs pounding from above and does not sway from strong pulling forces such as when spiking shells and 2) a tough surface with a smooth texture that can be easily cleaned, is waterproof, resistant to acids and solvents and is resistant to scratches and long term wear.

The workbench shown here has both these features plus a paper shelf and a built in hands-free spiking horse located conveniently along one of the sturdy table legs. The paper shelf is a nice thing to have if you work with sheets of paper instead of rolls, since it allows you to store the sheets flat while still being able to conveniently access them while you work. This table will accommodate two stacks of 36" x 24" paper, a standard size for shell building. Typically one stack would be your heavy 60-70lb kraft for case rolling while the other stack would be your lighter weight 30-40lb kraft for nosings, outer wrappers, match pipes etc.

An optional bench is included as it is useful as a seat when using the foot operated spiking horse. A long bench such as this allows you to straddle it long-ways so that you have a surface in front of you to rest shells on when spiking large shells. The bench also works well for Maltese spiking, where you sit on the strands of spiking twine as a means of controlled tension. When not in use, the bench fits nicely at the end of the table and provides a handy secondary table top for piling things on as you work, such as paste buckets, hand washing buckets, boxes of end disks and other supplies you need to access as you work.

Note that the dimensions for the table given here are about as small as you would ever want to make. You can change the dimensions to get a larger table up to a maximum of 4x8 feet in size without increasing the costs of building the table. If you have space for a larger table, then it is recommended you scale this project up because larger tables allow larger projects, multiple smaller projects or multiple people working from the same table.

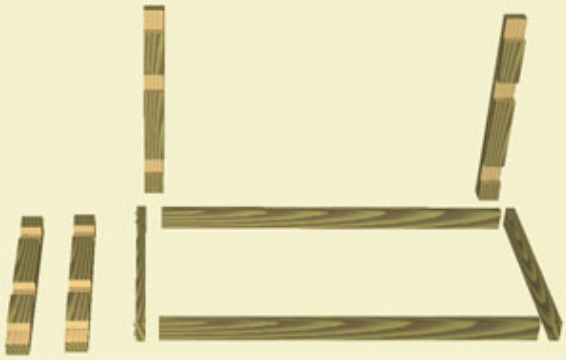


Figure 1: Each of three shelf frames are assembled on a level floor.

Figure 2: Shelf frames are fastened into nothced 4x4 corner posts using one lag screw on each joint.

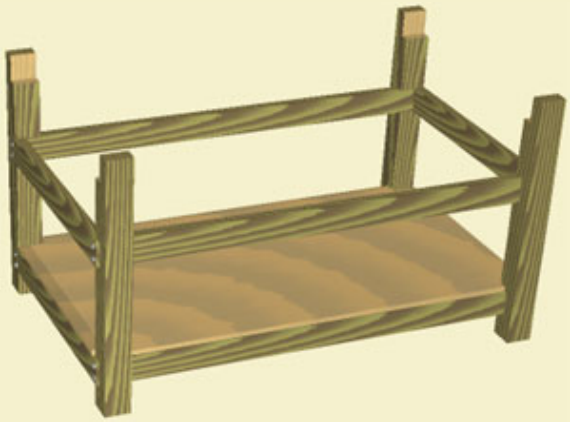
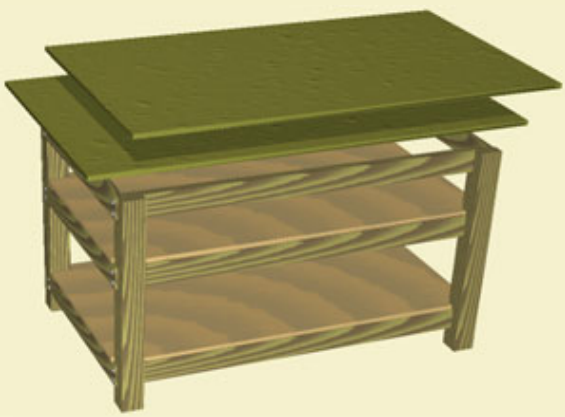


Figure 3: Each plywood shelf is put in place before adding the next frame.



Building the Table:

The first step to building the table frame is to cut the four table legs made from 4x4 posts so that they are 35" long. These will likely be made from treated outdoor lumber, since it is hard to find untreated pine in this size. The treated wood tends to be heavier and stronger anyway, so they make a good table frame. Do not try to skimp on the table legs by using smaller sized lumber, the 4x4 posts are essential in providing a sturdy pounding area when pleating canister shells or even pumping comets using a mallet.

Once the table legs are cut, you will need to make three notches in each leg, which is where the frame will intersect. The bottom notch should start 5" from the bottom end of the post, while the top notch goes right at the top end of the post. The notch for the paper shelf should start about a foot down from the top of the post. All three notches are 3-1/2" long and 1-1/2" deep, such that a 2x4 will fit snugly into them and lay flush with the surface of the post. If the 3-1/2" dimension is exceeded by much then the table may be prone to wobbling, so only cut just enough to hold the 2x4 frame members.

Using notched joints is essential in building a table which does not rock when pushed or pulled on. The notches are easier to make than you might think, and are done by making several cuts that are 1-1/2" deep and about 1/2" apart for the entire 3-1/2" length of the notch. This means you will have to make about 10 cuts per notched out area, so a skill saw, table saw or radial arm saw is almost a must-have tool. Once the parallel cuts are all made, the thin wafers of wood are knocked out using a hammer and chisel to get the desired notch. You will have to clean up the bottom of the notched area a bit using the chisel to smooth out the jagged break-off points.

Next you will assemble each of the three shelf frames on a level floor surface. Use two of the 3" long 1/4" lag screws at each end of the short pieces to hold the frame together, as seen in Figure 1.

You will want to assemble this table at its desired location, because it will be very heavy and difficult to move around. The table is assembled starting with the bottom frame, which should lock into the notched posts as seen in Figure 2. Only a single 3" long 1/4" lag screw is required at each joint, fastened from inside the frame, through the long frame members and into the post.

The plywood shelf for each frame needs to be put in place before inserting the next frame, otherwise you will not be able to get it into place. Note that each plywood shelf will need to have 3-1/2" x 1-1/2" notches cut out of each corner so that it will fit around the posts. Each shelf should be fastened to the frame using wood screws or nails prior to installing the next frame above it, otherwise it is harder to work between the frames.

The paper shelf is constructed just like the bottom shelf, as is the final top shelf. The top shelf does not get a plywood floor though, rather it is fitted with the final table top. As seen in Figure 4.

The table top needs to be at least 1-1/2" thick to provide a sturdy surface. Particleboard is the material of choice for table tops because it is not prone to warping like plywood, plus its high density is better at absorbing vibration than an equal thickness of plywood or wood boards. Particle board can ocassionaly be found in 1-1/2" thicknesses, but it is easier to just stack two standard 3/4" boards on top of each other to get the desired thickness.

The tabletop sheets are first cut to size, then the first one is screwed down onto the underlying support frame. The second sheet is then screwed down onto the first sheet. Be sure to counter sink the screws in both sheets so that the screw heads do not rise above the table surface. A #8 wood screw that is 1-1/4" long works good for this task.

To finish off the table, you will need to laminate the top surface with Formica. Formica has the best resistance to wear, acid and solvents, and is also

Figure 4: Table top is made from two sheets of 3/4" particle board screwed together and laminated with Formica.

Figure 5: Assembly of optional utility bench.

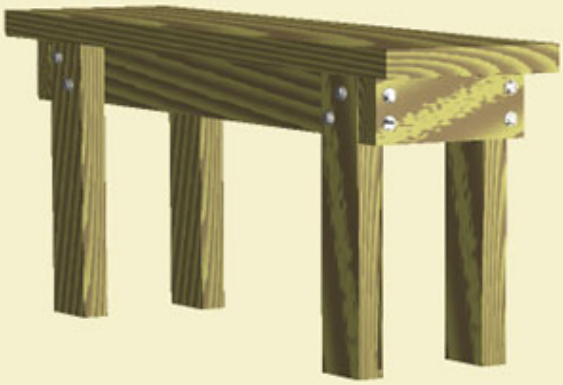


Figure 6: Assembled bench showing placement of fasteners.

relatively cheap. You will want to get a solid color, preferably a light color like white so that you can tell when it needs cleaning. Formica seems to have two common surface textures: glossy smooth and matte. The glossy type works good for removing dried paste, but it scratches more easily than the matte type. I prefer the matte finish because it is tougher and you can run a chisel over it without scratching it.

More...

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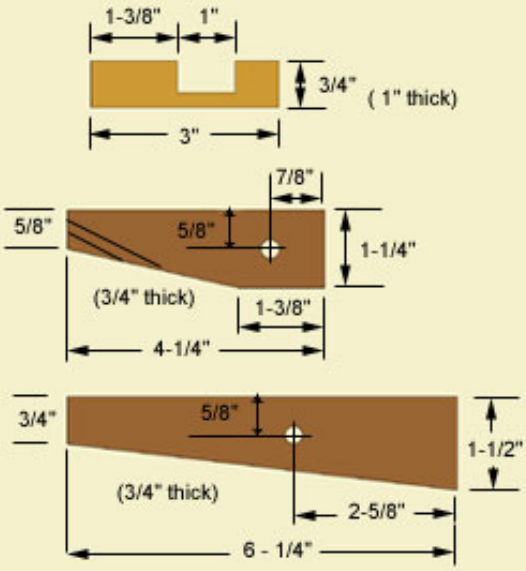

Figure 7: Dimensions for spiking fixture parts.

If you have never done laminate work, don't worry because it isn't that hard. First cut your Formica sheet so that it is slightly larger than the table top. Formica can be cut by scoring the back with a razor knife and then bending the sheet until it snaps in half on the line.

Next coat both the table top and the back of the Formica with contact cement. There are a few different types of contact cement on the market, but the original nasty smelling stuff seems to work the best. The fumes are so strong from this cement that you will probably need to wear a good respirator mask. It's pretty difficult cleaning contact cement out of a paint brush, so just use an old brush or a disposable brush and toss it when you are done.

The contact cement is allowed to dry for about 30 minutes or until it is dry to the touch. Now for the tricky part-- you have to position the sheet over the table exactly where you want it without letting it touch the table. You really need another person to help you with this step, because as soon as the sheet contacts the table it is going to stick so you don't want it to get stuck in the wrong position. After you make sure that the Formica sheet is positioned so that it will overhang all edges of the table, drop it down in place. Use a rubber mallet to pound it flat all over the surface so that it comes in full contact at all points.

The last step is to trim the overhanging Formica around the edge. If you have a router and a laminate trimmer bit, this task takes only a few minutes. If not, well... you might want to think about borrowing, renting or picking up a used router for this task. Otherwise you could try hacking it with a thin kerf Japanese saw and sanding down the jagged edge that results.

Foot Operated Spiking Fixture:
A nice addition to your workbench is the handy spiking jig shown in Figure 8. This spiking "horse" is unique in that it can be used both standing up in the traditional way and sitting down. When used standing up, the fixture is basically a sideways version of the spiking horse shown here. However, in smaller shops there may not be enough room to spool out 15 feet of twine for spiking in the traditional manner.

This side mounted spiker features a foot operated lever that actually allows you to spike a shell while sitting right in front of the device. This is ideal for space constrained shops, and may even be a preferred method of spiking once you get the hang of it.

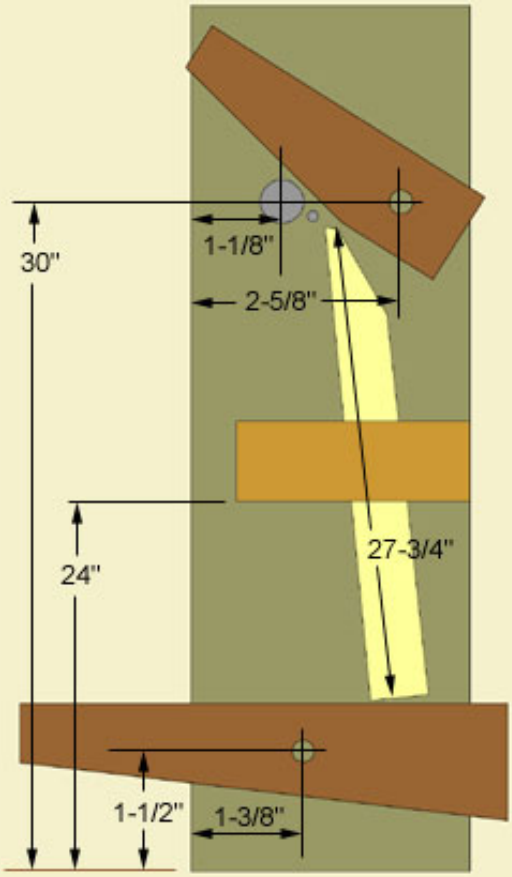

Figure 8: Placement of spiking fixture parts, located on the side of any 4x4 table leg.

Figure 9: Using a bucket and 10lb dumbell weight as a string dispensing bin.

When used sitting down, the operator presses down on the foot lever each time he needs to spool out more string. The lever pushes a rod up that takes the clamping bar pressure off the string so that it can be pulled out. The operator then releases the foot petal at the same time he pulls on the twine to bring the lever back down to lock the string in place. Enough string can be pulled out to spike a couple of turns around the shell, then the process is repeated. It is awkward to coordinate at first, but can be quite fast once you get the hang of it!

To build the spiking attachment, fabricate the two levers shown in Figure 7 from some scraps of hard wood such as oak or maple. Soft wood like pine will not work due to the weak grain, which will split apart when pulling hard on the string. Note the small 1/8" diameter hole that must be drilled at an angle through the smaller lever. This is where your twine will pass through.

The 3" long guide block can be made from pine, since it is only used to keep the push rod in place. The push rod used here is square, but a round dowel rod could easily be used as well. If using a dowel rod, you could then just drill a hole through the guide block instead of cutting out a square channel.

Figure 8 shows how the pieces are mounted onto one of the workbench legs. The 1/4" bolts used as the pivot points are not tightened all the way so that the levers can freely move. A washer is placed on the back side of each lever as a spacer so they don't rub against the table leg. Note the small nail shown behind the aluminum pin in Figure 8. This nail keeps the push rod from binding the spiking twine against the aluminum pin when lifting the lever to spool out more twine.

A small eyelet is used under the 1/2" diameter aluminum pin in order to guide the incoming twine, which can be seen in Figure 11. The larger eyelet in Figure 11 is used for Maltese style spiking, as described here.

A simple fixture for holding the twine can be made using a bucket and a 10 lb dumbbell weight as seen in Figure 9. The nice thing about this simple string bin is that it will work for any kind of twine configuration, including balls, cones or cylinders. The twine just tumbles in the container as the string is pulled off, rather than requiring a your string to have core that fits over a dispenser.

To load the dispenser, the twine is first passed through a hole in the bucket lid, then through the hole in the dumbbell weight. The twine is then closed inside the bucket and the weight placed on top to keep the bucket from lifting or falling over as the twine is pulled. This setup is then placed under the spiking horse as seen in Figure 10. The twine is then passed through the eyelet, over the top of the aluminum pin, then looped around the pin and up into the hole of the clamp lever as seen in Figure 11.

As a finishing touch to your completed shell building workbench, segments of cloth measuring tape can be stapled to the edges of your table top for quickly measuring lengths of string, paper, blackmatch and other common items, as seen in Figure 12.

Figure 10: String dispenser placed on the floor under the spiking fixture.

Another feature not shown here but common to commercial shell building tables is shielded razor fixed to the table near the spiking area, such that string can be quickly cut by pulling it into a slot that leads to a razor blade. The narrow slot is large enough to pass a string into but not a finger, for obvious safety reasons.

With the permanent spiking horse, tape measures and cutting device, the number of tools that the operator has to have on hand and manipulate is minimized and efficiency is increased. The paper shelf and storage area helps keep the most commonly used items close at hand, thus optimizing your time spent in the shop!

Figure 11: Closeup showing the spiking fixture strung and ready to use. Note the small eyelet to guide the string.

Figure 12: Measuring tape fastened to edges of table top for quick measurements.