Gluing and Clamping Strategies

Lots of tape, lots of cauls and lots of clamps make glue-ups easy

BY LON SCHLEINING

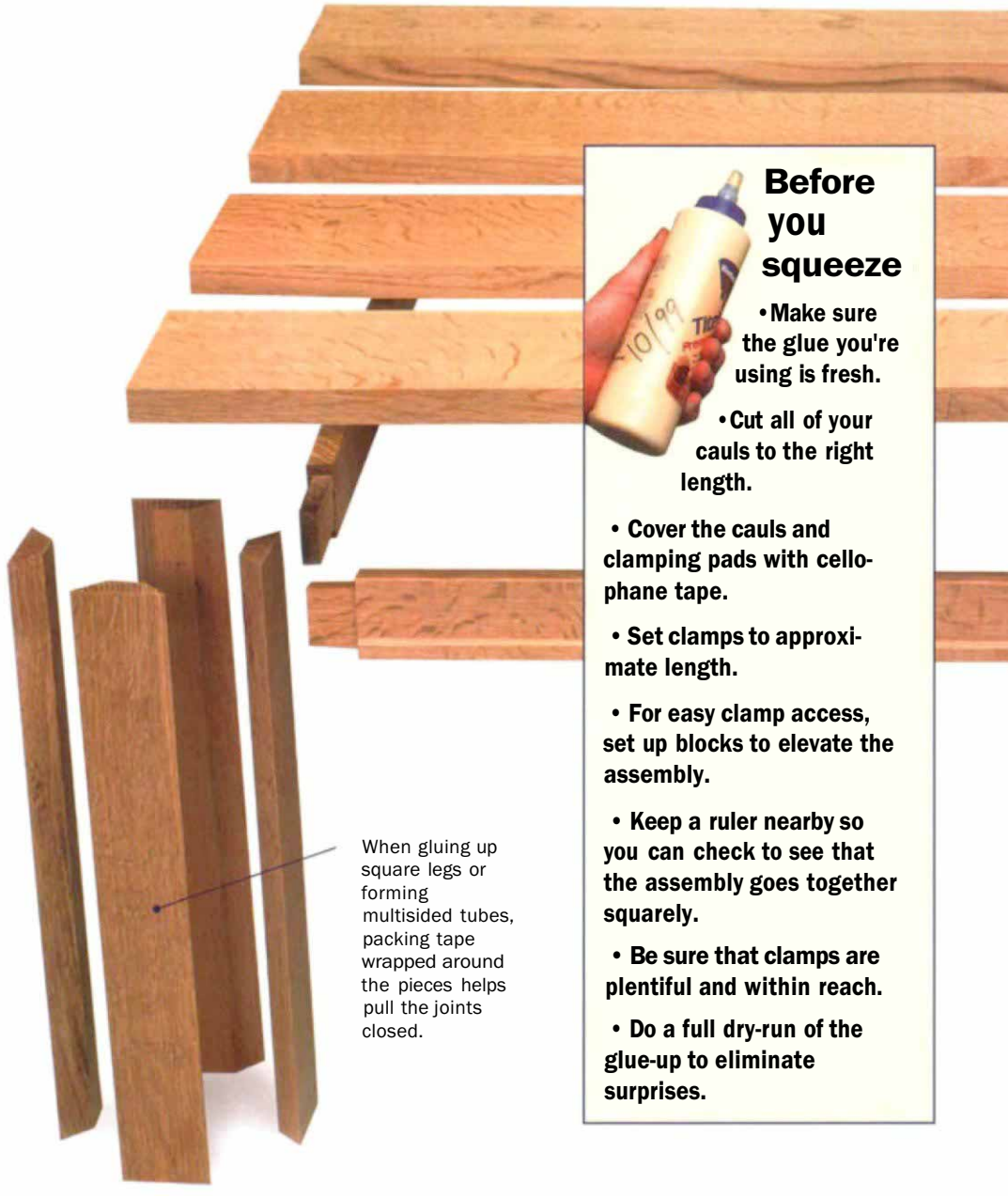
If you don't have complete confidence in your gluing systems, perhaps it's time to take a closer look at them. When I ask a group of woodworkers how many trust their glue-ups completely, very few hands pop up. Personally, I couldn't sleep if my gluing techniques were suspect. When my stairbuilding shop is really cranking, it is not unusual to go through 10 gal. or 12 gal. of glue in a year. That's not much by some standards, but it represents a fair amount of gluing for a three- or four-person shop. We've developed systems for gluing that are reliable and fast, not so much because we set out to do so, but because we have to have reliable glue joints so that we can sleep at night.

In this article I'll outline a few common gluing situations a woodworker has to tackle and provide a few tips that, hopefully, even the seasoned woodworker can use.

It's easy to test your gluing system

If a glue joint fails, the first suspect is the glue itself. But the glue is seldom the real problem. Modern glues are so effective as to be nearly foolproof. More often than not, operator error is the problem, not the glue.

You can easily test both the glue and

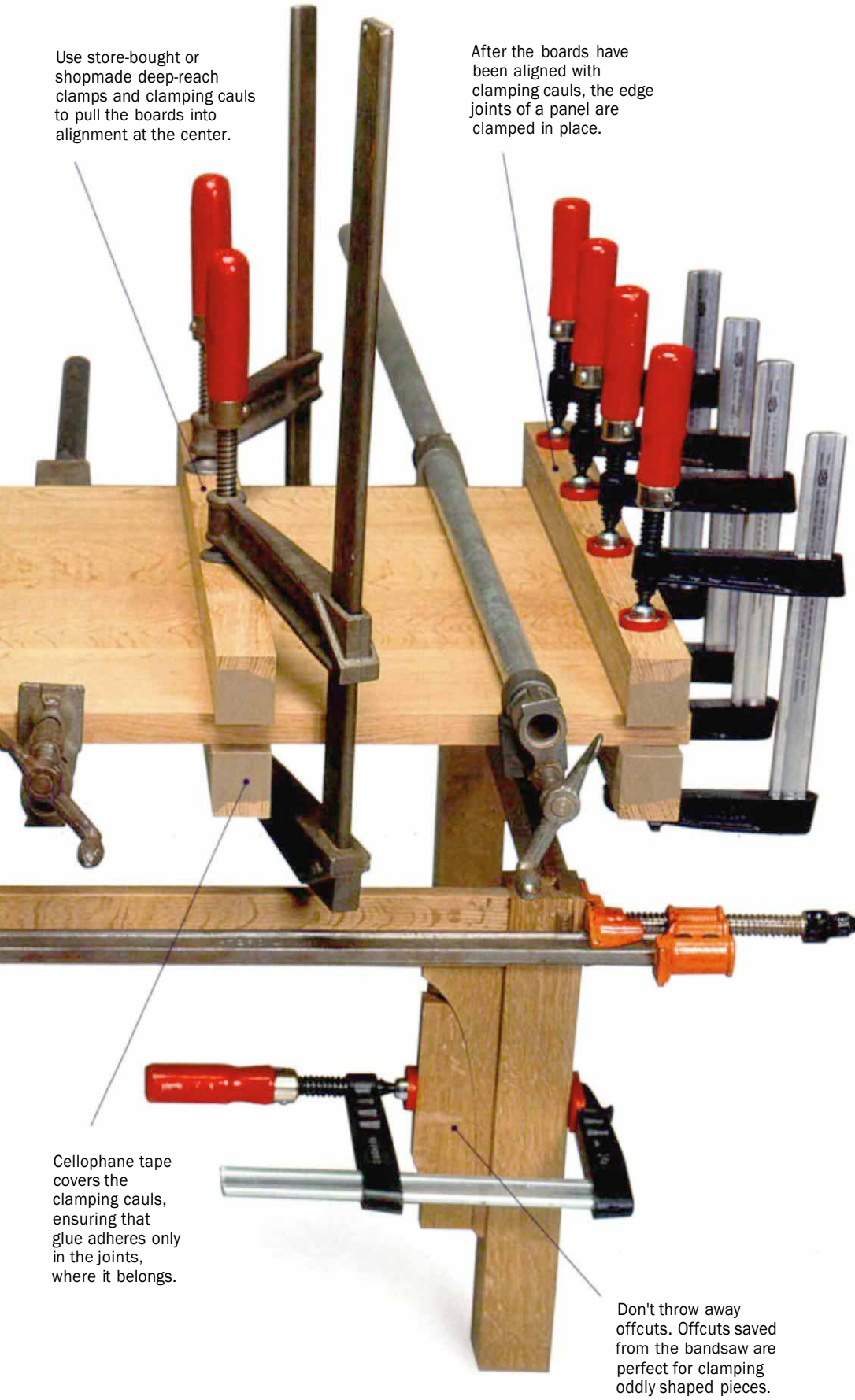


When gluing up square legs or forming multisided tubes, packing tape wrapped around the pieces helps pull the joints closed.

Before you squeeze

- Make sure the glue you're using is fresh.
- Cut all of your cauls to the right length.
- Cover the cauls and clamping pads with cellophane tape.
- Set clamps to approximate length.
- For easy clamp access, set up blocks to elevate the assembly.
- Keep a ruler nearby so you can check to see that the assembly goes together squarely.
- Be sure that clamps are plentiful and within reach.
- Do a full dry-run of the glue-up to eliminate surprises.

Photos, except where noted: Matthew Teague; this page and facing page: Michael Pekovich



your gluing system to increase your confidence. Simply glue up a sample, let it cure, then break it apart. If the sample breaks at the joint, you have a problem with the glue or the joint. If the wood does not break along the glueline, the test demonstrates that the joint is stronger than the wood, which is what you want. If necessary, keep modifying your system until you achieve satisfactory results.

Glue has a limited shelf life

On those rare occasions when the glue itself fails, either the type of glue being used is unsuitable for the job at hand or the glue has exceeded its shelf life. Remember, some glues have a very short shelf life—as little as three months in some cases. One year is more common, although it varies a great deal. One thing is certain, though: If you are still using that bottle of glue you got from Uncle Harry before he died a few years back, it's at least suspect. Do yourself a favor and buy a new batch.

I recommend buying small quantities of glue, as much as you'll likely use in a few months, from a place where the turnover of merchandise is high. That way you'll run out of glue before it gets a chance to spoil. When you bring home a new bottle, write the date on the bottle with a felt-tipped marker. Relatively speaking, glue is cheap. When it gets old, throw it away.

Many glues are susceptible to spoilage from freezing or excessive heat. It's important to keep track of temperature for both storage and actual gluing.

Different operations require different types of glue

Before you even buy a bottle of glue, read the label. Glue manufacturers want your glue-ups to be successful. They make a point to tell you exactly what you need to know right there in the fine print. If the label says the glue is unsuitable for use around moisture or under stress, no doubt they mean

just that. Lamination bending, for example, puts the glue joint under constant stress. Yellow glue, tough but flexible, is unsuitable. Epoxy or plastic resin is *a* better choice.

Some glues, the polyurethanes for example, like dampness, but most glues do not. Another reason to read the label and do some testing.

Well-fitted joints are a must

Clean, dry, well-fitted and porous edges glue well. If the mating pieces do not fit well enough without clamping pressure, perhaps the work is not yet ready for gluing. Joints ought to fit naturally without being forced by oversized clamps. If you have to force the joint together, you're asking a lot of your glue to keep it that way once the clamps are released.

Porous edges allow the glue to ooze into the pores and strengthen the joint. If you make a very slow pass over a dull jointer, chances are you'll pound the fibers of wood together instead of cleanly slicing them. This forms a glazed, nonporous surface that won't be suitable for gluing.

Cauls and dry-fitting are the keys to success

Moving too slowly may well be the most common cause of glue failure. Very quickly—especially in warm, dry weather—the surface of fresh glue will form a skin, a sort of blister. This blister prevents liquid glue from adhering to the other surface. If the glue skins over before the two mating pieces come together, you might as well call it a day. Sure, you can scrape off all of that excess glue, but the residual glue will seal the surface. The edges will need to be remilled, not just cleaned.

One sure way to reduce the time it takes to get something clamped up is to practice. Especially if the gluing operation is complex or large, a rehearsal helps ensure that you have all of the clamps you need and that all of the little blocks and pieces of masking tape are at hand. It's a good idea to dry-fit and clamp up the project entirely, as if you had spread the glue already, to make sure one last time that the pieces actually go together.

Keep in mind that the addition of glue

EDGE-GLUING

Raising the panel allows room for clamps. *With glue and damps at hand, begin by laying cauls on blocks so that it's easy to keep boards flat and in place.*

Tape is the Teflon of glue-ups. *Cellophane tape prevents the cauls from sticking to the glue joint and also provides a slick surface so that the pieces can slide together easily once pressure is applied to the cauls.*

When woodworkers edge-glue boards, it's common to see them relying on clamps not only to squeeze the joint together but also to keep the boards in alignment. These two jobs are easier if they are done separately. Shop-built clamping cauls align the boards first. Then the clamps squeeze them together.

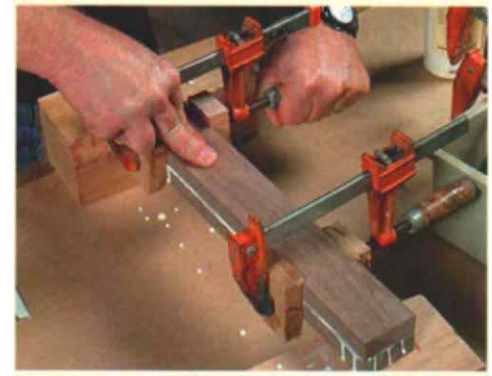
Clamping cauls are nothing more than straight, surfaced clamping blocks covered on one side with cellophane tape. Clamping the cauls from above and below pulls boards precisely flat, even if they are warped or cupped. The cauls also will hold the boards flat as they are squeezed together, even if their edges aren't milled perfectly square.

I make cauls from 8/4 square hardwood. Make sure they are

FACE-GLUING

Nothing is more frustrating than having the boards you're trying to clamp together move around when the clamps are applied. You have to unclamp the whole mess to move them back again, and by that time they're usually stuck in place. Enter our old friend, the clamping caul.

Cauls for face-gluing work just as well as they do for edge-gluing, making the job much quicker and easier. For face-gluing you need only small blocks covered with cellophane tape. First use cauls to control the alignment, then apply pressure to the glue joint. It's that simple.



Clamping face-glued joint with cauls. *First, use cauls to keep pieces aligned, then squeeze the joint together. Glue flows more easily when you start at one end and work toward the other.*

Tape and scrap make simple and effective deep-reach clamps. *Tape a spacer between two stout scrap boards and slide the assembly over the cauls. Pressure applied near the edge is transferred to the middle of the panel.*

Cauls keep edge joints aligned. *As the cauls are clamped together, the boards are pulled into perfect alignment. After the cauls have been firmly clamped in place, use bar clamps to pull the joints together.*

Bar clamps squeeze the joints together. *Apply just enough pressure to close the joints—too much pressure will force glue out. Keep the bar clamps above the surface because black marks will appear everywhere the clamps touch the wet glue.*

straight, then apply cellophane tape to one side. The tape prevents the cauls from adhering to the project and allows the gluing pieces to slide together once they're under control. Start by putting the lower cauls on blocks so you can get access to them for clamps. Then spread glue on the edges, place the boards into position and begin clamping the cauls down securely.

Start by clamping the caul in the center of the panel. Deep-reach clamps are great to have, but they're expensive. I find that a shop-built version works just as well. Just tape a few scraps of wood into a U shape and slide the assembly over the cauls (see the left photo above). With this setup you can easily clamp the center of even a 4-ft. panel. After clamping the center cauls, move toward the ends. Feel the alignment of the edges along the joints. Add a new set of cauls any place one board is above another. Once the assembly is perfectly flat, use bar clamps to squeeze the joints together. The boards slide between the cellophane-covered cauls with no trouble.

Because the joints fit very nicely, it takes only a little pressure—just enough to make contact between the two boards. Too much pressure forces the glue out of the joint.

If your test glue-up indicates that a joint is stronger than the surrounding wood already, it's hard to justify using something to strengthen it further. When you use cauls during a glue-up, most reasons for using dowels, biscuits or splines go out the window.

MITERED FRAMES

Picture frames and mitered boxes—both basically end-grain glue joints—present some of the biggest challenges for gluing and clamping. This is the perfect time for biscuit joinery; and the more biscuits you use, the better. Although clamping is tricky, I prefer plain, old bar or pipe clamps over the various gizmos on the market for clamping picture frames.

Glue up all four corners, keeping the pieces in alignment as much as possible. Set a bar clamp across each corner as close to the center of the joint as possible. Keeping the frame down on a flat surface, apply pressure very gradually to one clamp at a time, squeezing the joint into alignment as you go, back and forth until the pressure is even and the joints are aligned. Remember that light pressure is usually sufficient. Tighten just enough to keep the joint together, but stop before forcing all of the glue out of the joints.

Two biscuits make a stronger joint. *Biscuits provide ample gluing surface and keep the pieces aligned. Once clamps go on, check the diagonals to make sure everything is square.*

in the joints will change the operation a great deal. It lubricates the pieces just enough for them to move around when you don't want them to. Then the glue begins to set up and grab the pieces, holding them in place just when you want them to move. But these problems are easily solved. The key for almost every gluing situation is to use clamping cauls. Simply put, clamping cauls hold boards in alignment while other clamps close up the joints.

Clamping time—The amount of time a project has to remain clamped up depends on temperature, humidity and the complexity of the project. It's important to follow the directions on the label of the glue you're using. If the label says clamping time is an hour, give it an hour. If the label says overnight, wait until the next morning to remove the clamps.

TIP
PVC pipe cut into narrow sections works like mini spring clamps. The pressure varies by the diameter of the pipe, its thickness and the width of the section you cut off.

Remember that the temperature requirements are critical. If the label says the minimum is 50°F, that means the air, the glue and the material itself must be at least that warm. It also means that the materials must stay that temperature for the duration of the curing time. It's worth noting that a simple light bulb inside a small, insulated enclosure will keep the contents quite warm, even if the rest of the shop is cold.

Cleanup—Gluing over butcher paper or newspaper certainly saves you from having to do a great deal of cleaning up. Wearing vinyl gloves not only keeps hands clean but also helps you avoid contact with toxic chemicals.

With most of the common polyvinyl acetate (PVA) glues, under normal conditions, a project usually has to stay in the clamps about an hour. I have been accused of using too much glue, but

DOVETAIL AND BOX JOINTS

When gluing a box or drawer together, all four corners typically have to go together at the same time. This might be as simple as a small drawer or as complex as a chest carcase, but the processes are the same.

Nowhere is a rehearsal more important than with a box joint or dovetail glue-up. There is no time to fuss with cutting clamping cauls when the glue is beginning to set up. This is one instance when it's nice to have an extra set of hands.

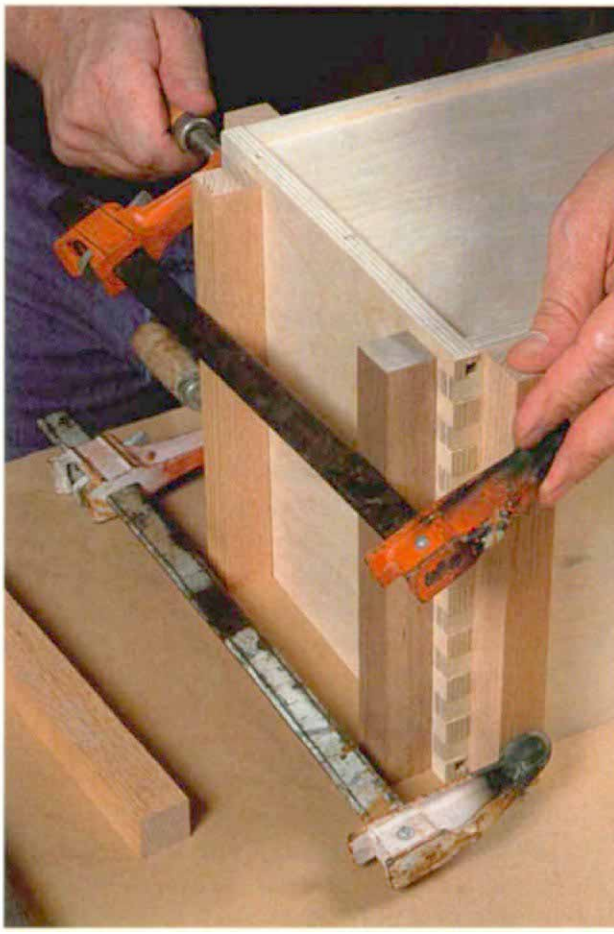
Cauls set just back from the joint on all four corners provide a clamping surface but still allow the joint to move together without interference. The cauls also help spread the clamping pressure evenly.

Apply glue to all of the surfaces and immediately press each corner together. Once all four sides are together and the joints have been hand-fit as much as possible, set the cauls in place and begin to apply light clamping pressure. As soon as the joint comes into contact, that's enough pressure. It's entirely possible to bend and permanently distort the sides of the box by applying too much clamping pressure.

The box needs to be glued up on a flat surface. To be sure there's no twist in the box, see if it rocks. If it does rock, use clamps to apply downward pressure on the high sides until you bring it back into alignment.

To check that the box is square, and while the glue is still soft, measure diagonally across the corners. If the box is square, the measurements should be the same. If it's slightly out of square, a single bar clamp, placed diagonally, will bring it square. Checking the squareness by measuring the diagonals is usually preferable to using a square because it's faster and more accurate, especially if excessive clamping pressure has pulled a curve into the sides of the box.

Masking tape keeps your project clean. *Apply glue sparingly to the joint. With clamps handy and everything in place, apply masking tape along the inside of the joint. The tape eliminates the need to clean excess glue out of the inside of the box.*



Clamping cauls spread the pressure. *Dovetail and box joints are squeezed together from both directions, so make sure the cauls don't cover the joint. Cauls placed right next to the joint evenly distribute the pressure of the clamps.*

MITERED BOXES OF ANY SIZE

Packing tape binds the box. *Stranded tape with imbedded fiber has tremendous strength. Strips of tape are laid on the face side of the box, keeping everything in place.*

Mitered parts roll up to form a box. *After the pieces have been turned over, glue is spread in the miters, and the box is rolled up.*

Shopmade blocks allow opposing clamps. *Shop-built clamp blocks provide a perpendicular pad for the clamps. As opposing clamps are tightened, the box is pulled square.*

Mitered boxes are quite easy to glue up by using shop-built blocks, stranded packing tape and a bit of patience. Lay the four pieces faceup along the bench, and run the tape every few inches across the faces of the boards. Turn the assembly over, spread glue in the joints and roll it up like a tool pouch. It sounds simple, and it is.

To ensure that the box remains square, clamp the box diagonally with the help of clamping blocks. The blocks are made of 2x2 stock and have a mitered groove on one side (see the right photo above). By placing the clamps opposite each other, you can easily check along the box with a square to see that everything is in place. It's easy to make adjustments accordingly.

Packing tape makes clamping even a complex shape like an octagon very straightforward. Start with the pieces faceup on the bench. Using the same technique as the mitered box, apply the tape across the faces every few inches, leaving an overlap to pull the last joint together.

Turn the assembly over, spread glue and roll it up, pulling the tape ends tight. Check to make sure the distance between faces is even all around so the assembly will be square and consistent.

MORTISE-AND-TENON DOORS

A little glue goes a long way. *Apply glue only deep into the mortise and on the end of the tenon to keep squeeze-out to a minimum.*

More often than not, well-fitted mortise-and-tenon joints align themselves, but you still have to keep everything square and flat. The center panels, if solid wood, need to float so they can expand and contract freely. For ¼-in. panels, little rubber pellets, called space balls, can be placed in the dadoes that accept the panel. These space balls keep the panel centered and securely held. On wider panels I trim pieces of cork to fit in the groove and never apply glue to the panel.

Frame-and-panel doors using cope-and-stick joints usually are glued up without dowels. Considering the amount of use a door might get, it's worth placing a couple of dowels in the corners. The dowels should fit loosely in the holes to allow a bit of room for glue and expansion.

If the cope-and-stick joint is not-quite perfect, cauls are an easy way to keep the pieces flat and aligned. It's important to make sure the door is flat and square, adjusting it as you would a box.

Let the panels float

Cork cushions keep the panel centered but allow it to expand and contract. No glue is applied to the floating panel. Use a utility knife to cut cork slightly oversized. Space balls—perfect for ¼-in. dadoes—are hard rubber pellets designed to do the same job as cork (available from louis and company: 800-422-4389).

because scraping glue before it hardens is so simply done, I see no need to skimp on glue.

Along a glueline, I want to see at least a thin bead of glue. When the glue has set up in the joints and the clamps are removed, the excess glue should still be soft and pliable. This is the perfect time to remove the excess with a scraper. I never wipe up glue with a wet rag, because the added water will raise the grain and the finished surface will be uneven.

My favorite glue-scraping tool is a small hook scraper, available in the paint section of almost any paint or hardware store. With a good edge on it, a small hook scraper will remove excess glue while it's still soft, thus saving hours of sanding. If you wait until the glue has hardened to scrape off the excess, it is very likely, especially with softer woods like mahogany, that you'll tear chunks out of the surface.

TIP
Use inner-tube strips to hold laminae together for bending. The strips hold firmly yet allow the bundle to flex as it bends.

I do my best to use a simple and quick system for gluing. Once the glue has been spread, I use every trick I know to speed it along. I always follow the manufacturer's instructions to the letter. When in doubt, I call the manufacturer on the phone. Manufacturers have always seemed more than happy to discuss individual situations. I have a habit of testing my glue joints constantly. If I trim a glue-up to length, I take the scrap piece and snap it over the corner of the bench to make sure the joint is reliable. I am always happiest when it breaks ½ in. away from the glueline. Your confidence builds with every test. If you adopt this habit, you'll soon be confident in the boards you glue together. You'll sleep better, too. □

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COOPERED PANELS

A simple form keeps the curve uniform. *Nowhere is the caul system more useful than with gluing up a coopered panel. By making a female caul, the staves are kept in alignment. Holes in the form's ribs serve as clamp pockets. A little tape keeps the staves from being glued to the form.*

A simple form for clamping curved shapes is easy to make and extends the clamping-caul principle to include shapes that are not flat. The idea is the same.

With this form, the alignment of the staves is easy. The form sits flat on bench blocks to make sure there is no twist. Use cellophane tape to prevent the form from being glued to the project and to allow the staves to slide. Drill holes in the ribs to serve as clamp pockets for the clamps on each side.

Align the pieces, in the case of a coopered door or chest lid. Lay all of the staves in the curve of the form. Then, and only then, clamp the staves together to force the glue joints to close up. Gently apply pressure to one clamp at a time until the joints close.

Clamp pressure must be distributed evenly. *Clamps grab onto the pockets drilled into the form's ribs, allowing the author to apply even pressure with opposing clamps.*

Hook scraper removes excess glue. *A hook scraper, filed razor sharp, quickly removes excess glue once it has blistered over but before it hardens.*