



Getting the most out of clamps—Bernie Maas uses both proven traditional clamping methods and some unconventional ones. The glue-up on the right is clamped with Hargrave I-bar clamps

and several Wetzler bar clamps. With student Ron Walker holding the left panel flat, Maas snugs up a pair of Jorgensen double-pipe clamps, which sandwich the panel two ways.

Clamps in the Woodshop

A look at their variety, construction and common uses

by Bernie Maas



A woodworker can never have too many clamps. But having lots of clamps doesn't solve all your glue-up and assembly problems. Knowing which clamps to have, as well as how to use each to its best advantage, is more valuable. I've used most types of clamps, both in my university workshop and in my home shop. I've compared the old standbys, like the double pipe clamps shown in the photo on the facing page, to many of the special-purpose clamps on the market (see the story on p. 57). I've checked out the differences in construction and the features that make certain clamps excel at certain tasks. I've also stumbled onto techniques that make clamps easier or more effective to use.

Instead of looking at every clamp type, I've presented the ones I think are most useful for furnituremaking—the everyday 'work-horses, such as bar clamps, hand screws and spring clamps (see the photo at right). Though clamps make great helping hands for jigs and hold-downs, I won't talk about those applications here (see "Toggle Clamps," *FWW* #96, p. 74). I also won't include inexpensive C-clamps. While *we* all use them to some extent, I don't feel they're well-suited for woodworking. That's because when you overtighten an inexpensive C-clamp, it will often spring out of line, making it worthless. There are better clamps that will open wider, deflect less and won't take forever to crank into position.

Choosing clamps for the shop

Compared to machinery, clamps don't rely on high technology to operate. For most models, you twist a handle or turn a crank, and the jaws of the clamp put the squeeze on your work.

How they're made—To help pick clamps, I consider what they're made of and what features they offer. Five questions are worth asking: First, how heavy and bulky is the clamp? I like the body to be stiff so that it doesn't deflect, but light so that it's easy to handle. Hard-steel bodies deflect less than soft-steel ones. And because hard-steel bodies won't dent, they won't influence the travel mechanism. On aluminum and mild-steel clamps, ding marks can prevent the jaw from sliding easily and from aligning properly. Second, what shape is the handle or crank? It should be easy to grip, yet provide maximum leverage. Tiny handles that dig into your palms or strain your fingers while turning will quickly turn you off. Third, how quickly and how far does the jaw travel? I prefer square, Acme threads, like those used in bench-vice screws, over fine, machinist threads. I also like the screw to have at least 3 in. of lead. Fourth, how does the clamp engage? For easy one-handed release, I prefer clamps to have friction-fit, spring-clutch or cam-actuated jaws (see the top photo on p. 56). Fifth, what are the jaws and pads like? I've found clamps that have their jaws pinned to their bodies and ball-joint pad connections, like Wetzler bar clamps, are strong, contact the work solidly and offer wide pivot action. Jaws and pads that are tack-welded, staked or crimped on just don't hold up. I also like models that have plastic or rubber protectors, which keep the jaws or pads from leaving stains.

Service and storage—For all-metal clamps, you should clean them, and add a drop of oil from time to time. Lubricating the threads will make cranking easier. More importantly, though, you should oil the screw's ball joint (without getting oil on the pad). A rusty or dry joint will cause the pad to twist into your work, leaving disc-shaped dings. For my classroom, it's important that the clamps be built to last through heavy use by students, including dropping, glue removal with scrapers and solvents, improper alignment and overtightening. The clamps must also store easily and compactly on a rack or in a drawer. For these demanding reasons, cost comparison rarely dictates which clamps I buy.



Older style clamps still work well—Spring clamps, used here by student Leisa Goerlich to clasp a cleat, are one type the author uses regularly. Two others on the bench are Wetzler bar clamps (laminating walnut) and a hand screw clamping an oak drawerfront.

Choosing clamps for the task

Picking which clamp to use for a given job usually boils down to size. Bigger jobs require larger and more rigid clamps. But, of course, clamp sizes do overlap. Nearly 90% of all the clamping I do can be handled by one of the following clamps.

Pipe clamps and bar clamps—For gluing up a panel over 24 in. wide, I use pipe clamps or bar clamps that have an I-beam cross section. I-bar clamps (made by Hargrave and the Colt Clamp Co.) are usually available in 1-ft. increments in lengths from 1 ft. up to 8 ft. I-bar clamps are rigid, won't deflect under load and are pricey. If I-bar clamps are like Cadillacs, pipe clamps are more like Chevrolets. They get the job done and are affordable, especially if you buy your own pipe. Plumbing supplyhouses usually have the best prices for pipe, but check your hardware store and local yard sales for odd-length cutoffs. One advantage of pipe clamps is you can couple sections together to make a clamp as long as you like. I've made them long enough to yank a deck together.

For medium-sized work (say, 18 in. wide), I use regular bar clamps, either Wetzler or Jorgensen. Both brands offer a range of throat depths. I prefer Wetzlers for deep-reach jobs because they have an easy-to-adjust sliding jaw on the bottom. I opt for wooden handles on bar clamps rather than T-handles. Wooden handles are comfortable and easy to work in tight places.

Hand screws and spring clamps—For small work (8 in. or less), hand screws or spring clamps usually do the trick, although I'll use small bar clamps if I need extra force. Hand screws come in all sizes, and their jaws can be adjusted parallel or flared. Because the jaws are wooden, you don't need pads to protect your work. In addition, these clamps can be positioned so that the jaws distribute pressure over a large area. To open the jaws of a hand screw quickly, grasp the two handles, and move them like you're peddling a bicycle. Spring clamps also come in a host of sizes. The jaws, which work like clothespins, come either as bare metal or



How clamps clamp—Here's a sampling of clamp jaws (from upper left down): Jet Clamp (turn-screw pivot); Quick-Grip (trigger clutch); Bessey's Klemmy (cam lever) and K-Body (friction slide). For handles, Maas likes Wetzler's wooden grip (top center) and Jorgensen's crank (bottom right) but not the C clamp's staked rod.



Plastic clamps suit delicate jobs. The rubber pads of Quick-Grip's spring clamp (left) are gentle on work. BTM's lightweight polymer clamps (top) resist rust and solvents. Their miniclamp and Testfabric's clear acrylic clamp are good for restorations.

sheathed in plastic. Spring clamps make a great third hand when steady, moderate pressure is needed (see the photo on p. 55).

Miscellaneous clamps and accessories—There's a slew of specialty clamps that have features for specific jobs, such as corner, strap and edge clamps. There are also tiny clamps suitable for model making, quick-gripping clamps for repair work and disassembly (see *FWW* #102, p. 112), and plastic clamps, which resist rust and solvents (see the bottom photo). In addition, accessories are available to improve the performance of your basic-duty clamps, including replacement jaws and odd-angle fixtures (see the photo on p. 59).

Using clamps

You should plan your clamping strategy before you start assembly. For instance, are you looking to clasp two or more pieces together, or do you want to hold something temporarily? Will you need spacers, cauls, pads? I like to underlay clamps with waxed paper. This makes cleaning the clamps easier, and it protects the work from stains. No matter the clamping situation, dry-assemble your pieces to check their fit before you glue them. Also, keep a mallet, a screwdriver and a putty knife handy. You never know when you'll need to tap something into line, release a sticky spring clutch or scrape off a hardened gob of glue.

Aim and pressure—Clamping pressure should run through the center of a clamp's pad, straight down the axis of the screw and into the jaw. For even pressure and the best glue bond, the beam of force should pass through the center of the pieces you're joining. If the aim is skewed, your panel may buckle or bow, or your lamination may cock. This causes joints to be out of square and prevents good bond. To minimize deflection, orient the clamps' axes as close as possible to the center of the mating parts. Also, keep the jaws of the clamps close to the work. This reduces jaw distortion and the amount that the screw extends. You can also use blocks of wood to extend the reach of the clamp. The blocks can telegraph the force to where it is needed.

When it's finally time to apply pressure, go easy. If you're using sturdy clamps, it's easy to overtighten things. Overtightening can crack a clamp's clutch plate, starve (and thus weaken) a glue joint, or mash the outer edges of your work. Too much force can also make a panel look like a washboard or a section of a barrel. You want to apply just enough pressure to draw the boards together and force little beads of glue out of the joints. For a detailed look at proper clamping pressures, see R. Bruce Hoadley's book *Understanding Wood*, p. 178 (The Taunton Press).

Laminating stock—If you're laminating pieces for a bowl, it's nearly impossible to keep them aligned as you apply the clamps. Everything likes to slide on the glue. To minimize slippage, plant a clamp at each corner, and tighten down alternately as if you were replacing an engine head gasket, torquing a bit at a time, from corner to opposite corner. Then run a row of clamps along the two outside edges using as many clamps as you can spare (see the photo on p. 55). Don't run one row of clamps down the center. The moisture from the glue will be sucked up by the laminates, causing the edges to curl away from each other. The resulting glue clots, encrusted in the gaps, will prevent any remedial clamping action. Basically, you'll end up with firewood.

Gluing up panels—When I align a panel for glue-up, I use splines, biscuits or dowels (for more on this, see Jim Tolpin's article on p. 74 in this issue). I place pipe clamps at about 15-in. inter-

Specialty clamps offer wide options

To accompany your standby clamps, you may want to equip your shop with an assortment of specialty clamps. Although I couldn't evaluate all the models, I've included examples of common varieties—a few I'd recommend, others I was disappointed with. Nearly all specialty clamps operate similarly to the following types.

Panel clamps: After trying out the two panel clamps shown in the top photo, I decided that they weren't really serious additions to a shop. Made by Veritas and Mark, the units had Lilliputian handles and short, anemic lead-screws, which made slow work out of what should have been a rapid panel glue-up. Before I could even use the Mark, I tediously had to assembly greasy, small parts. For the Veritas, I had to make cauls, which meant drilling and reaming out three dozen holes. For both clamps, I had to find and add shims to make up the space to the panels. Next I underlaid the joints with waxed paper, so the clamp wouldn't get glued to the wood. Finally, I had to pull my reliable Wetzlers off the rack because the panel clamps didn't flatten the work. Surprisingly, the simple old-time pinch dogs made by Osborne could pull boards together (although only at the fends). To use the dogs, just hammer them into the end grain over each joint.

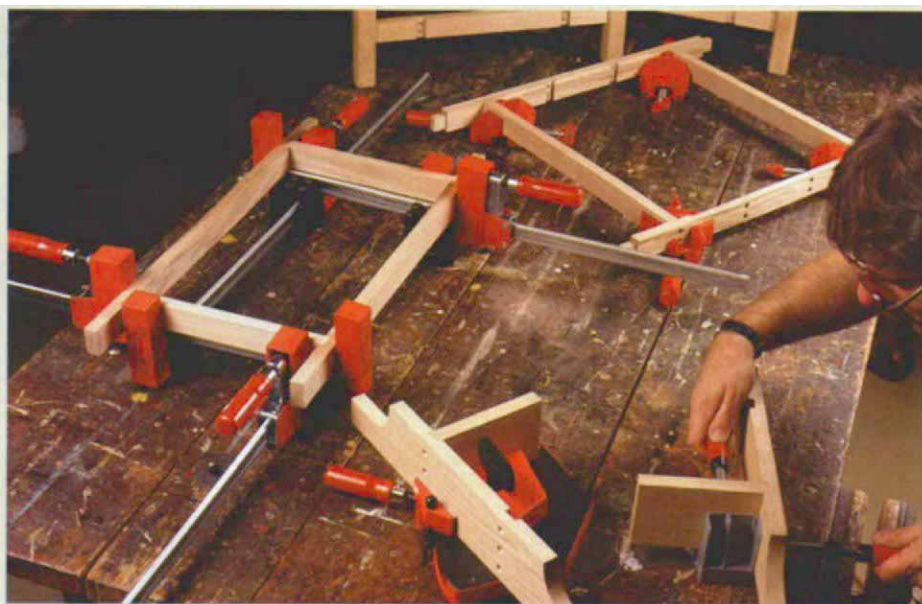
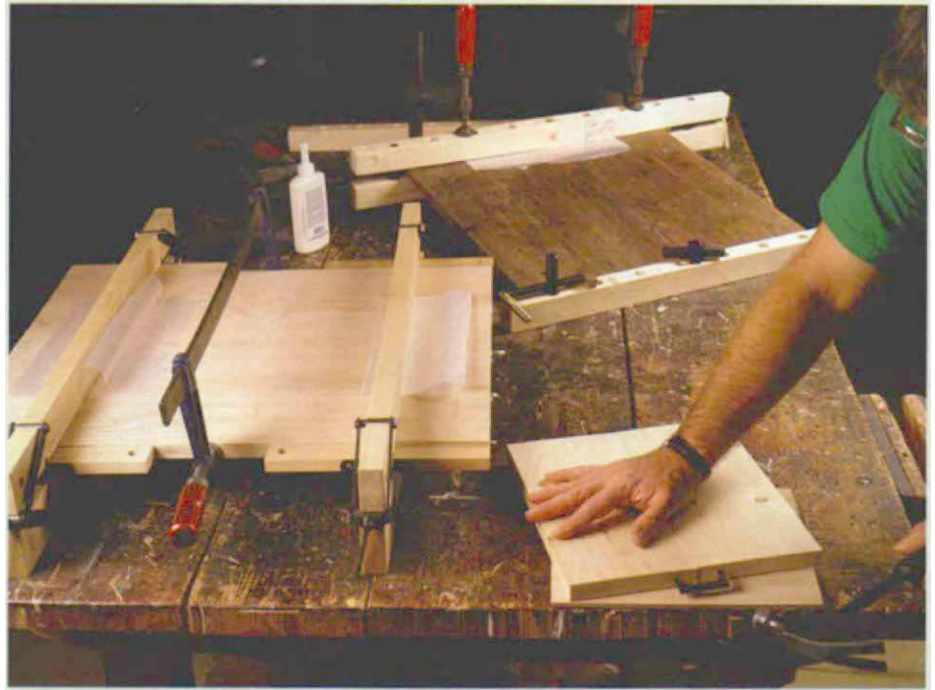
Frame clamps: If you put together lots of picture or other frames, these are a real time-saver. I looked at Bessey's KP framing system (see the photo below), which deserves a four-star rating in my book. It consists of four deep-throat, length-adjustable

(K-body) clamps and a set of four plastic support blocks. The blocks have two pairs of slots for lining up the clamp (one slot is for 90° corners, the other allows a piece to fly past the corner). Although four hands are better than two for setup, the KP system works quicker and more effectively than individual clamps.

Corner clamps: Usually lightly built, these clamps are designed to bring two pieces together at right angles, as shown in the bottom photo. I find they work best aligning corner subassemblies for glue-up. I then use regular bar or pipe clamps to assemble the whole carcass. Don't count on corner clamps to exert much pressure. They're really for alignment only. I looked at three different models. Bessey's Angle Clamp is

well-made and has a generous grip. Its single-hand operation beats the pants off my old Stanley 404's. Gross Stabil's Multi-Spanner also gets a thumbs up. Although it's dual-handled, this clamp has a generous depth capacity of just under 2½ in. And an extra set of screw sockets lets you use the clamp for 1-in. or 2-in. stock. Bessey's miter clamp is made oversized and mostly of plastic; the metal unit offered more versatility.

Strap clamps: Often called web or band clamps, strap clamps are useful when you need to exert circumferential or radial pressure. Stave construction and polygonal assembly are two cases where strap clamps are handy (see the top right photo on the following page). A few units use metal banding, but I prefer to use fabric straps be-



Pinch dogs and bar clamps outperform panel clamps (photo above). After trying the three clamps shown, Maas preferred to hammer in the simple Osborne pinch dogs (right). Both the Mark clamp (holding the left panel) and the Veritas clamp (reassembling the antique tabletop in the rear) required lots of setup and fiddling. Maas still had to use standard bar clamps to get those panels flat and tight.

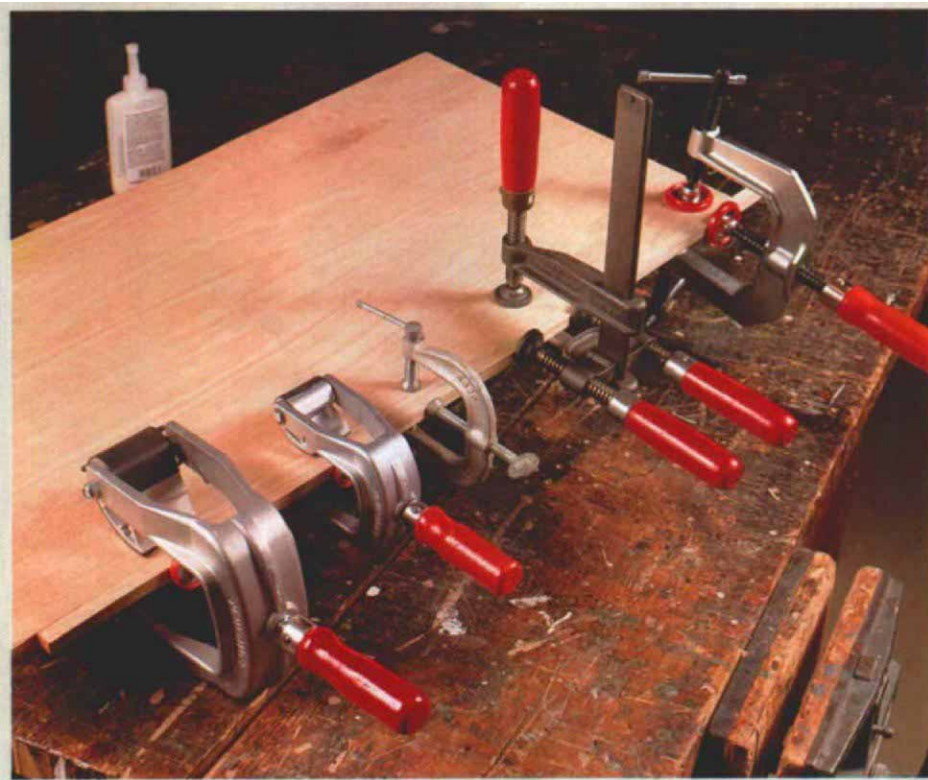
Frame-and-corner clamps tackle casework (photo left) like joining assemblies in this oak television stand (the legs are in back). The Bessey K-Body (far left) proved the best for squaring and holding a frame. Two other Bessey models, angle and miter clamps (front center and rear) worked well at clamping dado joints. Here, Maas tightens a T-shaped assembly using a Gross Stabil Multi-Spanner clamp (front right).

cause of their flexibility. My professional-grade Jorgensen model has a cast-iron winder and pre-shrunk canvas webbing. Bessey's newcomer (Poly-Angle strap clamp) uses a nylon strap, a sheet-metal and plastic winder and plastic corner pads that pinpoint pressure at the joint. Unfortunately, the clamp is lightweight. I don't predict its longevity in an active shop. The Bessey also comes with hold-downs. But oddly, they won't open up wide enough to fit a typical 6/4 benchtop.

Edge clamps: Edge clamps are a real asset when you're edge-banding plywood (see the top left photo). Usually you place these clamps from 3 in. to 6 in. apart to distribute

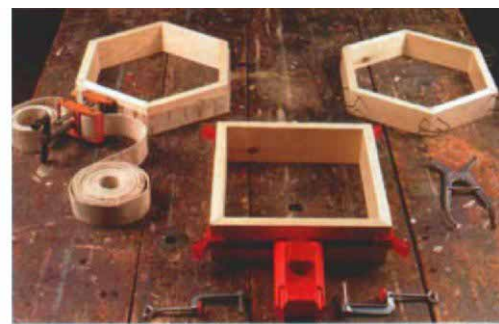
the pressure. I compared several edge clamps. The pricey, German-made Kantenfix (the small size lists at \$49) has the best jaws. They're cam-actuated and surfaced with non-skid rubber. The clamp is self-centering and snaps quickly into position, and its powerful springs grab onto a board as its beefy screw rams the edging home. Wetzler offers an edge-clamp add-on to go with two bar clamps. For pure cranking power, you can't beat this one. Gross Stabil, Bessey and Jorgensen Pony offer three-way edge clamps. The Gross Stabil and the Bessey were heftier than the Pony, whose pads were only lightly staked on. With all three models, the setting and resetting of three screws per clamp does get tiresome.

Miter clamps: Miter clamps are good for precise joint alignment, whether your components are straight or curved (see the bottom photo). I put a couple of versions through their paces. Top billing goes to the Wetzler double-clamp with its superior cranking power. The Gross Stabil miter clamp is an add-on that joins two of their bar clamps. It works on the same principle as the Wetzler, but the Wetzler is more heavy-duty. For easy, speedy setup and astonishing grip, an award should go to Ulmia's miter-joint clips. These clips are inexpensive, U-shaped spring-steel rings that get set into place with a spreader tool (see the top right photo). Their only drawback is the small dings left by the pointed tips. —B.M.

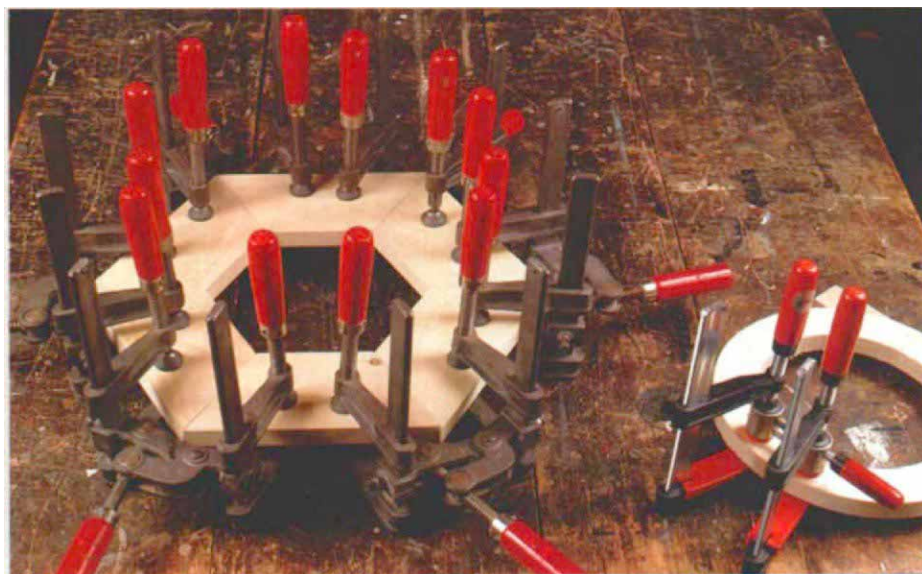


Clamps for edge-banding—Edge clamps (photo above) are lined up here for an end run on plywood. From left to right, the models are two sizes of Kantenfix (carried by Tape & Tools), Jorgensen Pony, Wetzler and Bessey three-way edge clamps. The Kantenfix models were the quickest to use, and the Wetzlers exerted the most force.

Miter clamps give precise alignment—This maze of Wetzler clamps (photo right) nicely tightens up a hexagonal frame. The Gross Stabil miter clamp (far right) was easy to install on a circular frame. To work both varieties, first clamp the two portions of the workpiece; then snug the screw that bridges the joint.



Clamping a many-sided glue-up—Strap clamps (photo above) are good for joining polygonal frames and stave-constructed projects. But for many applications, you can also apply Ulmia clip rings (top right) with a spreader tool (bottom right). The Jorgensen strap clamp (left) uses a canvas strap. The Bessey Poly-Angle strap clamp (center) comes with plastic cornerpads.



vals; half go over the panel, and half go under it to prevent buckling. With the panel glued and loosely assembled, I lay it gently on the bottom clamps. Then I install the upper clamps to complete the sandwich. For seamless panel joints, the boards' edges must be straight, and the corners must remain crisp. So I try not to smack the boards into line with a hammer. I snug the clamps slowly and evenly. Because I always make the panel oversized, it's easy to remove clamping dents when I trim the panel to size later. To remove a dent I didn't account for (assuming the wood fibers have not been severed), I lay a wet cloth over the damaged area and then pass a steam iron over it.

Flattening misaligned joints—The joints of a panel will often shift as you're clamping. Squashing the panel down with a gang of bar clamps will often not be enough. One way to flatten the seams is to straddle the junctions at the edges with hand screws. Another way to flatten joints is to use stiff, straight strips, or cauls, of wood or metal. I simply make a sandwich of the cauls and panel, and then I apply hand screws or bar clamps (see the photo on p. 54). The cauls act like joists because once set on edge, they remain rigid, so they keep the boards from flexing. If you need an extra pair of hands while you're doing this, dab on some hot-melt glue to tack the cauls in place.

If you want consistently flat panels, invest in several double-bar clamps. Jorgensen offers their #53 model for this and Hartford Clamp Co. offers their #3. Double-bar clamps are actually tandem pipe clamps; one pipe is placed above the panel, and the other smacks up, kitty-corner, to its underside. This arrangement keeps boards dead flat, especially if you have someone (I use one of my burlier students) stand on the bars as the clamps are drawn to the work, as shown in the photo on p. 54.

Squaring up carcasses—Glued-up casework can end up looking like diamonds rather than rectangles. This is because clamping pressure can force the case members to bow, which leaves you with no place to check with your framing square. For these situations, I lay the partially clamped carcass face down on a bench or the shop floor. Then I measure the diagonals. Next I make up a pair of V-blocks and place them on the corners of the longest diagonal. I run a bar clamp between the corners and gently draw them a bit beyond where I want them. If the case is severely out of square, I increase pressure gradually over several hours. This lets the wood fibers and whatever elasticity left in the glue give a bit. After I back off the clamps (with the back of the carcass in place), spring back sets everything square.

Bernie Maas teaches computer-aided design and woodworking at Edinboro University of Pennsylvania.

Video: Surveying clamps



Over the past 35 years, Bernie Maas has had a chance to see which clamps work and which ones don't. He's also come up with ways to correct misaligned work using clamps. To see Bernie Maas comparing different models and demonstrating common clamping techniques, order "Clampvid," a 28-minute video cassette (VHS) companion to this article. The tape is available for \$10. Order #011036, The Taunton Press, PO Box 5506, Newtown, Conn. 06470, or call (203) 426-8171.

—Alec Waters, assistant editor



Accessories can improve your clamping range. Clockwise from left: Mastodon's Jaw Extenders; Brink & Cotton's Stand-Up pads, hand-screw adapter tips that fit pocket holes to tighten joints; E-ZHold adapters that add a trigger to a Jorgensen bar clamp; and Bessey's Irregular-Angle set for clamping at odd angles.

Sources of supply.

Clamps

Bessey (American Clamping Corp., PO Box 399, Batavia, NY 14021; 800-828-1004)

BTM Corp., 300 Davis Road, Marysville, MI 48040; (800) 878-1900

Colt Clamp Co. Inc., 33 Swan St., Batavia, NY 14020-3245; (800) 536-8420

Gross Stabil Corp., 333 Race St., PO Box 368, Coldwater, MI 49036; (800) 671-0838

Hargrave (Warren Tool Group, PO Box 286, Garrettsville, OH 44231; 800-543-3224)

Hartford Clamp Co., 466 Park Ave., PO Box 280131, E. Hartford, CT 06128; (203) 528-1708

Jet Clamp (Advanced Machinery Imports Ltd., PO Box 312, New Castle, DE 19720; 800-648-4264)

Jorgensen/Pony (Adjustable Clamp Co., 417 N. Ashland Ave., Chicago, IL 60622; 312-666-0640)

Kantenfix (Tapes & Tools, PO Box 1195, High Point, NC 27261; 910-884-5371)

Mark Products, PO Box 46143, Bedford, OH 44146; (216) 232-1281

Osborne (Garrett Wade Tool Co., 161 Avenue of the Americas, New York, NY 10013; 800-221-2942)

Quick-Grip (American Tool Co., 301 S. 13th St., Lincoln, NE 68508; 402-435-3300)

Testfabrics Inc., PO Box 62, Sweet Valley, PA 18656; (717) 256-3132

Ulmia (Garrett Wade Tool Co., 161 Avenue of the Americas, New York, NY 10013; 800-221-2942)

Veritas Tools Inc., PO Box 1720, Ogdensburg, NY 13669; (800) 667-2986

Wetder Clamp, Route 611, PO Box 175, Mt. Bethel, PA 18343; (800) 451-1852

Accessories

Adapter Tips (Adjustable Clamp Co., 417 N. Ashland Ave., Chicago, IL 60622; 312-666-0640)

Brink & Cotton (Warren Tool Group, PO Box 286, Garrettsville, OH 44231; 800-543-3224)

E-Z Hold trigger adapters (Adjustable Clamp Co., 417 N. Ashland Ave., Chicago, IL 60622; 312-666-0640)

Mastodon, Wade Manufacturing Co., 1040 Balboa St., San Francisco, CA 94118; (415) 386-0310

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