A Stair Builder's Tool Kit

For short cash and a little effort, you'll save lots of time on your next handrail installation

by Bruce Abernathy

My career as a stair builder got its start thanks in large part to Hurricane Andrew, which prompted stricter structural requirements in the Florida Building Code that in turn led to wider acceptance of two-story homes. These homes needed stairs, of course, and I followed the book as I learned how to build them. But it seemed to me that most handrail tasks — determining rail height, laying out balusters, and cutting easings with a pitch block — required three hands; since I usually work alone and have only two, I began improvising ways to make my life easier and ultimately do a better job. Here are a few of the specialized tools I've developed over more than a decade of building stairs.

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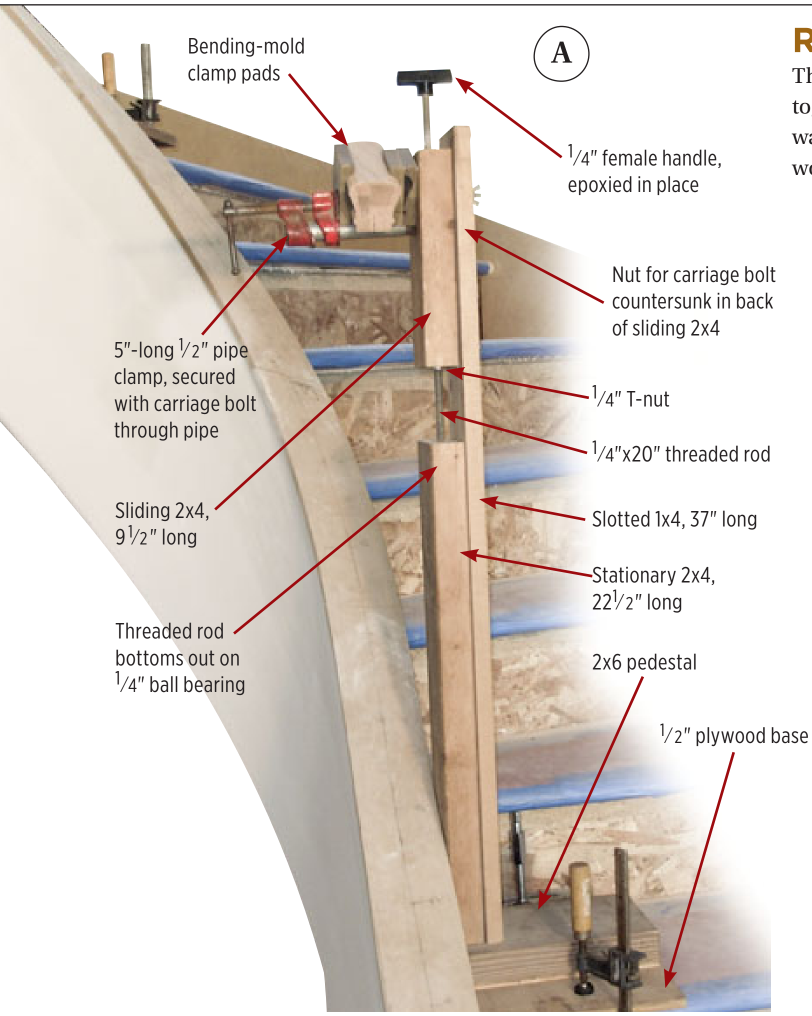
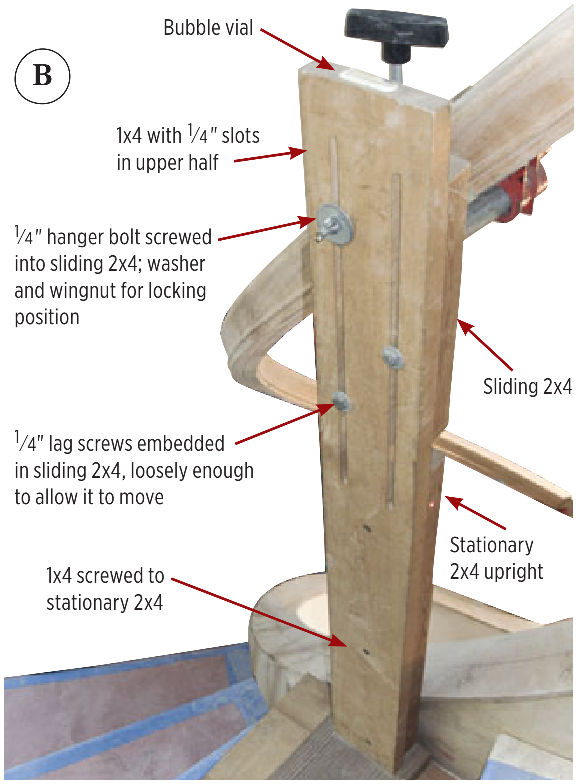


Rail Jack

This is an essential handrail jig. Rail jacks are often cobbled together on site from scrap lumber and drywall screws, but I wanted mine to be reusable and easily adjustable for over-the-post work, such as determining newel heights and fitting easings.

The base of my rail jack is a length of 2x6 attached to a 10-inch-



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by-14-inch scrap of ½-inch plywood. The upright is a 37-inch-long 1x4 screwed to a 22½-inch-long 2x4 (A). A pair of slots cut into the upper half of the 1x4 allow a second 2x4, 9½ inches long, to slide up and down on three screws (B). Two of the screws are ¼-inch lags, driven through the slot into the 2x4; the third one is a ¼-inch hanger bolt with a larger washer and wingnut for locking the rail height in place.

Height adjustments are made with a ¼-inch threaded rod and a T-nut. The 20-inch length of threaded rod passes through a hole bored lengthwise in the upper 2x4, through the T-nut, and several inches into the lower 2x4, where it bottoms out on a ¼-inch ball bearing. Turning the handle epoxied to the top moves the upper 2x4 up or down (C).

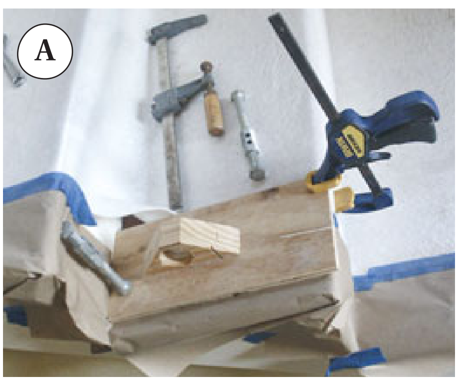
The final piece is a 5-inch-long ½-inch pipe clamp attached to the upper 2x4 with a 7-inch-by-⅜-inch carriage bolt, with the nut countersunk into the back of the 2x4. Bending-mold pads protect the rail and allow it to be clamped in place without changing its orientation to the staircase (D).

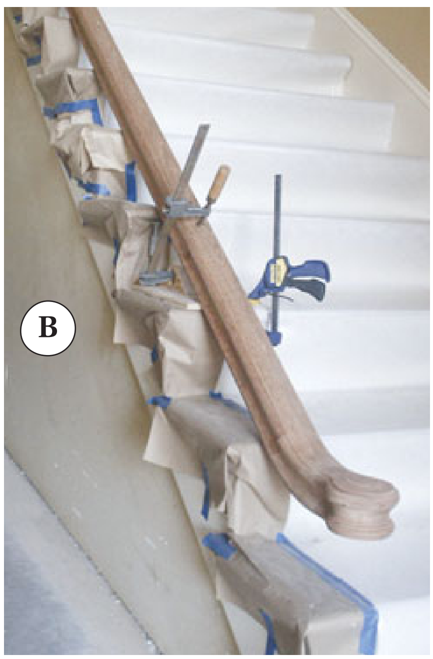
My rail jacks have small bubble levels (I buy them at Walmart in the RV department) glued to the top to indicate when the jack is plumb and level. Once the rail is at the right height and the levels read plumb, I tighten down the wingnuts on the rail jack and get to work.

I often use more than two rail jacks to make the assembly more stable. With the bubble levels on top, I can fine-tune the position of the rail over and over without having to reset the jacks.

No-Mar Clamping Jig

This is about as basic as it gets — a scrap of plywood with a small triangular block attached (A) that allows me to clamp the rail against the noses of the treads (B) while I test-fit easings and locate newels. A 1½-inch hole bored through the block accommodates the short bar clamp that holds the rail snug.





The jig is held in place at the back with a simple expandable compression clamp made from two ⅝-inch-diameter bolts joined by a threaded rod coupler; a quick-release bar clamp holds down the front. I use the same technique to secure my rail jack (C).

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Bench Rail

By allowing me to test-fit every easing cut, the bench rail (A) saves me a lot of trips between the miter saw and the staircase. I built mine from a 15-inch-long 3x3 newel offcut (the “rail”), a scrap of 1⁄4-inch plywood with a radiused slot cut into it, and a 15-inch-long 1x6. A 3-inch butt hinge connects the 1x6 to the newel offcut, which has a 1⁄4-inch-diameter hanger bolt sticking out of its side through the slot. Tightening the wingnut locks the bench rail in position.

To set up the bench rail, I clamp it to the workbench so that the lower end is unobstructed. Then, using my easing protractor (which I've already set to cut the easing), I raise or lower the hinged arm until the protractor reads level and tighten the wingnut (B). Now the bench rail is the same angle as the rake rail; it doesn't matter whether my bench is level.

After first cutting the easing, I butt it up against the bench rail and use a torpedo level on the part of the fitting that is supposed to be level (the cap for a lower easing, or the top of the easing for the upper easing) to check the cut (C). With the bench rail as a reference, I can then make the needed adjustments to the cut angle without trips to the staircase.

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Easing Protractor

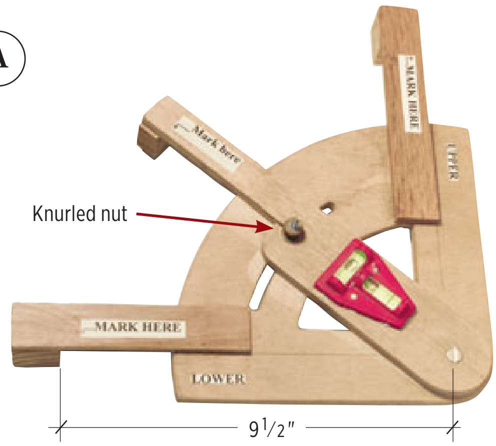
I used to mark and cut easings with the help of a pitch block, but I was always unhappy with the inaccuracy of this method. Eventually, I realized that lower and upper easings are really just a transition from level to plumb; join the two together and they create a 90-degree arc that can be laid between the blades of a framing square, with the tangent point touching the blades at the 9½-inch marks (most easings have a 9½-inch outside radius). No matter what the rake angle of the stair is, if you cut this 90-degree arc in the right place, you'll get a perfect fit at the volute and the gooseneck. That's the principle behind my easing protractor, which I use to determine staircase pitch and cut accurate angles.

The body and arm are made from ¼-inch plywood (A). I epoxy the bubble to the arm very carefully, using a surface I know to be plumb or level for reference and letting the bubble determine when it's in the right position. The bubble must be parallel to the centerline of the arm for the instrument to read accurately.

The side blades have 1-inch gauge blocks attached to their ends exactly 9½ inches from the pivot point. They must be oriented exactly 90 degrees from each other, with the marking side of each arm aligned with perpendicular lines that pass through the pivot point. As shown here, this protractor will only work on easings with a 9½-inch outside radius. For other radiuses, the distance from the end blocks to the pivot point must equal the outside radius of the fitting.

To mark the top cut on a volute easing, for example, I set the protractor on the positioned handrail, then swivel the arm until the bubble reads level and tighten the set screw (B). With this setting locked into place, I place the protractor against the fitting and align the lower blade with the bottom cut on the easing. I then mark the upper cut where the pivot arm touches the easing (C). Overeasings are handled the same way, except that they are placed the other way around in the protractor, with the bottom cut on the upper blade.

A



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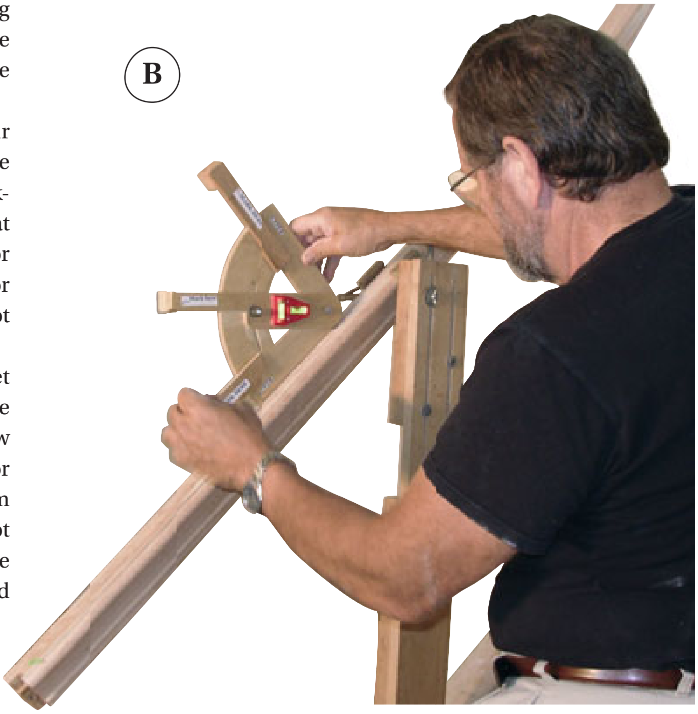

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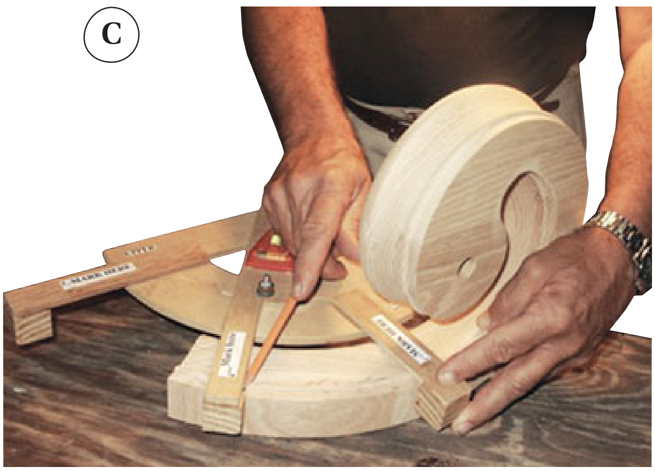

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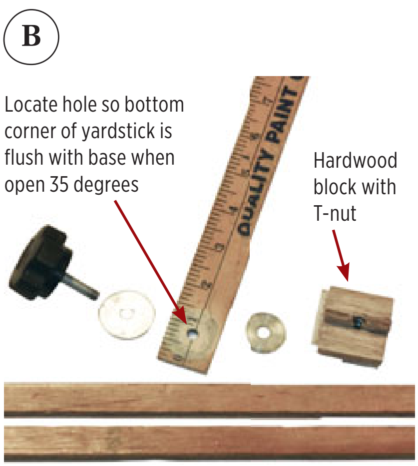
Rail-Height Gauge

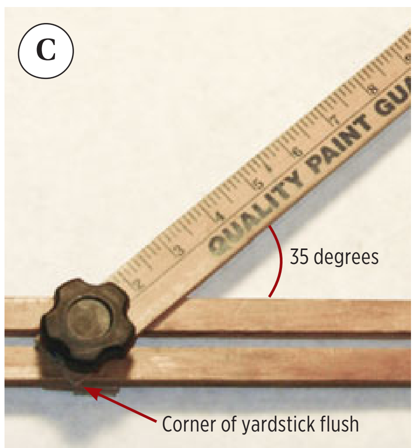
When it's time to position the handrail at a uniform height above the tread nosings, my rail-height gauge is much easier to use and more accurate than a tape measure (A). The gauge, which works like an oversized T-bevel, consists of a wood measuring stick (my original one uses a yardstick) fastened to a 36-inch-long strip of $\frac{1}{2}$-inch-thick plywood about $1\frac{1}{2}$ inches wide. The plywood strip has a $\frac{1}{4}$-inch slot ripped exactly down the middle so that accurate readings can be taken regardless of which way the yardstick is swiveled. The two pieces are joined together with a plastic star knob with a $\frac{1}{4}$-inch-diameter stud, a couple of brass washers, and a T-nut sunk into a hardwood block (B).

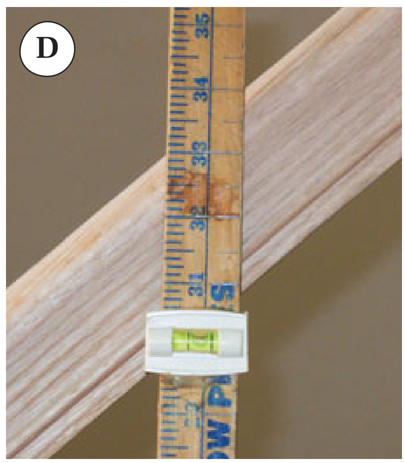
The hole at the bottom of the yardstick should be drilled so that its bottom corner is flush with the bottom of the plywood strip (C) when the gauge is open to approximately 35 degrees (the pitch of a 7-over-10 stair). Finally, to make sure the yardstick is plumb when I take my measurements, I epoxy a bubble level at about the 30-inch mark (D), clamping the stick along the edge of a post I know to be plumb and using the bubble for reference as I do the gluing.

To use the gauge, I place the base strip across the tread nosings and raise the yardstick until the bubble reads plumb. I then tighten the knob; the square block prevents the T-nut from spinning, which allows me to tighten the knob with one hand. Always read the gauge on the higher side by sighting across the top of the rail.

I also use the rail-height gauge to locate wall brackets. As long as the stair's rise and run remain constant and I keep the base in contact with the nosings, I can loosen the knob and slide the measuring stick along the slot until it's aligned with a stud.







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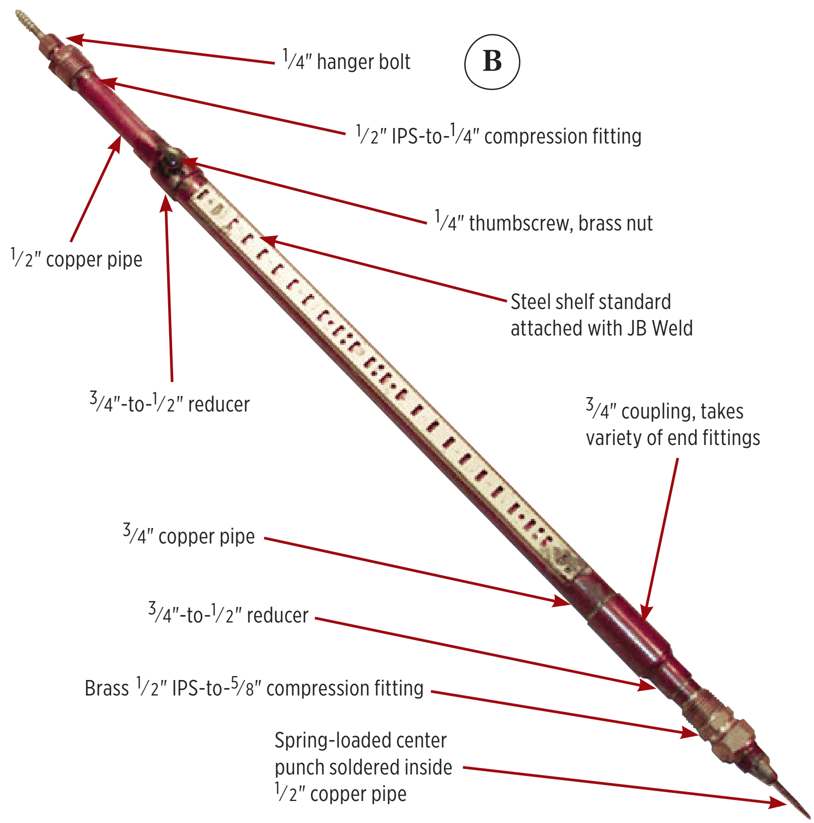
Baluster Projector

A baluster projector is a great tool for accurately measuring baluster lengths and laying out their locations on the handrail (A). I also use it as a point-to-point plumb stick, and even support handrails with it on occasion. I made mine from about $10 worth of copper pipe and assorted fittings (B). The top portion is a 19-inch length of ½-inch-diameter hard copper pipe; it slides inside either a 15-inch or 24-inch length of ¾-inch pipe. (I need the extra length for taller railings; the shorter projector is good for curbed stairs.) I solder a ¾-inch to ½-inch reducer to the top end of the larger pipe, first removing the shoulder on the inside of the fitting so the smaller pipe will pass smoothly but snugly through it.

I drill a 5/16-inch-diameter hole through the reducer and tubing, grind the area flat around the hole, and then solder a ¼-inch brass nut in place so that it is centered over the hole. This nut receives a ¼-inch-diameter wing screw for locking the upper, extendable pipe in place (C). A common steel shelf standard glued to the ¾-inch pipe with JB Weld allows me to attach a magnetic torpedo level.


A



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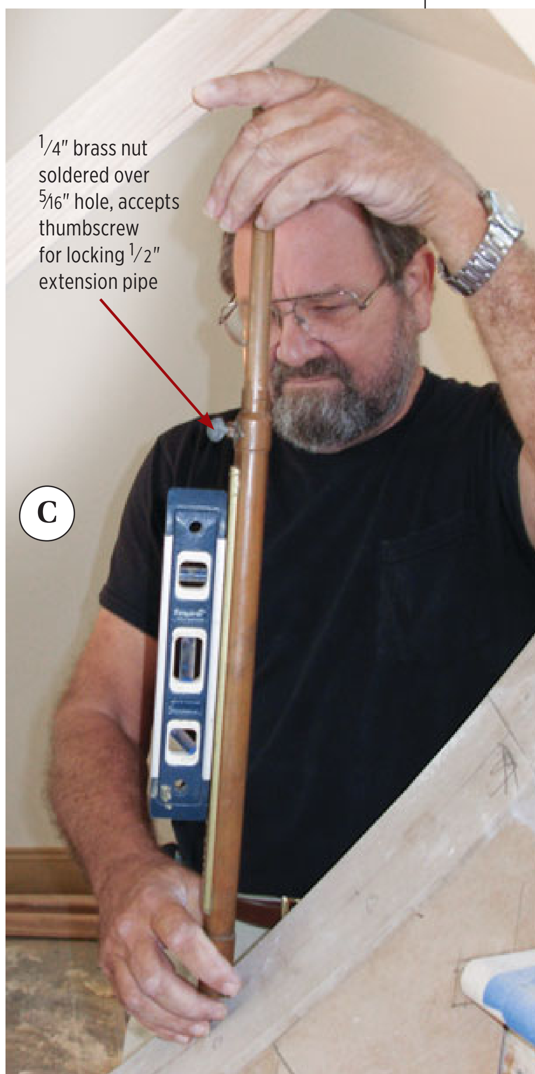

C

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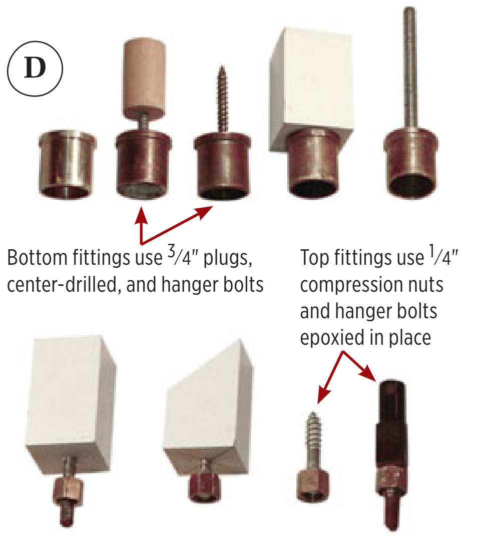
To increase its versatility, I designed the ends of the projector to accept interchangeable fittings (D). On top I transition with a reducer that goes from ½-inch IPS (so that the ½-inch pipe will fit inside it) to a ¼-inch O.D. compression fitting. After soldering the fitting in place, I remove the compression nut and sleeve, then glue a ¼-inch hanger bolt into the nut. To do this I put a dab of JB Weld inside the compression sleeve, insert the hanger bolt as if it were ¼-inch tubing, put both into the fitting, and tighten the compression nut. Once the glue sets up, I remove the nut — hanger bolt, sleeve, and all — from the fitting and clean up any squeeze-out. The wood-screw end of the hanger bolt is now perfectly centered in the nut, giving me an attachment point for square or angled wood blocks; or I can simply use the pointed end. I make up several of these compression nut-hanger bolt units for a variety of end fittings.

At the bottom end of the projector, I solder a ¾-inch coupling, then use brass or copper plugs, center-drilled for the hanger bolts, which I simply secure with a pair of nuts, one on the outside, one on the inside.

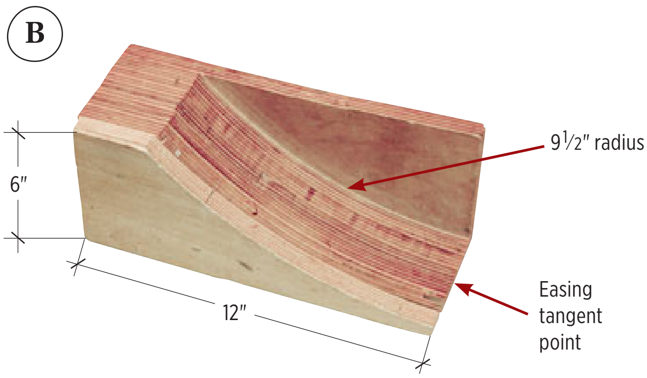
To project plumb points from the floor layout to the handrail, I use pointed tops and bottoms (E). When there's a shoe rail, I fit the projector with 1¼- or 1¾-inch-square baluster bottoms; when using a plowed handrail, I fit the projector with a square top. I even have a spring-loaded bottom, made from a center punch, which makes it easy to move the projector around to find the plumb layout point.



Up-Easing Shoe

The 60-degree up-easing is the most common; it has a standard outside radius of 9½ inches. To hold these expensive fittings steady and square while I cut them, I've made an up-easing "shoe" (A). This allows me to fine-tune the cut so that the easing makes a perfectly smooth transition from the rake angle to either level or plumb.

My shoe is laminated from several pieces of ½-inch birch plywood with a 9½-inch radius cut out of them with a router and trammel (B). I make the blanks slightly long. After gluing the stack together, I set the shoe on the miter saw and trim it at the 90-degree tangent point. Then, when the easing is in the shoe and the miter saw blade is registered against the tangent point, the resulting cut will be perfectly perpendicular.



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Baluster Cutting Board

After recording the length of the balusters, I use the baluster projector and a baluster cutting board to quickly lay out the cuts. It's especially useful when I'm working with decorative metal balusters, since baskets, knuckles, scrolls, and other details can make the baluster tricky to measure with a tape. A sixteenth of an inch can make a tremendous difference as to whether a baluster fits or not.

The cutting board is made from a scrap of plywood measuring about 10 inches by 48 inches, with two 1x2 rails set at 90 degrees along the edge. I transfer the projector's length to the baluster with a combination square, then make my cut on the long side of the line so that the baluster will be exactly the same length as the baluster projector.