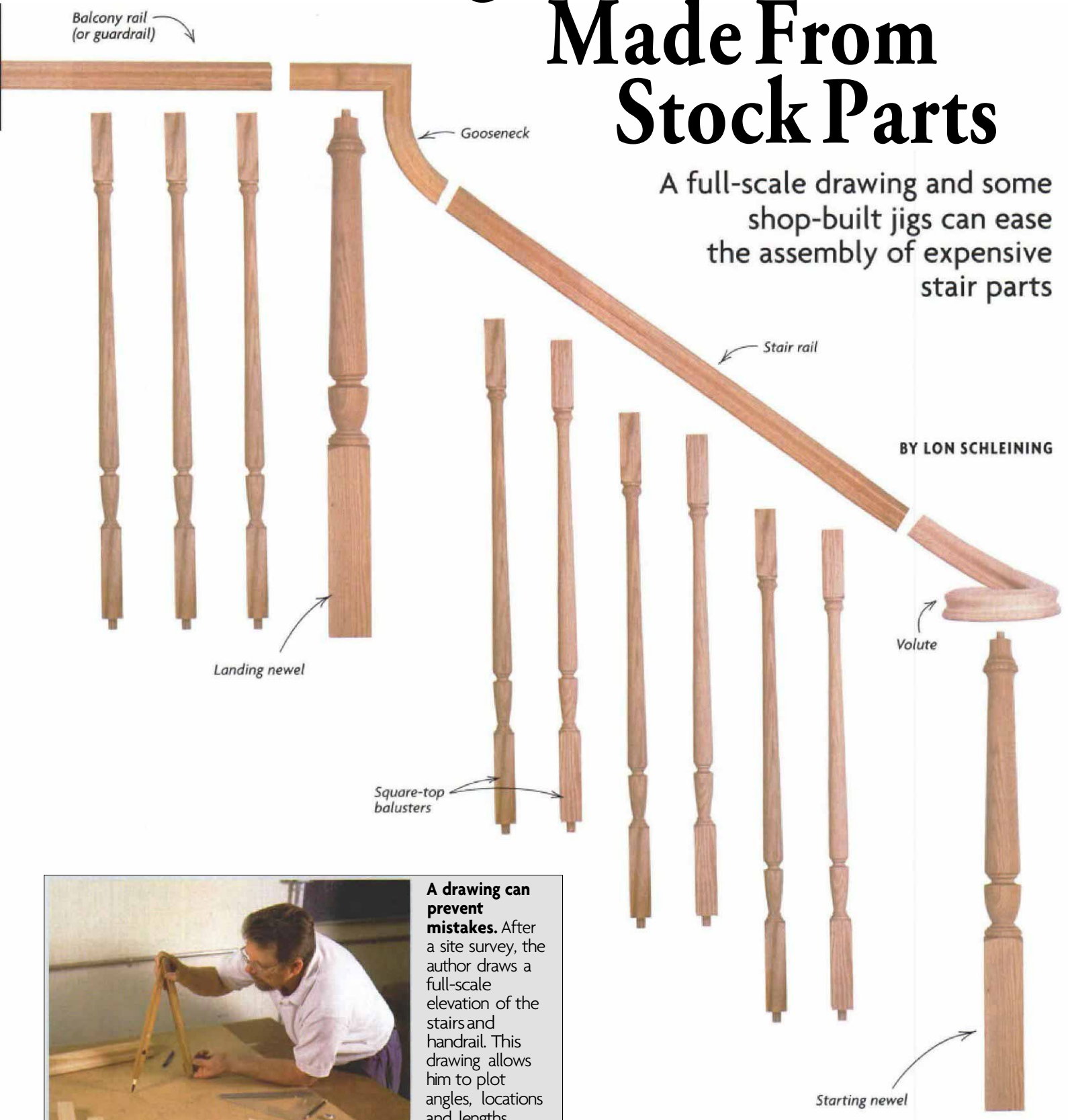
Installing Handrails Made From Stock Parts

A full-scale drawing and some shop-built jigs can ease the assembly of expensive stair parts

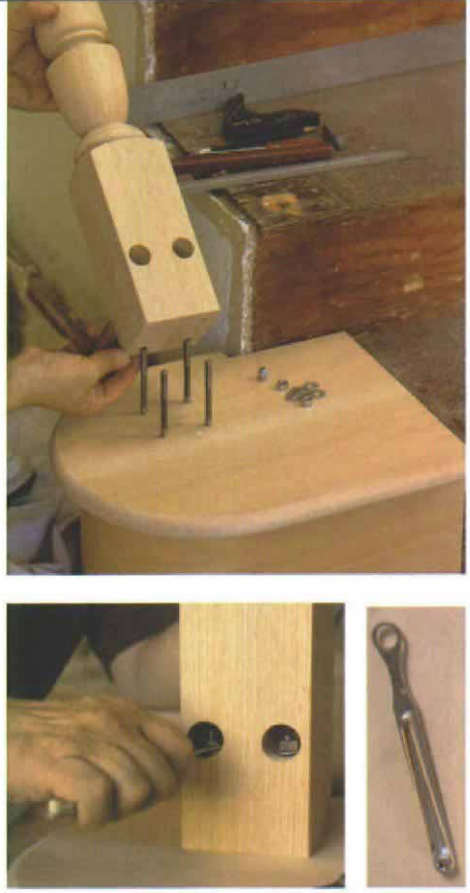
BY LON SCHLEINING



A drawing can prevent mistakes. After a site survey, the author draws a full-scale elevation of the stairs and handrail. This drawing allows him to plot angles, locations and lengths before he starts to cut.

Stair-part photos: Scott Phillips

Bubble level keeps the drill straight. After drilling access holes in the newel, the author clamps the post plumb and drills four bolt holes that must be true. The bubble level's plywood base fits tightly onto the drill's motor housing.



Hanger bolts provide a strong base for the starting newel. Four hanger bolts driven into the starting step will provide firm support for the starting newel. A specialty wrench (note rubber band) is used to start and tighten the nuts.

Landing newel is bolted to both riser and tread. Unlike the starting newel, the landing newel is bolted in two directions. The lower left hole provides access to the vertical hanger bolt; lag bolts are driven horizontally into the other three holes.

Of all the parts that make up a home's interior, the most visually dramatic is often the staircase. In particular, a stair's handrail is a combination of precise joinery and crisply milled components that looks as delicate as it is strong. It should come as no surprise, then, that building a handrail can be a complicated job, even for an experienced carpenter.

After installing hundreds of handrails, I've come up with a pretty simple system to handle everything from manufactured stock parts to custom stair railings. On a recent remodel, I installed new turned newel posts, handrails and balusters on a staircase that would be carpeted later. These few examples won't be the final word on how to install handrails, but they should get novices off to a solid start and perhaps offer more experienced carpenters a new trick or two.

A full-size drawing is the first step to easier railing installation

Nearly all the instructions I've seen describe fitting a handrail by first laying it on the stairs instead of setting it on the previously installed newel posts. The installer attempts to clamp fittings in place or uses charts and formulas to determine the height of newels; easings (such as volutes and goosenecks) are trimmed with the aid of a pitch block.

Instead, I find that making full-scale drawings is the easiest and fastest way to lay out handrails (photo facing page). It's much easier working through difficult problems on paper than making mistakes with expensive stock. I use 60-in. wide brown wrapping paper from Papermart (800-745-8800) for these drawings.

After taking the necessary measurements at the job site, I draw the top, the bottom and an intermediate step in elevation view to locate top and bottom newels. Obviously, there are usually more steps than that in a single run, but I can figure the pitch angle of the stair and handrail by drawing a line touching the three tread nosings. Next I draw the handrail at its correct angle and height determined by code, in my case between 34 in. and 38 in. above the nose of the tread. If there is a guardrail, I draw it at least 36 in. above the floor. I draw certain areas, such as the starting step, in plan view as well as elevation to locate the volute position.

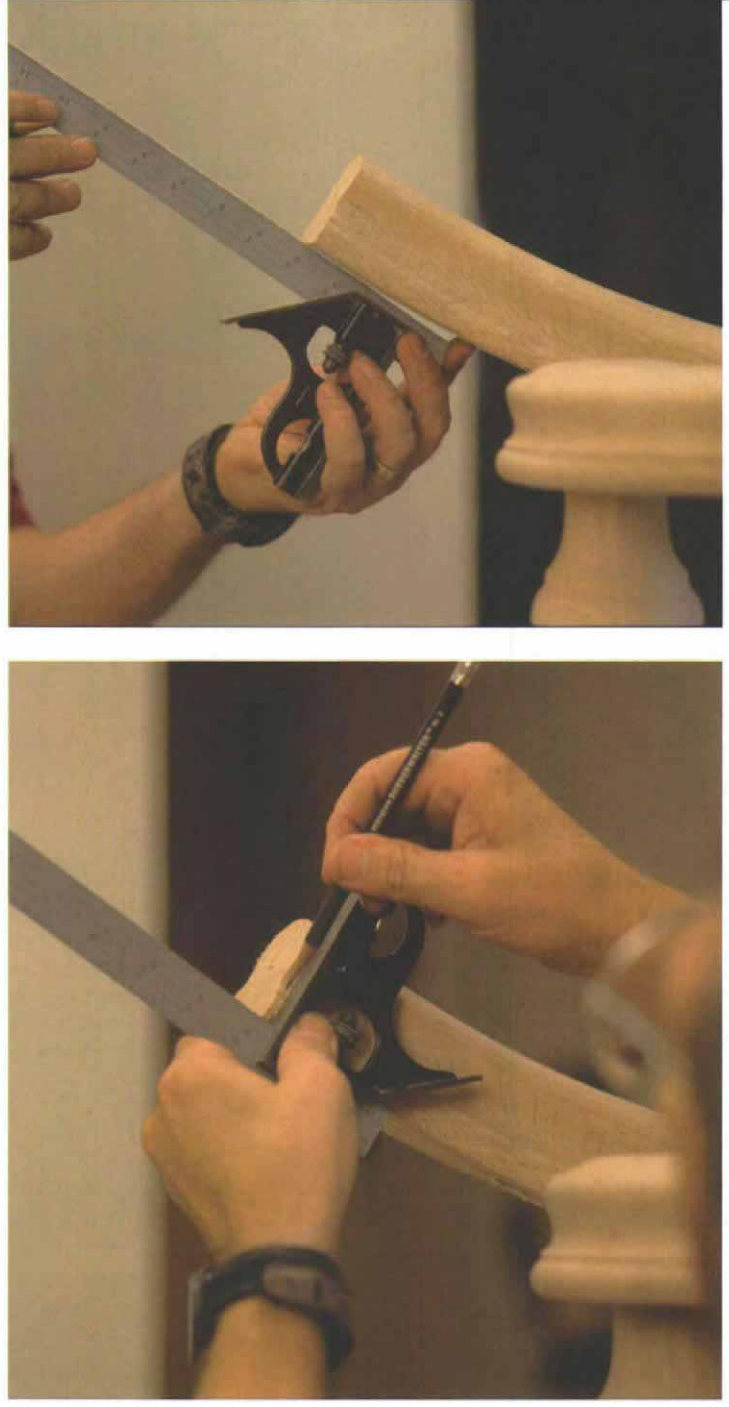
In a few minutes, I'm able to make a list of parts that I need and do nearly all the planning for the whole job. When I get to the site, I unroll the drawing and refer to it for layout work. It's also a great device for discussing designs with the clients.

At this stage, I make sure that the staircase will pass muster with the building inspector. For instance, the building code in California specifies a maximum opening of 4 in. between balusters, so I may need to draw three balusters per tread instead of the more common two per tread I might have planned.

Quality parts are a must

After drawing the plan, my next step is to buy parts. Stock parts from larger manufacturers will almost always be usable, but you or your client might be more observant than the factory inspector. Cosmetic flaws such as checking, grain tearout, color variations, obvious chatter marks and uneven machining will really stand out on a finished staircase. It's always a good idea to look before you buy; if you can't, ask about the manufacturer's (or retailer's) exchange policy. I buy most of my parts from Leeper's Wood Turning

Taut string establishes the angle and height of the railing. The author fastens a stringline with tape between two fittings to check the position of the railing and to determine the proper angle at which to cut the fittings.



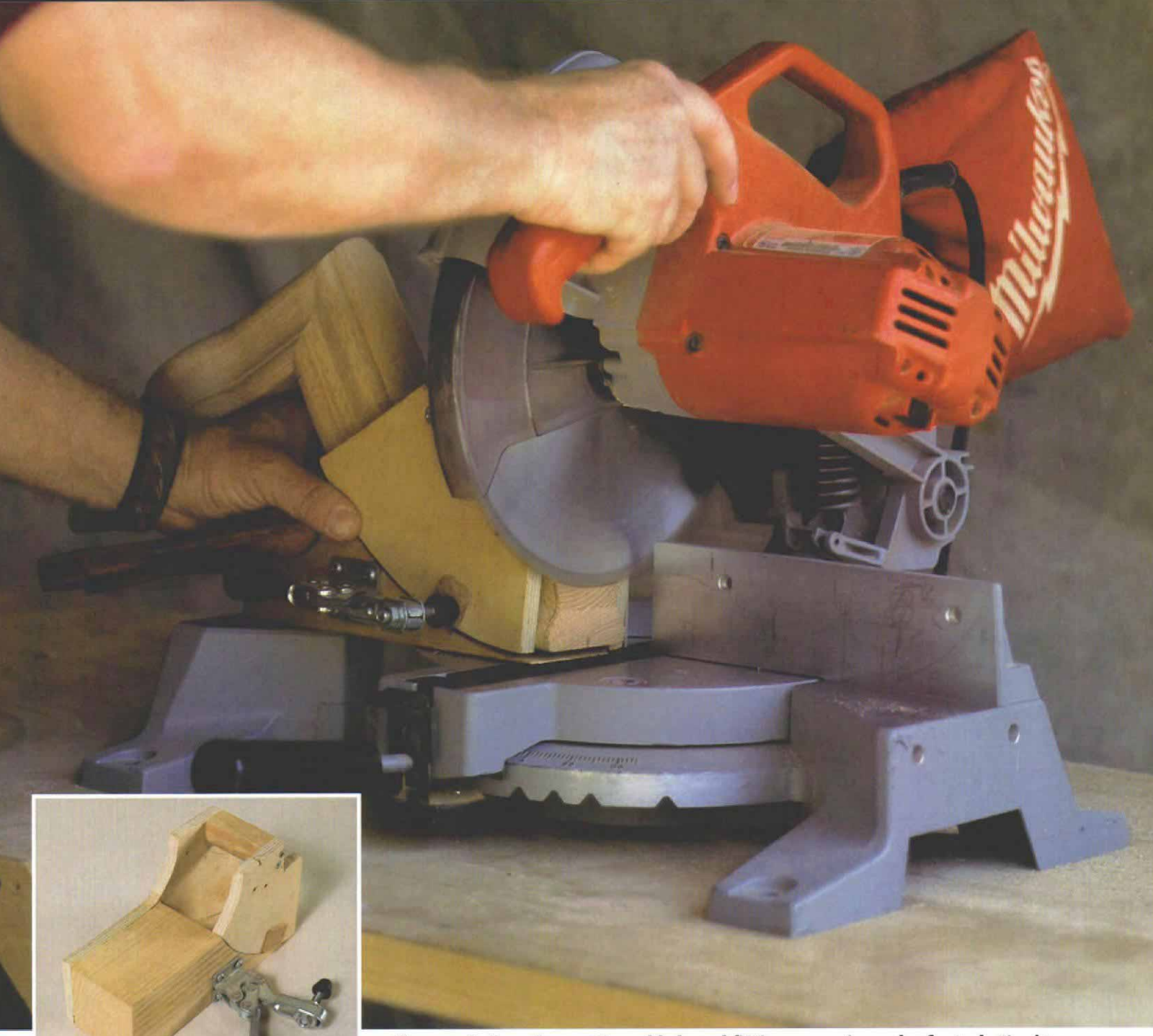
Using a combination square to transfer the railing angle to the fitting. The author aligns the square's blade with the string (top) and marks the tangent on the fitting. Maintaining the blade angle (bottom), he flips the head over and draws the correct angle.

(800-775-1173). They're local for me (they're also a mail-order retailer), and they offer good quality. I've also had good results with parts from L.J. Smith (740-269-2221) and Coffman (540-783-7251), two manufacturers that distribute nationwide.

Handrails, probably the most scrutinized part of a staircase, are available in solid or finger-jointed stock. Some people don't like finger-jointed stock because the joints become highlighted when the railing is stained, so I always check with the client first. When ordering, I specify lengths that will span between the newels on the stairs and balconies, assuming that a certain amount will be trimmed off for fittings. I make sure to draw the balusters on my full-size layout sheet. Although adjacent balusters on a tread are not all the same length, each should show a consistent proportion of turning. I also buy extra hanger bolts, washers, nuts, screws and plugs, just in case.

Strong railings need sturdy newels

Starting and balcony newels are typically bolted to the framing. If the newels are not securely fastened, the staircase might look pretty, but the railing won't be strong. To make certain that it's solid, I always build the starting step from medium-density fiberboard that's bolted to the floor. After cutting the newel to length and marking its location on the step, I lay out the four bolt holes, both on the newel end and on the starting step. (Not everyone uses four bolts in this situation, but I think four bolts give you more adjustability and keep the post from twisting.) With the newel clamped securely, I use a Forstner bit to drill the 1-in. dia. access



Shop-made jig makes cutting odd-shaped fittings an easier and safer task. Fixed to the saw table by a bar clamp, the jig secures the fitting at the desired angle. Adjustment can be made by loosening the toggle clamp.

holes, then drill four ⅜-in. holes in the post end to a depth of about 4 in.; here, it's important to drill straight (photo left, p. 95).

After drilling pilot holes, I run four 5/16-in. by 6-in. hanger bolts (those with wood threads on one end and machine threads on the other) into the step, and then slip the newel onto the bolts (photo top center, p. 95). To start the nuts deep inside the access holes, I use a cool gizmo (photos bottom center, p. 95) made by Universal Building Systems (800-200-6770), or in a pinch, I use a screwdriver to hold the nut flat while spinning it on with a pencil eraser. I tighten the nuts until the newel is secure and plumb, shimming as needed with thin oak wedges. I try to use only one size of bolt throughout a job so that I need only one size washer, nut, wrench and socket. After the handrail is installed, I go back and glue 1-in. dia. plugs into the access holes.

Landing newels are the transition for railings between stairs and landings. I bolt them horizontally to the riser and vertically to the tread. I run one 5/16-in. hanger bolt into the step below that pulls the newel down; three 5/16-in. lag bolts pin it into the riser (photo right, p. 95). After drilling the post and driving the hanger bolt into the tread, I seat the post onto the bolt, apply glue and screw the lag bolts into the riser. Two levels taped to the post speed up the adjustment process.

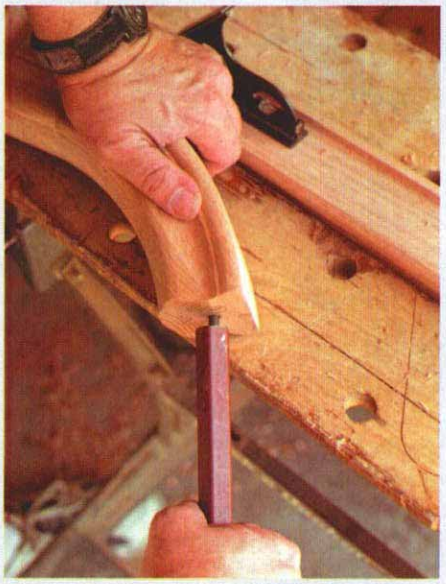
Using string to ease layout

There are two basic types of railings: post-to-post railings, which are cut to fit between newel posts; and over-the-post railings, which run uninterrupted over newel-post tops and use fittings and easings to change

LOCATING RAIL BOLTS

A thin slice of railing makes a good template for marking bolt holes. Using a template to mark bolt holes on mating pieces of railing will make a better match and save layout time.

Clamp the rails and fittings when drilling. A portable clamping bench is handy for keeping the railing parts steady while drilling. Both access and hanger-bolt holes should be as straight as possible to avoid misalignment of the parts.



Hanger bolts can be adjusted with a piece of hollow tubing or pipe. Occasionally, it's necessary to bend a hanger bolt carefully once it's in place. A foot-long piece of tubing exerts enough leverage and won't mar the threads.

Glue strengthens the junction of rail and fitting. To make sure that the joint will not separate, the author spreads the joint apart with a screwdriver and squeezes PVA glue into the opening. The glue is dyed to match the wood.

railing height and direction. Although there are many of these fittings, I installed two in the over-the-post railing featured here.

With the newels installed, I place the fittings, in this case a volute at the bottom and a gooseneck (photo p. 94) on the landing, on the newel pegs. I drill and counterbore a hole into the top of the fitting for a screw, which I hide with a plug when the railing is done. I make sure each fitting is level and straight.

Next, I run string between the easings to mark the bottom of the handrail (photo left, p. 96). I center the string on the fittings, using masking tape to keep it taut. I first see if the volute and gooseneck are rotated correctly by lining up the string with my square. I then check that the string is parallel with the stair and that it's at the corresponding height shown on the drawing.

I align the blade of the square parallel with the string under the fitting (photo top right, p. 96). This helps me to locate the tangent where the handrail and fitting meet. I then flip the square, keeping the blade parallel to the string, and mark the angle of the cut on the fitting (photo bottom right, p. 96). After cutting the fittings (photos p. 97), I reattach them to the newels and run the string again to check the angles. Now I can measure and cut the straight railing sections. If an angle is off a bit, I can compensate by cutting a matching angle on the railing.

When all the rail parts are cut, I mark hanger-holt locations on the ends of the matching parts with a slice of railing I use as a template (photo top left, facing page). After clamping the railing, I drill bolt holes and access holes in the railing (photo center left, facing page), and drill the bolt pilot hole in the easing. If the bolts need to be tweaked, I carefully bend them with a foot-long piece of ¾-in. tubing, which won't mar the thread (bottom photo, facing page). After bolting a section together, I check to see that the assembly fits on the respective newels. If it doesn't need fine-tuning, I screw the fittings to the posts, loosen one fitting at a time, squirt glue into the connection (photo right, facing page) and retighten the fitting. Because it's rare that the rail and fitting profiles match exactly, once the glue is set, I fair the two mating surfaces together with an assortment of tools that includes a 5-in. orbital disk sander, rasps, files, gouges and sandpaper. Fingertips will play over this joint, so it should be imperceptible to the touch.

Installing the balusters

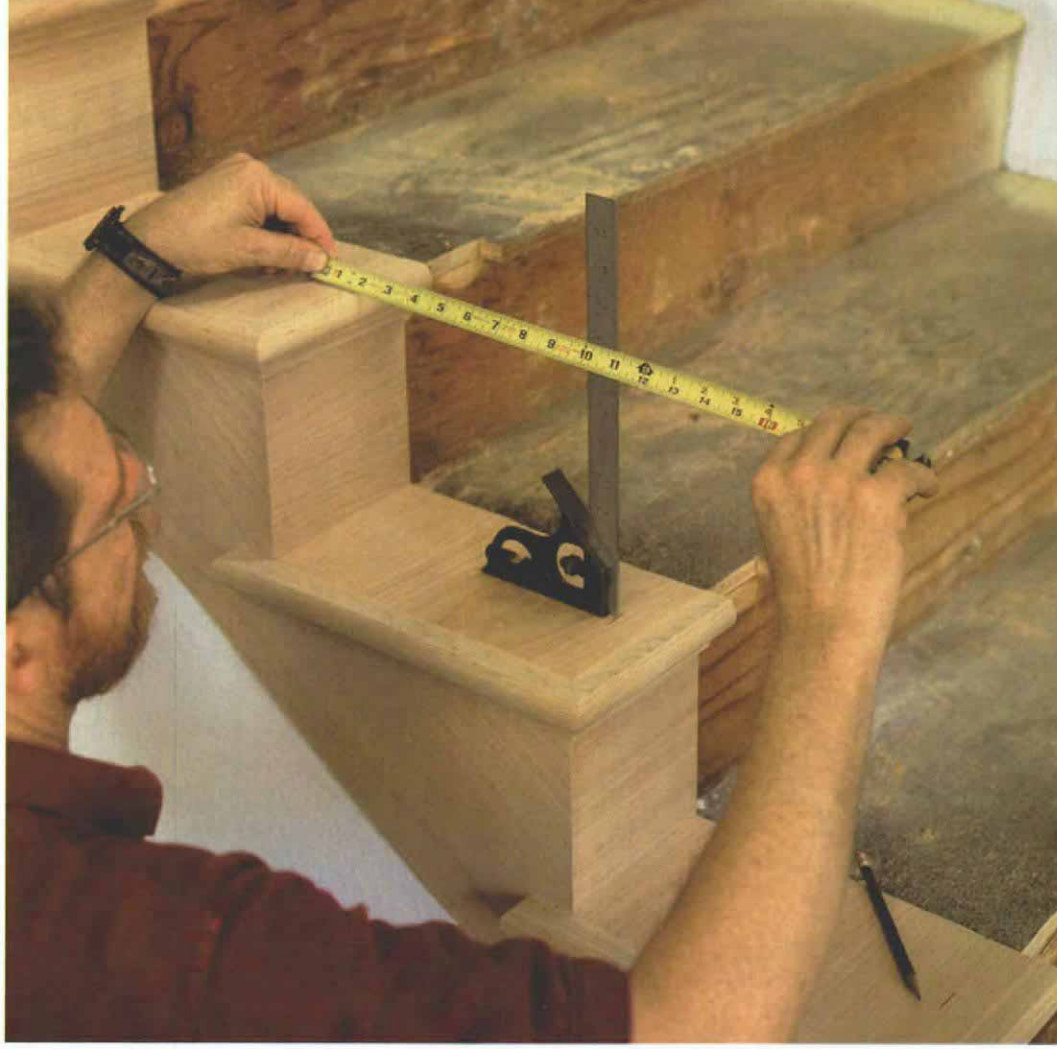
The balusters are fun to set because their installation signals that your hard work is nearly done. From the layout, I know I need to locate two baluster positions on each tread.

I align the forward face of the first baluster flush with the riser below and mark its location on the tread. After I mark the same spot on the tread above, I measure the distance from one mark to the other (top photo), divide this measurement in half and mark the middle baluster's position on the tread. When referenced from the outside of the tread, these lines mark the locations of the baluster pin holes (these balusters have dowels turned on their lower ends). Again, I rely on the bubble level for drilling plumb holes.

I use another shop-built device to determine baluster lengths (photo bottom left). Once I've cut the balusters, I glue the pins into the treads and nail the baluster tops to the underside of the railing. Thin pieces of fillet stock are cut individually and nailed between the balusters to lock them in place (photo bottom right).

I lay out balusters on a balcony or landing by first measuring in an equal distance from each newel. Using dividers, I find a baluster spacing that comes close to the spacing on the stairs. I always check these marks carefully before I drill any holes. □

Lon Schleining is a stairbuilder in Long Beach, California, and also teaches woodworking at Cerritos College in Norwalk, California. Photos by Charles Bickford, except where noted.



For consistent baluster spacing, locate the front balusters and divide. After establishing the locations of the balusters at the fronts of the treads, the author measures the distance between the two points. The halfway point becomes the location of the second baluster.

Sliding jig makes measuring balusters easy. Clamped to a level, this shop-built ruler is adjustable in height and quickly registers the height and handrail position of square-top balusters.

Fillet piece locks the balusters to the rail. After the balusters are pinned in place, thin fillet stock is cut, glued and nailed to the rail's underside, strengthening the entire assembly.