Building Stairs with Stock Parts

by Bill McLearn

Part II: Balusters, Newels, and Handrails

Ed. note: This is the second in a two-part story on building stairs with stock parts. Part 1, covering the finish skirts, treads, and risers, ran last month.

Stock balustrade systems come in a variety of styles from several manufacturers. I use Morgan parts because I've had good results with them. Some of the systems are quite simple, with straight rail sections running from post-to-post; others are elaborate over-the-post systems with curvy volutes and goosenecks. In general, any style can be used for any conventional stair layout. Which one you choose is a matter of client preference and expense.

The system I'll describe here is the "Cornwall" style by Morgan. It's a post-to-post system at the middle and upper landing newels (meaning the rails butt into the newel posts, rather than pass over them), with a volute that passes over the starting newel. A gooseneck connects the top of each rail to its landing newel (see Figure 1).

A staircase like this one takes me three or four days to build, working with a helper, once the rough stringers are up. The cost to the customer for this particular stair was around $2,500, but this can vary widely depending on the parts used.

Ordering the Parts

To order balustrade parts you must know the layout and dimensions of the stairs: the rise and run of each flight of stairs and of each step, and how many treads there are. You'll also need to know the finish height of the handrail, measured directly above the front edge of the treads. Most codes require a minimum height of 30 inches, which is the height I used in this particular staircase.

Baluster styles. Traditional balusters come either *turned* (round in the middle, square on top and bottom) or in any of several tapered styles, some with square bottoms, some round their entire length. For this stairway I used tapered newels with square bottoms.

I use two balusters per step and order accordingly. Unless you have very deep treads, two balusters per tread meets code, which in my area allows no more than 5 inches between balusters. Remember also to order enough balusters to support any volutes, and for any level landings that may require them.

You'll need to order balusters in two different lengths: one length for the front baluster on every tread, and a longer length for the rear baluster. See Figure 2 on measuring for balusters.

Choosing newels. Newels needn't directly match balusters, but should complement them. They generally look best stained, so I order them in red oak. For an L-shaped stair like this one, you'll need a *starting newel*, a *landing* or *angle newel* for the landing midway, and another landing newel to secure the top.

As we'll see later, the various newels' lengths are determined both by the stairway's style and by their anchoring methods. The angle newel, which gets anchored into the 90-degree angle formed at the turn in the stairs, is longest.

Ordering the rail. To figure the rail length for each flight of stairs, I measure from the leading edge of the bottom rough tread to the approximate site of the newel anchor at the top of that flight. I then order a piece

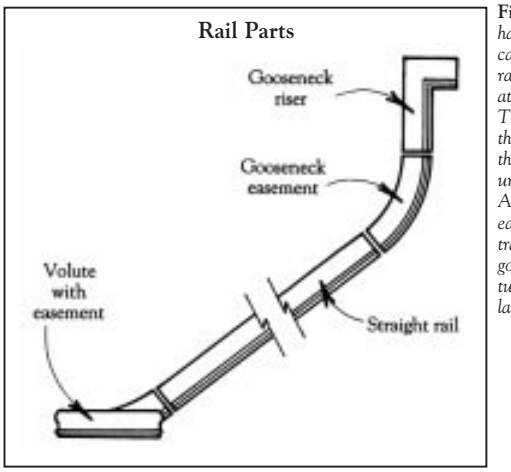

Figure 1. *The handrail for this staircase starts with a spiral volute with an attached easement. The easement allows the volute to attach to the straight rail in an uninterrupted curve. At the top, another easement makes the transition into the gooseneck, which in turn butts into the landing newel.*

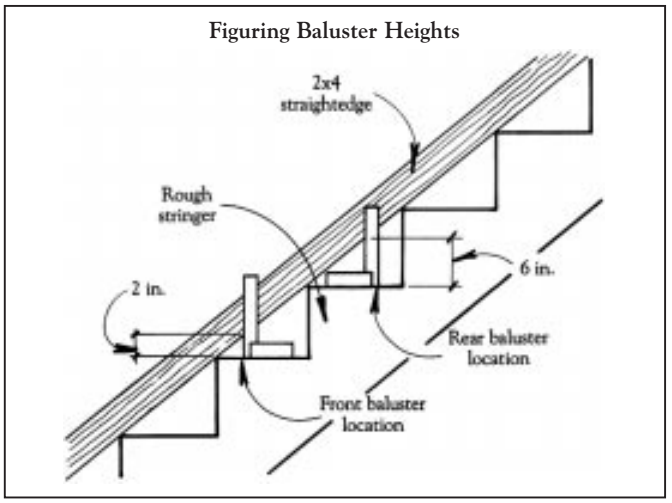

Figure 2. *To figure the height of the balusters, the author lays a straight 2x4 up the stairs, resting it on the leading edges of the rough stringer. He measures the vertical distance from the rough stringer to the straightedge along the centerline of the front baluster. He adds this measurement, 2 inches, to the finish rail height of 30 inches, giving a total of 32 inches. He then subtracts the 3-inch thickness of the rail (measured at a plumb cut) to get the final exposed height of the front baluster, 29 inches. An inch is added for the tenon into the bottom of the rail for a total front baluster height of 30 inches. For the rear baluster the added vertical distance is 6 inches.*

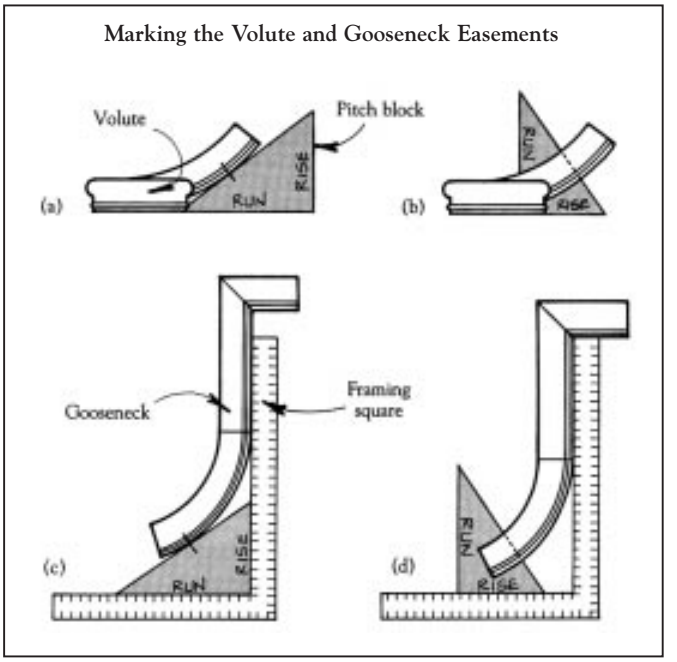

Figure 3. *The volute comes with an attached easement. With the volute on a flat surface, McLearn slides the pitch block under the easement (a), run side down, and marks the point where they touch. To mark the cut line, he flips the pitch block so that the rise side is down, and aligns the long side of the pitch block with the mark (b). He then traces a line for the cut.*

The gooseneck easement is marked in a similar fashion. First the author cuts the vertical length of the gooseneck, taking the measurement from the chart supplied by the factory. He then connects the gooseneck and easement and lays them on their sides against the blade of a framing square (c). With the pitch block placed as shown, he marks the point where it touches the easement, then flips the pitch block to mark the cut (d).

of rail the next foot up. I usually use Morgan rail #720. It has a traditional profile and comes in both oak and birch.

I prefer oak, especially if I am going to stain the rail a light color. Oak is more expensive than birch, but it shows less shade difference between rail sections when stained.

Which rail pieces to order. For this stairway, in addition to newels, balusters, and straight rail sections, we'll need: a volute to start the rail; a double-riser gooseneck to connect the bottom straight rail to the angle newel; a one-riser gooseneck to connect the upper rail to the top landing newel; and two easements, which are curved sections that allow us to connect the straight rail sections with the volute and the goosenecks.

Cutting the Easements

The trickiest part of assembling the rail is cutting the curved sections of the easements and other fittings so that the straight rail sections in between fit into them at the correct angle. For this you'll need a "pitch block" — a triangular piece saved from when you cut the stringers. If you didn't save a pitch block (I throw one in my truck the day I cut the stringers), you can make one by cutting a right triangle, the short sides of which precisely match the rise and run of one step. Mark the run and rise sides clearly. Figure 3 illustrates how to use the pitch block to mark these cuts.

You'll have to devise some way to hold the curvy volute steady against the miter saw while you cut. I screw a piece of scrap to the bottom of the volute to help hold it. A 14-inch miter box is a big help. I use a sharp carbide crosscut blade for all these rail cuts, as they need to be extra smooth. And I always make a shallow trial cut slightly past the mark to make sure the angle of the miter box is perfect.

Joining the Rail Sections

Joining the rail sections begins with carefully marking and drilling holes in the ends to accept the rail bolts (see Figure 4). For marking the bolt holes I make a template from a 3/16-inch-thick slice of the rail. The template won't perfectly match the profiles of all the pieces, so I always line it up flush along the bottom, centering it side to side as nearly as possible.

I first join the volute with its easement to the straight rail section. I slip the straight rail onto the bolt and dowel sticking out of the volute, then check for alignment. The easements and straight rails rarely line up perfectly. I try to line up the bottom and sides as closely as possible, as it's easier to reshape the top section of the rail. If the bottoms and sides don't line up nicely, I pull the pieces apart and ream out the holes on the straight rail until I can get the bottoms aligned.

When I like the fit, I smear construction adhesive (Liquid Nails) on the ends of both rail sections, taking care not to get adhesive on surfaces to be stained. Then I rejoin the two pieces and turn them over so I can thread the washer and nut onto the machine threads. Needle-nose pliers work best for this. When the nut is snug, tighten it further by tapping the cogs with a hammer and nail set.

On good days, everything lines up as I tighten the bolt. But sometimes the pieces twist as the bolt is tightened. To straighten them I give them a few taps with a hammer. I may even clamp them for 20 minutes while the adhesive sets. I don't worry about surface marks, as I'll thoroughly sand the whole joint area later.

The volute is now attached to the straight rail, but before I can cut the upper end of the straight section I'll have to cut and assemble the gooseneck parts and temporarily install the

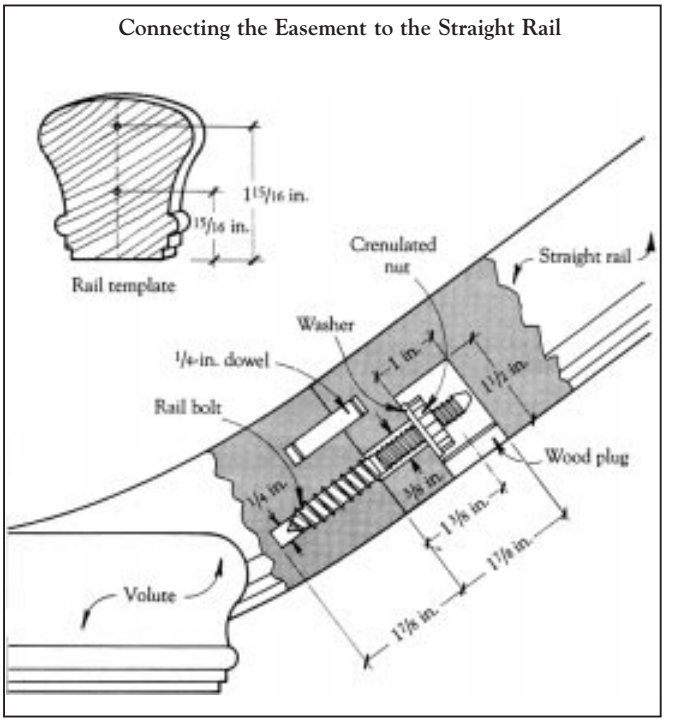

Figure 4. *To fit the rail pieces together, the author makes a template for marking the holes in the ends of the rail sections: one hole for a rail bolt that draws the pieces together, and one for a 1/4-inch dowel to keep the pieces from twisting.*

To make the template McLearn cuts a 3/16-inch-thick slice off a length of straight rail. He marks a vertical centerline on the template, then drills two holes on the centerline as shown, just big enough for a pencil tip.

The rail bolt has wood threads on one end and machine threads on the other. The author drills a 1/4-inch hole in the easement for the wood-screw end, while the machine end slides into a 3/8-inch hole he drills in the straight section. A 1-inch-diameter hole drilled on the underside of the straight section 1 3/8 inches from the end allows access for the crenulated nut that pulls the pieces together. McLearn chisels the side of this hole flat to give the nut good purchase.

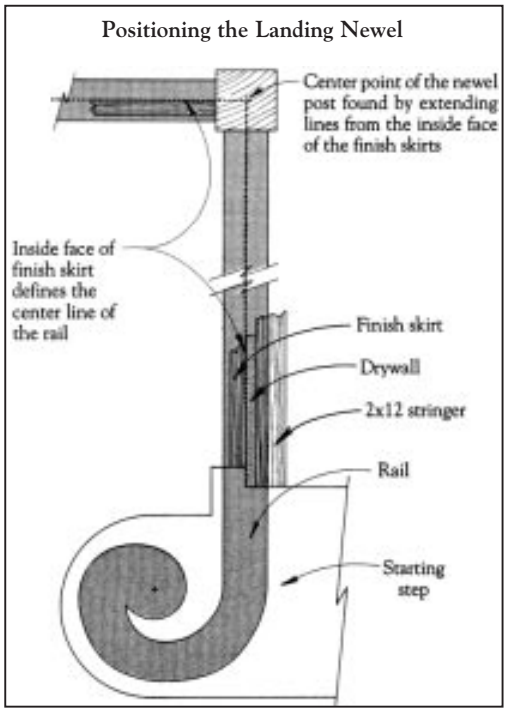

Figure 5. *The landing newel is centered over the inside edge of the finish skirts of each flight, which serves as the centerline for the railing and balusters.*

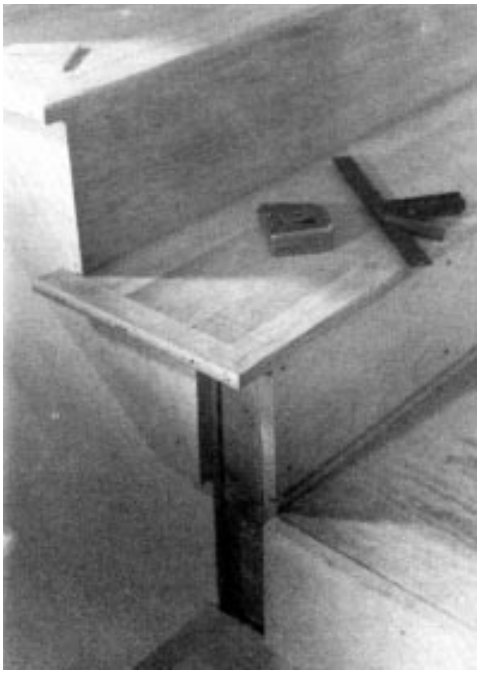

Figure 6. *To anchor the landing newel firmly against the upper stringer, the author cuts the first tread of the upper flight back to the stringer using a jig saw. He also cuts away the skirtboard and underlying wallboard.*

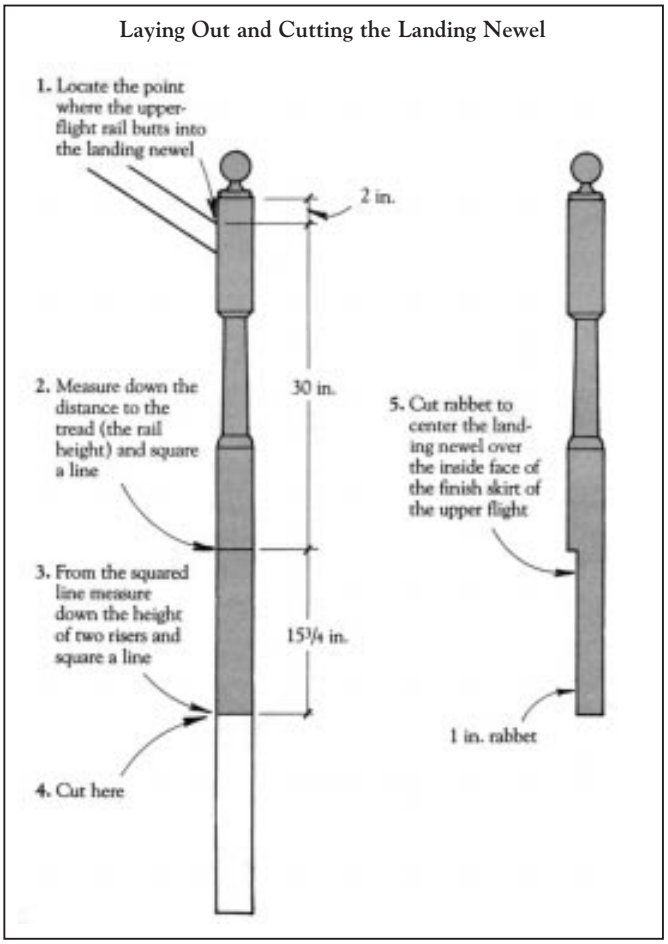

Figure 7. *To mark the landing newel for cutting, the author starts by locating the point where the upper rail will butt the top square section, 2 inches below the top of the section. He then follows the steps indicated, cutting to length and rabbeting one side so that the post is centered over the inside face of the finish skirt. The depth of the rabbet will vary depending upon the thickness of the wallboard used.*

starting and landing newels. Then I can calculate where to cut the upper end of the straight rail with the rail parts set right in place.

The Gooseneck

Morgan packages its two-riser gooseneck in two parts. The top half has a prebored hole in the end to accept the rail bolt, which is already installed in the easement. I cut the height of the straight, top section according to specs supplied by Morgan for the rail height I'm using, in this case 30 inches. Then I mark and cut the gooseneck easement, using the pitch block again, as in Figure 3. Join the gooseneck pieces and set them aside. You'll have to wait until the newels are in place to mark the cut on the horizontal section at the top.

Newel Posts

The starting newel is fairly simple to mount. It comes longer than you need it, so it needs two adjustments: a "shave" off the bottom round section so that the remaining exposed section rises to the desired height; and a cut off the bottom doweled section so that it comes about 1/8 inch short of the subfloor.

Morgan supplies a chart that tells you how high the exposed section should be, based on the rise and run of the stairs and how high you want the handrail. I measure accordingly from the top of the newel and make a mark around the entire post. Then with a rolling motion on my table saw I cut to a depth that will leave a diameter matching the dowel's. To remove the unwanted wood I chisel from the bottom, and then sandpaper the shaved section smooth so that it will fit in the prebored hole in the starting step. Last, I cut the bottom doweled section so that it is 1/8 inch short of the floor.

When the heights are correct and the new doweled section is sized, I dry-mount the starting newel to help me in marking the gooseneck cuts. Later, when the railing is assembled and the baluster holes have all been drilled, I'll apply adhesive and permanently attach it.

The Landing Newel

The landing newel for this stairway has a 3x3-inch square base, a turned section in the middle, and another square section at the top 12 inches tall. The rail will butt into the square section at the top. I like to have it land about two inches short of the top.

I center the landing newel over the inside faces of the skirtboards of both the lower and upper flights (see Figure 5). This is also the center line for the rail and balusters, which is predetermined by the placement of the volute above the starting step.

I have to cut the skirtboard and wallboard away, as well as a section of the first tread of the upper flight, in order to anchor the newel directly against the stringer (see Figure 6). The bottom of the landing newel will rest on the last tread of the lower flight, and it will be rabbeted to fit snug against the stringer of the second flight. (For details of cutting the landing newel see Figure 7.)

To anchor the newel I drill three or four plug holes into its face; each hole is 3/4 inch in diameter and about 1/2 inch deep. Then I drill pilot holes for drywall screws or 5/16-inch hex-head lag screws. I hit either the stringer or a framing member with every screw (see Figure 8, next page).

Finally, I apply adhesive and screw the newel in place. Before I bury the screws I check for plumb, shim if necessary, then drive them home.

The top newel post is anchored in a similar manner, requiring a rabbet cut to fit it against the rough carriage and center it above the inside edge of the finish skirt.

Completing the Rail Assembly

With the landing newel installed and the starting newel dry-mounted, I can now mark the cuts on the upper end of the straight rail and the horizontal section of the gooseneck. To do this I dry-mount the volute on the starting newel, then clamp the top of the rail to the landing newel or just rest the rail atop the clamp (see Figure 9). Then I adjust it to get the desired rail height, 30 inches, along a plumb line from the front edge of the tread to the top of the rail. I mark the cut for the gooseneck by tracing the edge of the newel post against it. Likewise, I trace the line where the gooseneck easement meets the straight section onto the straight piece.

Now I can cut the end of the straight rail and the horizontal section at the top of the gooseneck. I fasten gooseneck to straight rail and the lower flight rail assembly is complete.

Figure 8. *The author mounts the landing newel with either drywall screws or hex-head bolts, making sure that he hits a stringer or framing member with each screw.*

Figure 9. *With the landing and starting newels in position, McLearn sets the straight rail in place, resting it on a clamp attached to the landing newel. He first sets the rail at the correct height, along a plumb line from the front edge of the top tread (left). Then holding the gooseneck in position so that its easement cut crosses the straight rail, he marks the cuts at the end of the straight section and at the top of the gooseneck (right).*

Balusters

Compared to the rest, siting and mounting the balusters is easy. I mark the holes on the treads for the baluster bottoms, then, with the assembled rail lying on the treads, I mark the locations for the holes in the underside of the rail.

Marking the holes. The starting step comes with a full size pattern to mark the baluster holes. Use it. Then, rather than measure each regular tread separately, I make a template from a piece of 1x scrap 10 inches long — the run of one step. I square marks across one edge at 2 1/2 inches (one-fourth of the run) and 7 1/2 inches (three-fourths of the run). Notice that here I'm talking about the *run*, not the width of the tread including the overhang.

To use the template I lay it on the tread and butt it against the riser, with the marked edge in line with the inside face of the finish skirt. Then I transfer the marks onto the tread to site the bottoms of the balusters.

Before I drill these holes, though, I transfer these marks to the underside of the rail to mark the holes for the tops of the balusters. I pull the starting newel out of the way and lay the rail assembly directly on the treads themselves. The volute will be poised several inches over the starting step. I cut a support block and use it to align the newel hole in the starting step with the hole in the bottom of the volute (see Figure 10). Then, using a combination square, I transfer the baluster locations on the treads up to the underside of the rail.

I remove the rail assembly and drill 3/4-inch holes in the treads for the dowels on the baluster bottoms. I drill all the way through the tread so that extra glue will escape out the bottom and not force the baluster up.

The holes for the baluster tops in the underside of the rail are 5/8 inch diameter by 5/8 inch deep. To drill these holes I use a pitch block with a guide hole, ripped so that I can clamp it to the rail as I work. I drill these holes as precisely as possible, then cut the balusters to finish length, remembering to account for the part at the top that will be buried in the rail.

Figure 10. *McLearn sets the rail assembly directly on the treads for marking the baluster holes in the underside of the rail. He uses a support block to align the volute directly above the newel hole in the starting step. He then transfers the baluster locations on the treads to the bottom of the rail with a combination square.*

Finishing the Joints

The last thing to do before actually mounting the rail and installing the balusters is to shave down and sand any uneven joints in the rail. You'll need a sharp chisel or two, a utility knife, a rasp, and sandpaper.

I clean up these joints starting from the underside of the rail. First I chisel or knife the stepped and beaded areas near the bottom to make them line up. For the top rounded section I chisel, rasp, or sandpaper as necessary, until the joint is "invisible" to a fingertip passed over it — as many a fingertip will during the life of the stair.

Mounting the Rail Assembly

I now install the starting newel, applying Liquid Nails to the dowel and sliding it into place. When it's seated, I go below to the basement, pull through that finish nail I drove earlier (see Part I, January), and screw up through the hole with a drywall screw about 1 1/2 inches long. It helps to have a helper hold the newel in place to prevent slippage.

Before installing the balusters, I set the rail assembly back into place and trace the rail profile where the end of the gooseneck butts the landing newel. I pull the rail back off and placing my rail template over the rail profile I have just traced, I make a mark through the upper hole. I transfer that mark around to the other side of the newel, then drill holes for a 3 1/2-inch #8 drywall screw — a 3/4-inch countersunk plug hole and a pilot hole through to the other side.

I can now install the balusters. The doweled bottoms go into the holes, secured with Liquid Nails. I cut them back a bit if they bottom out, to prevent expansion-related rising later.

Now comes the tricky part — setting the railing in place and getting all the baluster tops into their holes. You'll need a helper or two for this step. First I put Liquid Nails into all the holes in the rail and at the end of the gooseneck that butts the landing newel. Then, starting at the bottom with the balusters around the volute, I work up the staircase, trying not to leave any high spots in the rail. Using a rubber mallet, I seat the railing firmly on the balusters, then drive a screw through the landing newel into the gooseneck.

The upper flight's rail is assembled in essentially the same manner as the lower rail. It's a little easier though, since the bottom of the rail is a straight piece that butts into the landing newel, and the upper end has a one-riser gooseneck.

Finishing Up

We have only to fill all the nail holes and plug the screw holes on the newels. Finish sand all the rail joints and plugs, and the staircase is ready for the painters. ■

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