Rebuilding a Federal-Period Fence

Meticulous shopwork and careful on-site planning recreate a local landmark

by Stephen Sewall and David Stenstrom

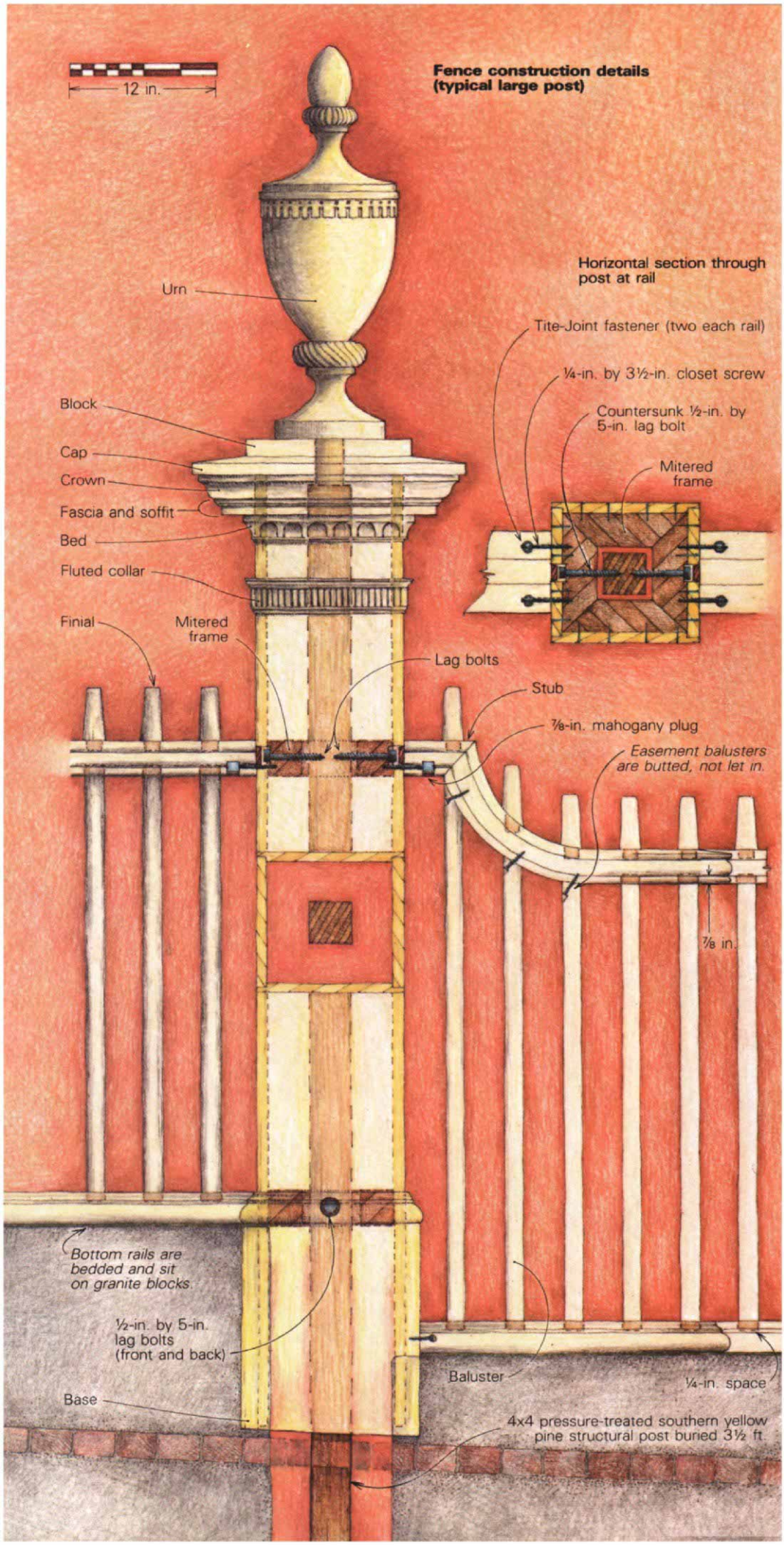
The fence in front of the 1800 McLellan-Sweat mansion in Portland, Maine (now an annex of the Portland Museum of Art), was a classic of Federal-Period craftsmanship. It incorporated elaborate and finely detailed woodwork, especially in the small moldings and carving that mimicked the portico and roof balustrades of the house. Over the years, the fence had been neglected and vandalized, but when the Portland Museum of Art was funded to build a large modern addition, the architects decided to replace the deteriorated fence with a replica, and to extend it to the corner of the proposed building to draw old and new together. Our shop, the Woodward Thomsen Co., won the contract. We specialize in architectural woodworking, and we've done a lot of historic restorations.

Planning and preparation—Working with the project architect, we chose a large and small post, a rail section, and a large and small urn to use as models. To ensure quality and precision, we decided to do as much of the work as possible in our own shop.

The architect specified Honduras mahogany for most of the fence—about 7,000 bd. ft. of it. He also specified that all of the millwork had to be dipped in a 5% pentachlorophenol solution (available under various brand names at most building-supply houses) for at least five minutes. Since this stuff leaves a waxy film on the wood, we had to keep gluing after dipping to a minimum. In order to dip large and long glued-up pieces, we had a 1-ft. by 2-ft. by 16-ft. tank fabricated from sheet metal. We bought the dipping solution in a 55-gal. drum and poured it into the tank. Penta does an excellent job of discouraging rot, mildew and insect borers, but it can be dangerous to handle (see *FHB* #15, p. 21). We did our dipping in a room with an exhaust fan, wore rubber gloves and clothes, and spent no more than one or two hours a day dipping.

Posts—Construction started with the posts. There were seventeen 12x12 posts and four 7½x7½ ones. Each would be built as a hollow box in the shop and then slipped over a pressure-treated 4x4 southern yellow pine structural post sunk in the ground. We decided to build

The fence that Sewall and Stenstrom built for the Portland (Maine) Museum of Art annex is a replica of the original. Its Federal moldings and decorations echo the trim of the McLellan-Sweat house.



Facing page: To cut the proper molding profile in the curved railing sections, called easements, Sewall and Stenstrom used waste pieces of mahogany as fences for their router so they could swing an accurate curve (left). They finished up the profile by hand, using chisels and sandpaper. Holes for the finials were drilled in easements with a Forstner bit (center), which tracks well when entering wood at an angle. Looking like a school of swimming serpents, the top rail sections with their easements attached await assembly (right). The underside of the easements are not drilled, because the balusters will butt here, rather than be let in.

each post box around two interior frames of 3-in. thick pine, as shown in the drawing at left. These mitered frames would provide enough solid material to anchor the railings to, and would let us slip the post boxes over the structural 4x4s (which are really 3½ in. by 3½ in.) with some room for adjustment.

From mahogany boards at least 12 in. wide, we cut 84 8-ft. lengths. We didn't face-joint these boards because we knew the box construction would straighten up the stock. The rough stock was a generous 1 in. thick, so we were able to get a net thickness of ⅞ in. after passing it through the planer three times, flipping it after each pass. After planing, all the stock was jointed on one edge. We ripped the front and rear pieces 12¹⁄₁₆ in. wide, and the side pieces 11 in. wide; then we routed a strong ⅞-in. by ⅜-in. rabbet in the front and rear pieces to accept the side pieces.

We marked the location of the frames inside a side piece, then mitered the frame, members and glued them up with epoxy, holding them together with corrugated fasteners. While the glue was still wet, we glued and screwed the frames to the inside of the marked side piece, and assembled the rest of the post around the other three sides. We bunged the screw holes with mahogany plugs, and marked the number of the hollow post on its inside top end.

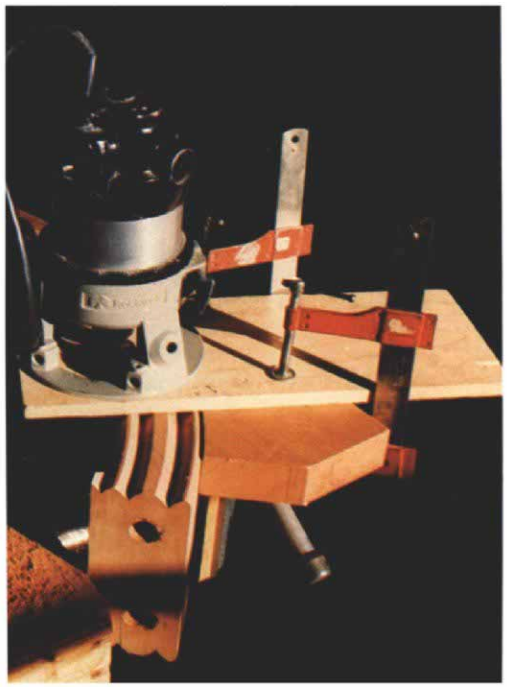
The two streets that the fence fronts aren't perpendicular, so the corner post had to be a parallelogram in section. We checked the old corner post to get the correct angle. The construction of this corner post was no different except that the rabbets in the front and rear pieces and the edges of the side pieces had to be cut at the appropriate angles.

Moldings—The urns at the top of the posts sit on 2-in. thick 13x13 blocks. Each post has seven different moldings. Just below the block is the cap, made out of four mitered pieces and beveled to the outside. We put the bevel on the stock by attaching a shim to the bed of the planer and running the stock through with one edge on the shim. We built a jig to help us align the pieces of the cap quickly, and we glued and screwed them to the block.

The upper moldings on the post are much like a cornice on a building. The topmost is in the shape of crown molding. Underneath the crown is a piece of stock that resembles a fascia and soffit. Below this is a molding with U-shape cutouts, which could be called a bed molding.

The architect told us which of the original posts we were to take our molding samples

Illustration: Christopher Clapp



from. We cut squarely through each molding to get proper profiles, and transferred these onto blank shaper knives.

Two of the moldings required special cutting. We cut the flutes in the collar piece on the router table using a ¼-in. fluting bit. Our router table has a slot in it that lets us use our table-saw miter gauge. To feed the stock, we held it against the miter gauge at 90° and clamped a stop to the table to limit the length of cut. The large bed molding with its U-shaped cutouts was first drilled with 1½-in. holes, then shaped. The drilled holes were then turned into U's with a few stopped cuts on the table saw, followed by clean-up with a little drum sander chucked into the drill press.

The fluted molding wasn't face-glued because its grain runs perpendicular to that of the post, and we wanted to let the post sides move. This problem could have been avoided if we'd been able to use a high-quality marine plywood for the posts. Other moldings were face-glued to each other when their grain ran together. Most of the moldings were also screwed or finish-nailed, and we epoxied all of the miters.

Railings, balusters and finials—With the moldings on the posts, we started work on the railing sections. This part of the project involved the most critical measurements and complicated planning. From the plans, we were able to take off the rough lengths of the railing sections. Most of them are about 24 ft., some are less and one is about 28 ft. The upper and lower molded railings are made up of two pieces laminated together. The architect had specified that there could be no more than two joints in each section, and that joints be at least 3 ft. apart. We sanded the parts first, then face-glued them and screwed from underneath.

The last step before dipping the rails was to lay out and drill the holes for the more than 1,000 finials and balusters. These were spaced about 4⅝ in. apart on the old fence. From the plan, we calculated the length of the sections and divided by 4⅝ to get the number of balusters we thought we'd need. When things didn't come out even, we added or subtracted a baluster to get consistent spacing.

Once one rail in a section was laid out for its bore centers, we used it to mark the other, being sure to mark the starting end with a big scribed X so that we wouldn't accidentally turn one rail end for end during assembly.

The top railings accept finials from the top and balusters from below, so we had to drill partway through them from each side. The finials needed a ⅞-in. deep by 1⅜-in. dia. hole, and the balusters needed a ⅞-in. deep by 1½-in. dia. hole. To line the two holes up, we drilled a ¼-in. pilot hole through from the marked side, using two 1-ft. by 8-ft. scraps of latex-coated particleboard as extension wings on the drill press to support the long lengths. The slippery latex coating also made it easy to slide the railing along. We used a fence clamped to the drill-press table to center the bore across the piece. The partially assembled lengths were then ready for dipping.

Easements—Because this fence changes level, we needed to make thirteen easements—continuations of the upper rail that curve up to the needed height, then level off in a short 6-in. stub before connecting with a post at the new level. The old easements had been carved from solid blocks of pine. To speed up the process and to make a more consistently good product, we made ours in two pieces: the curved part and the horizontal stub, which we made out of a piece of molded railing stock.

Easements ranged from a 3½-in. to a 14-in. rise. We drew each one full scale so that we could calculate the size blank we needed and determine the angle of the joint between the curved part and the stub.

We glued up the blanks for the easements out of one piece of 1¾-in. stock, sandwiched between two pieces of 2½-in. stock. This brought the rough width of the rail to 6¾ in. The finish width after shaping was 6⅝ in. We drew the profile of the easement on the face of the block so that the angle cut would be perpendicular to the edge of the block for convenience's sake. The other end cut was done freehand on the bandsaw. We cut the curves carefully, and saved the waste pieces to use as sanding blocks with coarse sandpaper to keep the curves true.

We attached the sanded curves to the rail lengths temporarily with two ¾-in. dia. birch dowels, and marked the molding profiles onto the end of the easement. At the other end we doweled the stub on in a similar fashion and marked the molding profile. We ordered a two-flute 1¼-in. V-groove router bit, and ground the wings to match the profile of the molding. With the waste pieces we had saved from cutting the curves, we fashioned fences to go onto our shopmade wooden router base. We then cut as close as we could to the molding profile (photo above left). The final shaping was done with chisels and sandpaper.

To cut the drip-cap slant on the top of the easement, we modified a 2-in. long three-wing shaper cutter. We tapered the wings to match, and cut the easements against a collar mounted on top of the cutter. The cuts were made in two passes using two collar sizes.

Before gluing the easements onto their railing lengths, we drilled ¾-in. holes in them so finials could be doweled in. We bored the holes by clamping the easements to the drill-press table as they would sit on the fence, and using a Forstner bit (photo above center). These bits track well at an angle because they are guided by their rim and not their center. The easements, stubs and railings were then glued up into single lengths (photo above right).

Assembly—It took two people to lift the railing sections and to speed up the assembly time to within the working time of the epoxy glue. The dipped lengths of railing were brought to a long hallway in our shop. Making sure the X ends were matched, we glued and screwed these lengths together into full-section lengths.

We screwed a row of 2-ft. long lengths of 2x4 to the floor every 4 ft. along the length of the

hallway, shimming where necessary to provide a level base. We set each bottom rail on this level base and coated the baluster holes with epoxy using an artist's palette knife. Upper rails with easements, if any, were placed upside down on sawhorses, and their baluster holes were coated with epoxy, too.

We made lengths of 2x4 to keep the upper and lower railings the right distance apart. The balusters were cut ¼ in. short of bottoming out in the holes so that glue or slight inconsistencies would not interfere with even spacing. The balusters under the easements were butted, not let in. We marked them by eye, sawed them to length and sanded them, then glued and screwed them in place. Finally, we coated the finial holes with epoxy and installed the finials.

Urns—The urn was a popular motif during the Federal Period, and one of the prominent features of the fence is the turned and carved urns atop the posts. The large urns are 33 in. high and 11½ in. at their greatest diameter. The urns on the four gate posts are smaller and proportioned differently. The original urns had been turned from solid pine blocks. Working with the thickness of stock now available, we glued up four pieces of 12-in. 12/4 mahogany to make the urn blank. To minimize the amount of wood to remove, only the two inside pieces contained wood for the 2¼-in. by 4-in. tenon and the top.

We acquired an old lathe with enough swing and weight to turn the urns. But even with its cast-iron bed and legs, we learned it was necessary to match the densities of the two outer pieces in the glued-up block. Otherwise, when turning the block to round at the lowest speed (about 250 rpm), the lathe would shake and the centers would wear in the somewhat soft mahogany. As it was, because of the weight of the blank after it was true and round and the conical center in the tailstock, the urn would work its way off center and need to be repositioned by cutting the end off the piece and remarking the center. The only solution was to turn and sand one section at a time. That each portion of the urn was not turned on exactly the same centers was hardly noticeable.

After the blank was round, we marked reference points along its length. We cut half-circles of ¼-in. plywood to determine the important diameters. Because each urn was separately hand measured and turned, each came out a little different, particularly in the shape of the curves. We felt that this was all right—even desirable—because of the variations in the sizes and shapes of the originals.

We used the same approach in the carving. Each large urn had an upper fluted ring and a lower ring with spiral fluting. At its widest point were vertical flutes terminating in a ¼-in. hole. All of the spiral fluting was clockwise except on the urn that sits to the right of the front gate. The fluting on it is counterclockwise. The small gate urns had reeding on the rings. Studying the old urns, we discerned the simple, irregular nature of the carving. We tried to do the work in the same spirit. We wanted to do the carving well, but without agonizing over perfection (photo facing page, left).

Finish and installation—The final finish on the fence was three coats of Benjamin Moore solid-color stain, mixed to match the trim of the mansion. The first coat was sprayed on at the shop, because this was the best way to coat the molded, turned and carved elements of the fence. The finish coats had to be applied at the site, though, and the stain had to be brushed to get the best coverage and to protect the environment. Any area of the mahogany that we had not adequately covered would have bled through red when it got wet.

The bottom rails of the fence sat on continuous granite blocks. At the posts, there were spaces 6 in. to 10 in. wide between blocks. On the old fence, this space was filled with the 6x6s or round cedar posts around which the finish posts had been built. The bottoms of these posts had mostly rotted, and we had to dig out the debris to set our new 4x4s.

After the holes were dug 3½ ft. deep, we set the posts plumb and on the centerline of the granite. Getting this right was critical. We'd left the rail sections a little long to give ourselves some play, but the baluster spacing was already determined, and the end baluster was supposed to be the same distance from the post as it was from the baluster next to it. Also, we couldn't shift the post more than ½ in. in either direction once it had been slipped over the 4x4s.

After the structural posts were in place and the holes filled and tamped, we brought the shop-fabricated fence posts to the site. They were complete except for base, cap and urn. We knew how high each of the posts was supposed to be, but their bottoms had to be cut to fit over the granite and to come to within about 1 in. of the sidewalk in front and the ground behind. We made the cuts with a sabre saw and painted the cut wood. We lifted the built-up posts and slipped them over the 4x4s. At the locations of the internal frames, we drilled and counterbored for ½-in. galvanized lag bolts and washers. The bolts were positioned at bottom-rail height front and back and at upper-rail height on the sides. With the bolts opposing one another, we could loosen one and tighten the other to align and plumb the fence post. Tapered plugs were epoxied in the counterbored holes and trimmed flush.

Next we transported the rail sections to the site. We laid each section on sawhorses between its posts. There could be no mistake in cutting the sections to length, so we took four measurements; one each at the inside and the outside of the post at the position of the upper and lower rails. We compared these with the planned length of the section. We also used a long straightedge, a level and a square to determine whether the curbs were straight and perpendicular to the plumb posts.

After checking and rechecking our work in every conceivable way, we cut the rail sections to length using a clamped-on guide and a circular saw (photo facing page, bottom right). All the cuts were okay, but this whole process was nerve-racking, as the disadvantages of erecting shop-fabricated sections became apparent. We were constrained in ways that the builders of the original, assembled-in-place fence hadn't been. There are so many variables that it's hard to anticipate everything that can go wrong. Working on the site, we were subject to weather, lack of machines, and the distractions of passersby, so the final result was often the best compromise. However, we still believe that our procedures ultimately produced a better fence, and one that should last longer, because shop conditions allow more control over quality.

After the rail cuts were made, we lifted the section into place between the posts on top of the granite and noted any small adjustments that could be made for a better fit. We traced the profiles of the upper rails on the posts. The section was removed and put back on the sawhorses. With a template made from a ½-in. cross section of the shaped upper rail, we marked the positions for two ¼-in. by 3½-in. closet screws in the post (photo facing page, top right) and turned them in with a vise grip. A closet screw is like a hanger bolt—a lag-bolt thread on one end and a machine thread that works with a Tite-Joint fastener on the other. With the same template set against the end of the upper rail, we determined where to slot the bottom of the rail so it would slip over the closet screws protruding from the posts. The template also located two ⅞-in. dia. holes on the underside of the rail to accept the Tite-Joint fastener.

The cut ends of the rails were painted. We spread bedding compound (Pettit Marine Paint Co.) on the bottom of the bottom rail to prevent contact between it and the granite. The rail section was lifted into place and the Tite-Joints tightened. We drilled, countersunk and fastened the lower rail to the post with 3-in. screws. All holes were plugged, and the plugs were chiseled and sanded flush and painted.

After the posts and rail sections were in place, the post caps with the urns attached were secured in place. Baseboard pieces were fit around the bottoms of the posts. We fit them carefully where they butted the granite. These baseboards helped make the posts more rigid. The base caps, which have the same profile as the bottom rail, were mitered and coped around the posts. The last steps were to hang the gates and do touchup painting. In the third stage of its history, the new fence embodies both the original high-style Federal design and the Colonial-Revival reconstruction and extension of 1912. □

Stephen Sewall and David Stenstrom are architectural woodworkers in Portland, Maine. Photos by Stephen Sewall, except where noted.

Urns. **The urns were turned in the shop out of four glued-up 12/4 blocks of mahogany (facing page, left). Sewall carved the flutes and other decorations by hand. The result was a collection of urns that vary slightly in shape and detail, just as the originals had.**

Installation. **Rails were cut to length on site (facing page, bottom right). In the top photo, a shopmade post has been lowered over the structural 4x4. Stenstrom uses a template to mark the position of the closet screws. He has already cut the grooves and drilled the holes in the underside of the stub end of the upper rail. The grooves will slip over the closet screws, and the holes will hold the Tite-joint fasteners.**

Photo facing page, left: David Stenstrom