



Traditional Stairways Off the Shelf

About manufactured stair parts, and how they are made

by Kevin Ireton

On the banks of the Fox River in Oshkosh, Wis., stands an old stone building with a Victorian staircase just inside the front door. It's a heavy stair, done in dark oak, with a balustrade of spindles ascending on the left, complemented by a raised-panel wainscot on the right. The box newel that anchors the balustrade is also made of raised panels and is topped off by a square cap with a graceful curving cross section. The newel cap isn't nailed to the post; if you lift up on it, it comes off easily. Underneath you'll find a small scrap of sandpaper with writing on the back. In a faded penciled scrawl it says: "Built by R. W. Maurice Jan. 18, 1897." Such is the nature of stairbuilding and the pride it generates; people sign their work.

Stairbuilding is the pinnacle of the carpenter's trade. It combines the mathematical complexity

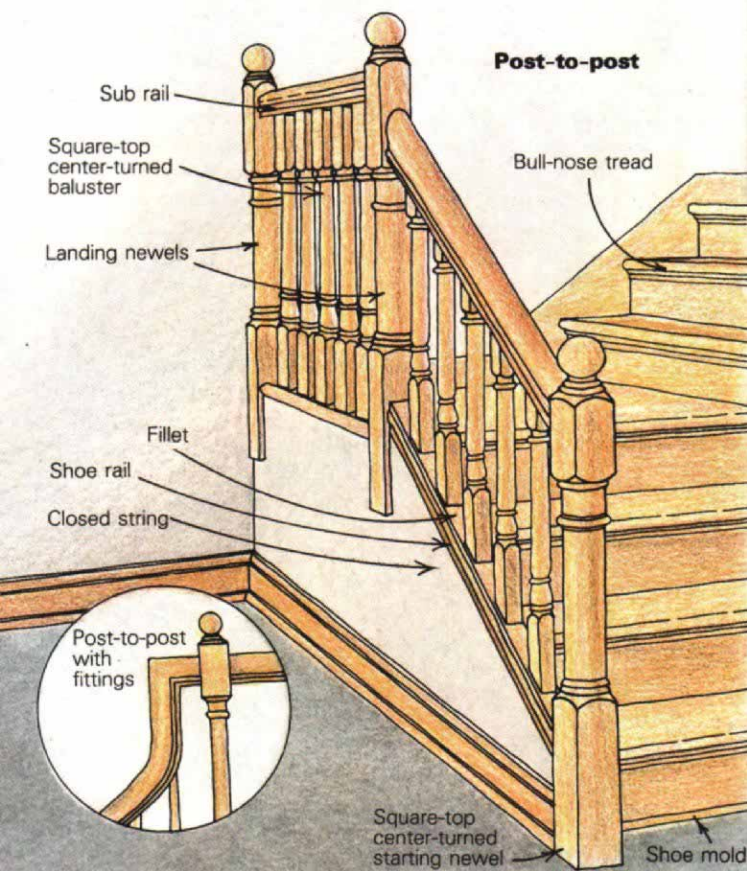
of roof framing with the exacting standards of furniture-quality finish work. Traditionally, the staircase is the dominant architectural feature inside a house.

From the end of World War II through the early 1970s, during the heyday of the rambling ranch-style house, the practice of stairbuilding flourished, not only because the indiscriminate suburban sprawl encouraged one-story and split-level houses, but also because mass production and modern technology were streamlining construction techniques wherever possible—and one result was that wrought iron became the

A great deal of handwork goes into manufactured stair parts. Above, a worker at Morgan Products Ltd. uses a chisel to carve the inside of a volute where the shaper couldn't reach.

material of choice for many stair railings. But rising land costs have meant a return to multi-story houses. Also, the current popularity of old-house renovation has brought with it the need to restore and rebuild the stairwork of 18th and 19th-century craftsmen. All of this has fueled a resurgence of interest in traditional stairbuilding.

But the resurgence has been hamstrung by a lack of carpenters with an extensive knowledge of stairwork. Without an experienced stairbuilder on his crew, a builder has two choices. He can either contract with a custom-stair outfit to build the stairway to specifications, or he can design the stairway around manufactured parts. In a future article, I'll write about custom stairbuilders, but here I'll deal with how and where off-the-shelf stair parts are manufactured and sold. To find out about these exotic-looking



Stairbuilder's lexicon

Balusters—Vertical members used to support the handrail and to fill the open area between the handrail and the tread or floor. *Taper-top balusters* (above right) are turnings whose shaft tapers, usually from 1 1/4 in. in dia. to 3/4 in. at the top. *Square-top balusters* (above left) are used with plowed (grooved) handrail and can be uniformly square in cross section or *center-turned*, which means that the center section is a decorative turning.

Balustrade—The complete railing system, including newel posts, balusters and handrail. There are two basic types: in a *post-to-post system* (above left), the handrail is not continuous but is fitted between newel posts; an *over-the-post system* (above right) uses handrail fittings to create a continuous flow of handrail over the newel posts.

Brackets—Thin decorative pieces that are attached under the returned nosing of an open-string stair.

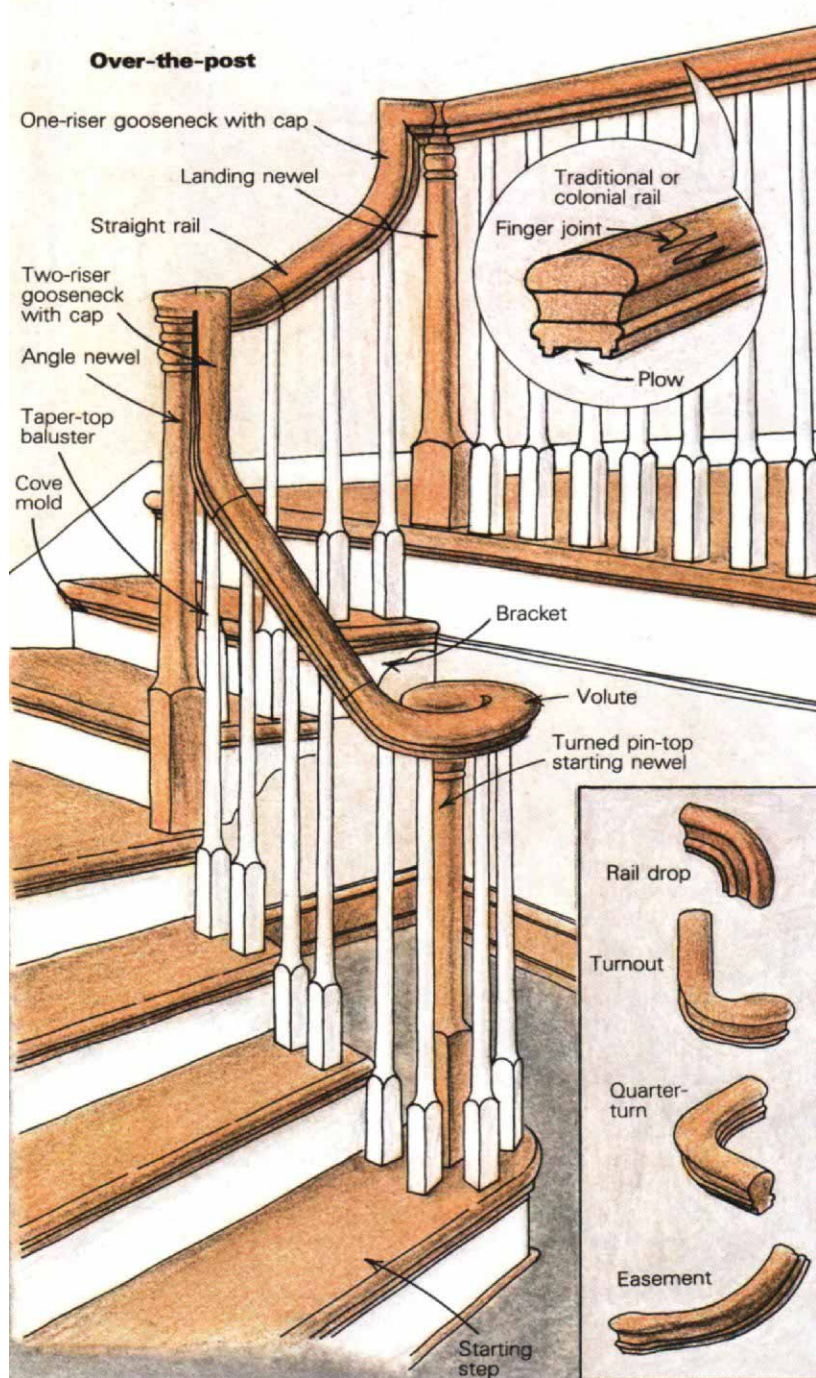
Closed String—A solid stringer that covers the ends of the treads and risers such that their profile cannot be seen (above left).

Fillet—A thin strip that fills the plowed (grooved) space between balusters in a handrail, sub-rail, or shoe rail.

Fittings—Sections of handrail used at the beginning and end of a balustrade or wherever the handrail changes height or direction. An *easement* is a fitting that curves in a vertical plane, used to change the angle of the handrail (shown at right is an easement with an integral newel cap). A *gooseneck* (above right) includes an easement and is used to change the handrail from the incline of the stair back to level, either at a landing or at the top of the stair.

A *quarter-turn* (right) is a level section of handrail used to make a right-angle turn. A *rail drop* is a curved fitting used as a decorative beginning or ending on a handrail (right). A *turnout* (right) is a starting fitting that curves in a level plane before curving vertically up the stair. A *volute* (right), or a wreath, is a starting fitting, similar to a turnout, that scrolls into a tight circle.

Handrail—The horizontal or inclined member that runs over the balusters and is supported by the newel posts. *Plowed handrail* (see detail above right) has a wide groove cut in its underside and is used with square-top balusters. *Wall rail*, usually simpler in design than handrail, is used where a stair runs along a wall and is attached to the wall with brackets.



Newel posts—The vertical members, larger than balusters, that support the balustrade. The *angle newel* (shown above) is the longest of the newels and is used at a landing where a stair changes directions and then continues to climb. A *center-turned newel* (above left) has *square ends* but a lathe turning in the center. A *box newel* is rectangular in cross section its entire length. A *landing newel* (shown above) is shorter than an angle newel and is used at a landing or at the top of a stair where the handrail changes from inclined to level. A *pin-top newel* has a dowel-like pin turned at its top, used to attach a fitting. A *starting newel* is simply the first newel of the balustrade.

Open string—A stringer that is cut out for the treads and risers such that their profile can be seen from the side (above right).

Shoe rail—A plowed rail that is used under square-end balusters when they don't sit directly on the treads (above left).

Starting step—The first tread and riser at the bottom of a stair, usually a step that is curved on one or both ends (above right).

Sub-rail—A thin rail attached to the underside of a handrail to make it more massive and allow for the use of square-top balusters (shown above left).

components, I visited some of the companies that make them.

Around the country, there are a handful of companies whose volume of sales qualifies them as major manufacturers of stair parts (see the sidebar on p. 61). I was able to visit three of them and tour their plants. I learned that these companies are highly competitive (at the distributor level), protective of their secrets and fiercely proud of their products. I also learned that, much to each other's chagrin, all three produce high-quality stair parts.

Stair-part basics—The balustrade of a staircase is the complete railing system, including newel posts, balusters and handrail. There are two basic types of rail systems—a post-to-post system uses square-topped or box newels with straight sections of handrail fitted between them, and an over-the-post system uses turned pin-top newels and various fittings—volutes, easements, goosenecks and quarter-turns—that allow a continuous flow of handrail (for definitions of the individual stair parts, see the previous page).

Most manufactured stair parts relate to the balustrade, but all the companies produce various other components as well. For instance, they all offer several styles and sizes of starting steps with curved risers. These are used with over-the-post balustrades that begin with a volute, and in some cases with a turnout. They serve as a structural and visual anchor for the balustrade, the shape of the starting tread reflecting the shape of the handrail.

Some companies make bull-nose oak treads for the rest of the stair, and these are available in various widths and lengths. You can also get nosings, cove and shoe mold, all to match the treads. Most of the companies offer decorative bandsawn brackets for use on the side of an open stringer stair. A few companies even make tread and riser caps for use along the outside edge of a stair that's to be carpeted. These give the illusion of a finished stair but save the cost of oak treads and risers that would otherwise be covered by the carpet.

Most of the industry, however, is devoted to producing newel posts, balusters, handrails and handrail fittings. The designs for many of these parts are very old, derived from the relatively delicate balustrades of colonial America. But some of the companies have recently come out with lines of stair parts that are more massive, including handrails as wide as 3½ in.

The three companies that I visited all have different product lines, though the most popular styles are available from all of them. They sell only through distributors, so if you contact them directly, they'll send you a catalog and the name of their distributor in your area.

Morgan—My first trip was to Morgan Products Ltd. in Oshkosh, Wis., where I met Sam Stecker, product manager for Morgan's line of stair parts. It was Stecker who showed me, with some ceremony, the signed note under the newel cap in Morgan's office building. After talking for an hour in his office, we walked outside into bright sunshine and crossed the street to the plant.

Morgan has been in business since 1855, when

it operated a planing mill on the same site that it occupies today. But now they're spread out over 27 acres and the plant is a labyrinthine conglomeration of buildings connected by walkways, conveyor belts, railroad tracks and even dirt paths. Some of the buildings are fairly new; others predate the 1897 note under the newel cap.

The stair parts that Morgan produces are either oak or birch, except for a small line of pre-assembled railings that are done in hemlock. They buy their lumber roughsawn, mostly from mills in the upper Midwest and Canada. Most of it is dried in their own kilns, a process that takes from 30 to 45 days depending on species, size and initial moisture content. Then the lumber enters the plant and is run through surface planers that give the operators their first glimpse of any defects. The next stages are crosscutting and ripping.

"Any manufacturer will tell you that a sawyer can make or break them," Stecker told me. The sawyers at Morgan use saws that rise up into the stock from beneath the tables. The planed and ripped pieces come to them on conveyor belts. The sawyers scan each piece for knots or other defects and gauge the distance between them. Next they slide the piece along under the saw guard, butting its end into one of a series of fixed stops on the other side of the saw. There are maybe a dozen of these stops, each for a specific stair part—baluster, newel or tread. The sawyer's job is to cut out all the knots, but at the same time, to get the longest possible piece.

From here the pieces for newels and fittings go on to gluing operations, where machines spread them with urea-base glue, clamp them and heat them at the same time to speed the curing process. The glued-up blanks are ready to be worked half an hour later. Pieces for turned newel posts and balusters are planed again to remove the excess glue and bring them down to final dimensions. Then these turning blanks are moved on carts to the automated back-knife lathes. Some of the baluster lathes are hand fed by an operator, but most are self feeding, holding up to 12 blanks at a time.

There are two basic types of balusters. Taper-top balusters are available with various amounts of decorative turning, but their distinguishing characteristic is that most of the shaft is a straight taper from about 1¼-in. dia. at the bottom to ¾-in. dia. near the top. Actually, the taper stops just below the top, and the last 3 in. is a uniform diameter. This is so that cutting the balusters to length doesn't affect the size of drill bit needed to install them in the handrail.

The other type of baluster is called square top or square end, and is used with a plowed handrail. The balusters are cut on the rake angle of the stair and toenailed into the underside of the handrail. The plowed areas between the balusters are filled in with thin strips of wood called fillets. The square-top balusters that Morgan offers are all center turned, which means that both ends are square but the center section has a decorative lathe-turned pattern cut into it.

When Stecker and I arrived at the station where newels are turned, the lathe operator was changing knives for a new run. He said the whole process took anywhere from two to four

hours. But once it was set up, he could turn out about 200 newels a day.

All the turnings go on to sanding machines where they get spun again, this time against rows of sanding belts of various widths (top left photo, facing page). These belts are backed by heavy broomstraws that press them against the baluster or newel.

Before being glued up into blanks, the stock for handrails is finger-jointed end to end to obtain the required length. I have worked with manufactured handrails and had always objected to the finger joints. Though strong and well done, they detract from the visual integrity of the handrail, especially when the adjoining pieces are markedly different colors.

I asked Stecker why they manufactured finger-jointed handrails. "We cut for yield," he told me. "It's a high-volume business. We manufacture miles and miles of handrail every week, and there just aren't enough clear lengths of lumber out there in the new-growth trees." They're also concerned about straightness and stability. Long pieces of solid handrail are more liable to twist or warp than glued-up rails.

Another advantage of finger joints and laminations is that Morgan can use up wood that might otherwise be wasted. This economizing is evident all over the factory. Everything is used for stair parts that possibly can be, most of what can't be used is chopped up and burned, either to run the kilns or to heat the plant.

Morgan offers four styles of handrail, with various other options possible using a sub-rail. However, their fittings are available in only one style. The most popular handrail—at Morgan and elsewhere—is called colonial by some companies and traditional by others (drawing, p. 57, inset at right). Morgan's traditional rail, which they call M-720, is stack-laminated with three finger-jointed layers ¾ in. thick. Individual pieces in each layer are seldom shorter than 24 in., and the top layer of the handrail is limited to three or four finger joints, depending on its length.

After the handrail blanks are glued up, they're fed into huge molders that turn out smooth finished rails in one pass. No sanding is needed.

I asked Stecker how quality control was maintained. "We have 70 quality-control inspectors for stair parts alone. All our employees have the authority to reject a piece of wood that comes to their station. No questions asked." And sure enough, at each station there was a small pile of rejects from the operator. Some of these get chopped up, some are used by the salespeople in their training sessions. Still others turn up around the factory. Defective newels become the corner posts on the flatbed carts used to move stock from one station to another. In several places, I saw tables with balusters for legs. When I visited the product-development offices, I found rejected newel caps with holes drilled in them doing duty as pen and pencil holders.

The carpenter shop—In the course of the tour, Stecker and I had worked our way toward the carpenter shop. Straight handrail, balusters and turned newels are all pretty much the products of automation; the operators only feed and tend the machines. But all of the fittings—vo-



Morgan's taper-top balusters are sanded on the machine above. They are spun at high speed against rows of sanding belts at the back of the machine. The belts are made in various widths to conform to the shape of the balusters and are forced against the baluster by stiff broomstraws.



Handrail fittings look more complicated to make than they really are. They all begin as simple shapes cut out on the bandsaw. The Morgan operator in the photo above is making level quarter-turns for use around a stairwell opening.

At Visador/Coffman, the shape of the volute allows the operator to pass it all the way around the shaper, thereby avoiding a great deal of handwork. In the photo below, he is using a template that holds two volutes at a time, allowing him to shape the inside curve of one and the outside curve of the other. He will make the final pass on the shaper head to his left.





At Colonial, there is a greater juxtaposition of old and new methods than at other companies. Using a bolted down Jorgensen clamp for a bench vise, this worker pares the sides of a one-riser gooseneck with newel cap.

lutes, easements, goosenecks, turnouts—are done largely by hand.

At no point are all of Morgan's stair parts being produced at once. They do short runs of a given piece, based on orders received and on projected needs. Some days people work on four or five different types or styles of fittings.

The blanks for the fittings are carted into the carpenter shop. Their first stop is a hulking 36-in. bandsaw (top right photo, previous page), where the operator traces a pattern on one or two faces of the blank, depending on whether he's making a fitting that curves in one plane (like a quarter-turn) or in two planes (like some of the easements). He cuts them out quickly, both hands guiding the cut, then one hand repositions the piece as the other sweeps the scrap into a nearby cart. The cart of blanks diminished appreciably in the 15 minutes that I watched. And the bandsawn parts grew in neat geometrical stacks.

The carts full of bandsawn pieces are then rolled over to the shapers. Each of the operators here has two shapers going at once—the first removes most of the waste and the second makes the final cut. For some of the fittings, like the up easement with an integral newel cap, a heavy steel template is attached to the top of the bandsawn part and rides against a fixed pin centered over the shaper head. Other fittings are nestled into wooden jigs and ride on bearings mounted above and below the cutters. Some parts are worked freehand.

Most of the fittings are made in two pieces and are assembled at Morgan in one of two ways. The volutes come with an easement already attached, so that you have a level scroll of handrail that unwinds into a short curved piece (the easement), which makes the transition from

level to the incline of the stair. These two pieces are attached with flat metal fasteners called clamp nails. The clamp nails have longitudinal barbs running along their edges and are tapered slightly so that as they're driven into place they draw the two parts tightly together.

The gooseneck fittings, which create the transition of the handrail at the top of the stairs from inclined back to level, are made with a gooseneck piece and a level piece that are mitered together using wood splines and wedges.

Before I began my tour, I had not imagined that anywhere inside of the factory I would find people with hand tools working pieces clamped in a bench vise. But once joined, the fittings are dressed by hand, using chisels, rasps and sandpaper (photo p. 56).

I asked Stecker why the profiles don't match exactly when you join a section of straight rail to a fitting. He pointed out that I had just seen the reason: the straight handrails are made by molding machines and the fittings are made on shapers. The cutters of these machines are changed all the time. Despite every attempt to keep the profiles the same, minor differences happen.

I spent two days at Morgan Products, Ltd. and developed a general understanding of how they make stair parts. I decided to spend one day each at the facilities of two other companies to find out if they were doing anything different. It turned out that the milling procedures that I saw at Morgan were more or less the same as at the other companies that I visited. But I did notice some interesting differences.

Colonial Stair Co.—The second company that I visited was the Colonial Stair and Woodwork Co. in Jeffersonville, Ohio, a tiny farming com-

munity in the central part of the state. Although Colonial began in Jeffersonville and is still headquartered there, the company now has two other plants, one 20 miles north in South Charleston and the other in Varney, W. Va. The Varney plant has all the manufacturing capabilities of the main plant and also has a sawmill. Colonial is the only company that I visited that cuts much of its own lumber from the log.

Forty years ago the building that Colonial occupies in Jeffersonville was a canning factory. Colonial started there because the building had a boiler, which they needed to run the kilns for drying the lumber. You can still see parts of the old canning factory, including the huge boiler that is stoked with sawdust by a man using a big coal shovel.

There is less automation at Colonial than at Morgan, fewer conveyor belts and more people handling the lumber. The plant is an old one-story building with a barn-like atmosphere. A lot of doors and windows were open on the hot June day that I was there. Some of the men had their shirts off. Two cats were making themselves at home, sleeping on workbenches, amidst all the dust and noise.

But it would be a mistake to assume from the small-town appearance that Colonial is anything but a major producer of hardwood stair parts. Paul Knapke, Colonial's vice-president and my tour guide for the day, pointed out that, calculated at the retail level, Colonial sold over \$20 million worth of stair parts last year. And what's more important, when I examined one of Colonial's volutes, I couldn't tell the age of the building where it was made or that its pieces were crosscut by a 40-year-old Dewalt. I could see only that it was made with a great deal of care and skill.

Colonial also has some very modern equipment that belies the old-world atmosphere. They have two electronic gluing machines, for instance, that clamp the blanks and then cure the glue to near maximum strength in three to seven minutes. One of these machines holds up to ten 16-ft. long blanks for handrails.

At Colonial, the production of handrail fittings isn't confined to one part of the plant the way it is at Morgan. There is a small carpentry shop, with table saws, sanders and buffing machines. But the bandsaws and shapers are in other parts of the plant. The fittings are cut to length in the carpentry shop, assembled and for the most part hand-finished. I saw four or five people working in there, but they were all sanding or buffing when I visited, except for the man in the photo above left.

Colonial sells a videotape that they developed, called "Treasures in Hardwood." It's a two-part, 60-minute tape about stairbuilding and balustrade systems and sells for \$54.95, including handling (the company's address is listed in the sidebar on the facing page). I wish the production quality of the tape were higher and that there was less time devoted to company history. But the information on the tape is useful, and although much of it is available elsewhere (all of the manufacturers furnish pamphlets on how to work with their stair parts), this videotape might serve as a good introduction for people who

have never worked with manufactured stair parts before.

At the end of my tour, I asked Knapke if there was really a difference in quality between the products of the major manufacturers of stair parts. "I'd be lying if I said there was a big difference," he told me. "I'd like to think that maybe the quality of wood that we use is a little better because of the control we have over cutting and drying it."

Visador/Coffman—Without a doubt Visador/Coffman in Marion, Va., has the newest and largest plant of the companies I visited. Built in 1977, it has over 100,000 sq. ft. of floor space in the one-story building that houses the milling operation. Raw lumber goes in one end and finished stair parts come out the other. There are 2,000,000 bd. ft. of lumber air drying in their yard, and another 750,000 bd. ft. stored in a climate-controlled warehouse that reduces moisture content much faster than air drying. Then the lumber goes into their kilns. They move 35,000 bd. ft. through their factory every day.

When I arrived at Visador/Coffman, I spent some time talking with Bill Foster, the general manager, and then met John Gray, the resident engineer, who conducted my tour. I saw more technology and less handwork at Visador/Coffman than I saw at either of the other companies. But I noticed other differences too. For instance, their volutes don't draw into as tight a curve as Morgan's. I didn't like them as well, but the design allows Visador/Coffman to work the shaper all the way around the volute, eliminating any rasp and chisel work (bottom photo, p. 59).

Visador/Coffman has six molding machines that were all turning out handrail on the day I visited. These machines make so much noise that they're housed in little flakeboard cubicles. The blanks are fed into a small opening on one side, and the finished rail comes out an opening on the other. One of the older men who was receiving the finished rail as it came from the molder had his right hand loosely wrapped around the rail, letting the machine feed it through his fingers. "He's checking for defects," said Gray. "If there's the slightest variation, he'll feel it." Other workers I saw used a steel template to check the rails.

The most exciting thing I learned at Visador/Coffman is that they offer veneered handrail in several styles. This process, called profile veneering, has been done in Europe for many years but Visador/Coffman is the only U. S. manufacturer that does it. They buy the veneer in rolls, like toilet paper, and wrap it around finger-jointed handrails. The result is a length of rail that appears to have no finger joints. It's made here in three different styles, and the core is essentially a smaller version of their regular handrails, except that more finger joints are allowed since they won't show.

The chief criticism of this veneered handrail has been that when you attach it to a fitting and have to dress it down you are liable to sand through the veneer. But Visador/Coffman makes their veneered handrail slightly smaller than the fittings so that you can dress the fittings down and not have to sand the veneer. They also

price the veneered handrail 15% cheaper than their regular handrail.

Another interesting item made by Visador/Coffman is bending rail, which you can use to make a handrail that conforms to the shape of a curved stair. Available in two styles, this rail is sliced vertically into layers about $\frac{5}{16}$ in. thick. To make a curved handrail, you use the stair itself as a mold, spreading the individual layers with glue and clamping them directly to the treads with the aid of L-shaped clamping brackets. Along with each bending rail, Visador/Coffman includes a 3-pp. illustrated installation guide.

Visador/Coffman also markets a couple of jigs designed by John Gray to help people cut and connect handrail fittings. One is a miter jig (\$24.50) to help you cut fittings on your miter box. The other is a slotting jig (\$120.77) that allows you to connect fittings to straight rail using clamp nails, instead of the traditional method, which is to use a rail bolt.

Designing and ordering—Though it may seem an obvious point, you should design your staircase, including the balustrade, before you build it. Some people assume they can find parts to accommodate whatever they design, and construction can get pretty far along before they go looking for some of the parts and fittings. Despite the wide selection of parts available, finding exactly what you need isn't always possible. Make the staircase a part of your house plans from the beginning. When you frame the stairwell, you begin to commit yourself to a specific design, and a lack of planning at this point can create problems that won't show up until later, when changes are especially frustrating and expensive.

Write to the companies listed above for their catalogs, and ask for any of their other literature (installation instructions, for instance) that would help you design your staircase. These catalogs contain lots of photographs and drawings that illustrate the design possibilities.

Once you've chosen a design, you'll have to make up a list of parts to order. This can be confusing since there are so many different parts and places to go wrong—left-hand or right-hand turnout, one-riser or two-riser gooseneck, angle newel or landing newel. You'll have to order your stair parts through the local lumberyard anyway, so contact them. They usually have a salesperson who regularly handles the stair orders and can help you determine the parts you need. If you're still confused, then call the manufacturer whose parts you want to order. All of the companies I visited said they get such calls regularly and are glad to help.

Order your stair parts as far in advance as possible. Although Colonial and Visador/Coffman both said they could ship orders in two weeks, that doesn't mean that your retailer can get them that fast. And even if he can, two weeks is still a long time if work has to stop because you waited until the last minute and then discovered that you had the wrong part.

Cost and compromise—The major manufacturers of stair parts sell only through distributors, who usually mark up the prices before passing them on to the retailers. And retailers of course

Manufacturers of stair parts

Colonial Stair & Woodwork Co.
P.O. Box 38
Jeffersonville, Ohio 43128

L. J. Smith, Inc.
Route 1
Bowerston, Ohio 44695

Morgan Products, Ltd.
P.O. Box 2446
601 Oregon St.
Oshkosh, Wis. 54903

Suckno Brothers
P.O. Box 337
South Plainfield, N. J. 07080

Taney Supply & Lumber Corp.
Taneytown, Md. 21787

Visador/Coffman Stair Parts
1000 Industrial Rd.
Marion, Va. 24354

This is not a comprehensive list, but these are the companies whose names came up during the writing of this article. For information on other companies that manufacture stair parts, contact the following trade associations:

Architectural Woodwork Institute
2310 South Walter Reed Drive
Arlington, Va. 22206

National Sash and Door Jobbers Association
2300 East Devon Ave., Suite 166
Des Plaines, Ill. 60018

mark them up again before selling to you. I called Bill Foster at Visador/Coffman to try to get some straight answers about retail costs. He agreed that there are a lot of variables that make prices hard to discuss. But he doesn't know of any major manufacturers whose prices are out of line; he thinks they're all pretty competitive with each other.

Also, Foster gave me a list of suggested retail prices that Visador/Coffman furnishes to their distributors. Using that list, I added up the cost of parts for a traditional-style balustrade on a typical staircase with a single landing. I came up with \$740 (no tax included) for all the newels, balusters, handrail and fittings.

The decision to use manufactured parts for a staircase instead of having them custom made is nearly always a matter of cost and convenience, just as it is with kitchen cabinets or any other architectural millwork that goes into a home. Manufactured parts are nearly always cheaper and more readily available.

While the decision to use them may be a compromise, a traditional staircase built with manufactured parts certainly doesn't look like a compromise. And given the challenges—designing it, ordering the parts and then building the stair—you won't feel you took the easy way out. You will feel the pride and satisfaction that increase directly with the challenges of any job. And maybe, as you set the last trim board in place, you'll feel the desire to sign your name on a scrap of sandpaper and slip it underneath. □