Making Classical Columns

Interior detailing with a router and lathe

by Joseph Deals

Classically detailed columns are commercially available in almost any size and configuration, but they're expensive, particularly when it comes to custom orders. And because the correct proportioning and form of classical design isn't common knowledge, local fabrication may not be a practical option. In addition, even a modestly sized column can easily exceed the capacity of most small-shop lathes.

To make the two load-bearing columns, which completed a room divider between our kitchen and living room (photo below), I devised a method of turning and fluting column shafts with a shop-built jig that uses a rail-guided router as the cutting tool. Each column has six separately made components (drawing facing page). The base plinth at the bottom and the abacus at the top are square sections. Except for the router-turned shaft, the remaining parts were turned on a lathe.

A hybrid design—The columns I designed combine a clasically correct 24-flute Ionic shaft with an Attic base, a plain necking and a Roman Doric capital. This hybrid configuration is quite common; it captures the grace of Ionic columnation without the need for a hand-carved Ionic capital, a detail that can overpower the design, the budget, or both.

Classical columns are typically proportioned in modules, with one module equal to the bottom diameter of the column shaft. The module system is more a guideline than a set of inviolate proportions. Every text introduces variations, but there is very little agreement on the details. According to Giacomo Barozzi da Vignola, whose *Comparison of Orders* (written in 1563) is often cited as the rulebook of classical design, an Ionic shaft should be seven modules high (not including the necking, which is typically one more module high), or in this case 49 in. To compensate for the relatively short hybrid capital, and to keep the length of the necking within proportional limits, I increased the shaft height to 52 in. The design of the capital is quite simple and substantially correct, but is detailed to echo the trim at the tops of the adjacent pilasters.

According to tradition, the bottom third of the shaft should be of a constant diameter, while the top two-thirds taper inward. This taper, or entasis, eliminates an optical illusion that makes a straight shaft appear narrowed in the middle. Because the columns are comparatively short, I modified the entasis ratio to avoid excessive taper, which might create an awkward appearance. Vignola gives ⅚ of the module as the correct diameter for the top of a shaft, which in this case would have equalled about 5.83 in. I increased the diameter to eleven-twelfths of the module, or 6.42 in., which I rounded off to 6⅜ in.

Coopering the shafts—Because the shafts posed the greatest challenge, I constructed them first. I never considered making solid shafts because they would require a lot of stock and be heavy, cumbersome and potentially unstable (solid columns have nowhere to expand but outward in response to increased humidity). My instinct was to attempt coopered construction, rather than the simpler but less elegant bricklaid alternative. Commercial columns are almost always coopered, but with glue-jointed staves tapered so that, once the shafts are turned, the thickness of the shaft walls remains constant from top to bottom. Because my columns would be relatively short, with a minimal taper, I deemed that degree of sophistication impractical.

I chose a straight-staved hexagon as a congenial compromise. By using 1⅜-in. thick poplar that I had on hand, I could ensure sufficient wall thickness to accommodate a fluted, tapered shaft without compromising strength. I considered splining the staves, but the logistics of gluing 12 edges and 6 splines and assembling everything quickly and gracefully was a terrifying prospect. Having decided on a plain mitered joint, I ripped all the stave stock

The fluted columns, combined with raised-panel pedestals, pilasters and an ornamental header, frame the opening between the author's kitchen and living room. The hybrid columns blend an Ionic shaft with an Attic base, a plain necking and a Roman Doric capital.

Photo: Staff

slightly oversize, set the staves aside for a few days, then jointed them and ripped a 60° bevel on each side. Now I was ready for glueup.

Rounding up the staves–Gluing each shaft was surprisingly simple. I cut the staves to length, laid six of them across a pair of sawhorses, and quickly applied yellow carpenter's glue to the beveled edges. One by one, I stood them on the floor to assemble the hexagon–my left hand on the tops of the staves as I placed them together, my right hand reaching for the next piece and setting it in place.

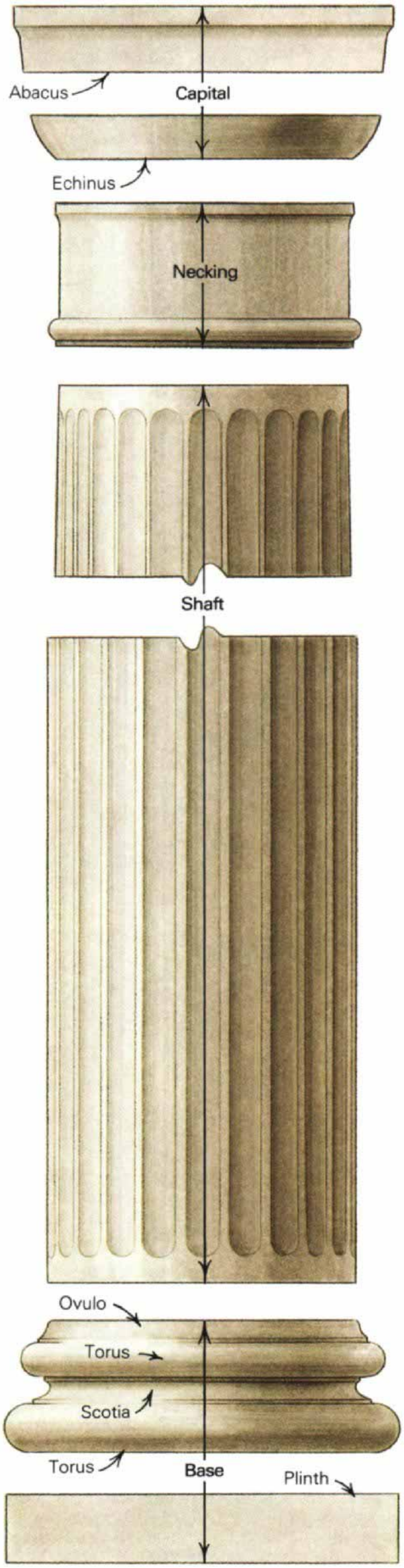
When the hexagon was complete, I tightened a large stainless-steel hose clamp around the top to hold the parts together. Then I used a combination of hose clamps and a heavy Jorgensen band clamp (which applies tremendous circumferential pressure) to pull the staves together down the rest of their length. Working my way down the shaft, I drew the staves tight with the band clamp, secured a hose clamp beside it, and then moved the band clamp to the next gluing position. I repeated this operation seven times.

I glued the second shaft the next day, and again the operation went smoothly. Because clamp pressure is applied evenly across the six arrises formed by the 12 butting edges of the staves, the effect was to force the staves into perfect alignment. Because the arrises would be removed in turning the shafts, damage from the clamps was of no consequence. As it turned out, splining the staves would have complicated the preparation considerably and done nothing to improve the results.

A shop-built router jig–My bench-top router jig consisted of an "axle" suspended between two turning centers, and a pair of rails above the axle that supported and guided the router (photos 1 through 6, next page). The axle was a length of ½-in. galvanized iron pipe, threaded at one end. With an outside diameter of almost ⅞ in., the pipe was stiff enough to support a column shaft without flexing. The shafts were attached to the axle by hexagonal plywood plates that were let into either end of the shaft and screwed to circular plywood end-caps. These two-part wheels were drilled through their centers with a ⅞-in. bit and fitted with a simple wooden clamp that locked the shafts to the axle (photo 1). The turning centers consisted of a pair of plywood brackets screwed to the top of my workbench.

A few construction details were incorporated to make the jig reliable and convenient. The head end of the axle was fitted with a 12-in. dia. pulley aligned with the headstock pulleys of an old Delta lathe that sits near the end of the bench (photo 2). The pulley was belted to the smallest headstock pulley, and the lathe was set for its slowest speed. That produced about 200 rpm on the column shaft, which turned out to be the upper limit of the router's capacity for a light turning cut. To provide a smooth, relatively non-wearing bearing surface, I inserted pieces of copper flashing beneath the pipe axle where it passed through the

Anatomy of a column



plywood turning centers. With a few drops of oil to lubricate the action, the shaft turned easily, and the holes didn't enlarge and become sloppy before the critical fluting operation.

Finally, a pair of 2x guide rails were sawn and planed to match the entasis, or taper of the column shaft (photo 4, p. 57). The inside edge was rabbeted to provide a bearing ledge for a plywood router base; the rabbet contained the router between the rails, but allowed it full axial movement. The rails were screwed to the turning centers high enough above the centerline of the column shafts so that the cutting bit would just clear the arrises, but not so high that the fluting bit would need to be extended excessively from the collet.

Turning the shafts–Shaft turning was simple but tedious. The router was fitted with a ½-in. carbide-tipped, hinge-mortising bit, with the initial cutting depth set to hog off as much material as possible without bogging down the router. I quickly discovered that it wasn't practical to make the roughing cuts with the shaft driven by the lathe; the router would chatter and dance as each arris swept beneath the bit, proving the machinist's axiom that an interrupted cut is the most difficult of all turning operations. Instead, I did the rough cutting with one hand guiding the router and the other turning the shaft, using whatever combination of motions was least tiresome at the moment. Wasting the bulk of stock across the arrises took some time, particularly at the smaller top end of the shaft where the cutting depth penetrated well into the flats between arrises.

Only when the shaft was quite round and very close to its final dimensions did I make a finish cut with the shaft driven by the lathe. This cut was accomplished by advancing the router slowly along the guide rails about five minutes to traverse the column. The result was close to perfect. Hand-sanding quickly removed the few traces of tool marks.

Fluting the shafts-The threaded end of the axle was fitted with a standard pipe cap through which I drilled and tapped a ⅜-in. fine-thread hole. That allowed me to bolt a 24-tooth circular-saw blade tight to the pipe cap, secured by a toothed lock washer under the bolt head to ensure a non-slip fit (photo 3). A simple lever and stud screwed to the plywood turning center engaged the gullets on the sawblade, serving as a simple but very accurate indexing head for cutting the column's 24 flutes. For safety's sake, the blade should *not* be mounted until just before the fluting operation.

In half the photographs and drawings I studied, Ionic flutes were of constant width, and the narrow fillets between them tapered toward the smaller diameter at the top of the shaft. In the other photos, the fillets were of constant width and the fluting was tapered. There is a subtle elegance to tapered flutes, but machining them would require changing the taper of the guide rails when changing over from turning to fluting. That was more trouble than I was willing to endure. A constant-width flute

Drawing: Bob LaPointe

produces a tapered fillet, so I needed to determine the maximum flute width by defining the minimum acceptable fillet width at the top of the shaft.

By referring to more illustrations, drawings and my own instinct, I chose a strong 1/8 in. as the minimum fillet width. That produced a flute width of about 11/16 in. and a fillet width at the base of the shaft of a bit more than 1/4 in., which was visually ideal. The router was fitted with a 1-in. carbide-tipped, core-box bit, which would cut the desired flute width without going too deep. The stops were tacked to the guide rails to hold the flutes about 1/2 in. from the tops and bottoms of the shafts. I clamped the indexing lever into a sawblade gullet and set the router depth for the cut.

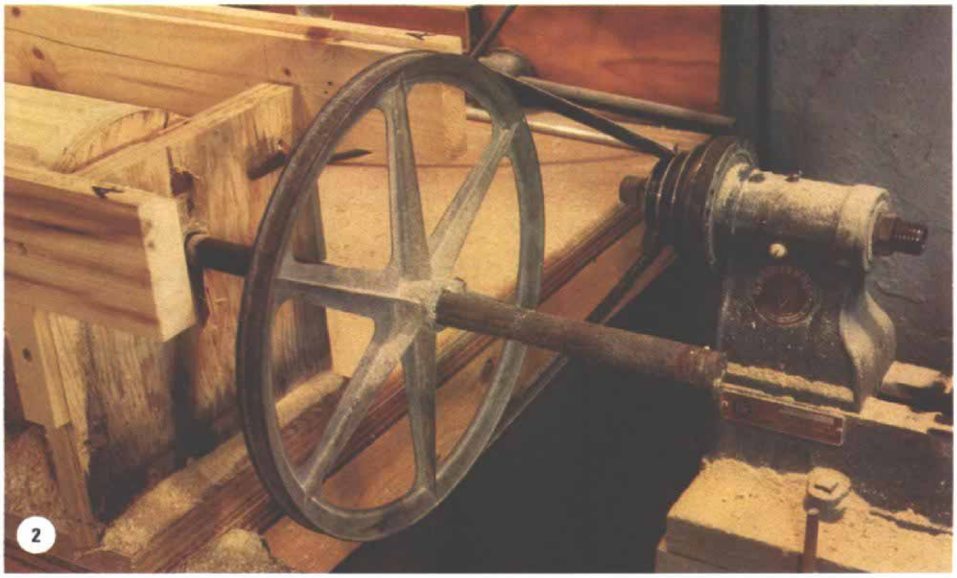
In contrast to the tedium of turning, milling the flutes was akin to magic. The first flute gave a hint of classic transformation. As the flutes began to march around the shaft, not only was the width perfect, but the shaft itself changed from a simple turning to a noble architectural feature. When the first shaft was finished, I took it down and put the second coopered hexagon into its place. Again I suffered the ordeal of turning, and then emerged from the noise and sawdust of a cobbled-together workshop device into the stratospheric realm of classic design. When it was over, the two shafts had taken on a life of their own.

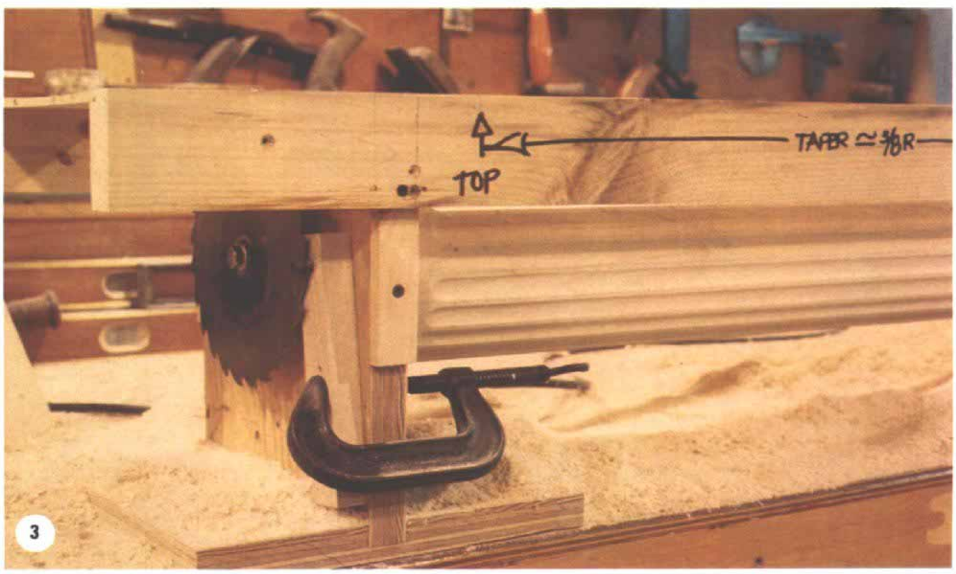
Capitals and bases—I had enough stock left over from making the shaft staves to glue up two short sections for the one-piece column neckings. Each necking is turned to the same diameter as the top of the shaft, with an astragal at the base and a slight flare to a shoulder at the top. The first necking was turned in the conventional way on my lathe. It then served as a model for the second, and was duplicated with the aid of a caliper and a few pencil lines.

It remained to turn the 1-in. high echinus (the broad flare at the bottom of the capital that abuts the top of the necking) and the cylindrical portion of the base. In conventional practice these parts would be made out of solid sections with the long grain horizontal. But I was concerned with the problem of hiding alternating long grain and end grain under a finish coat of enamel. To avoid future regrets, I made the turnings so the long grain would be oriented vertically. This would produce a narrow band of end grain around the circumference of the torus, but at least it would be continuous.

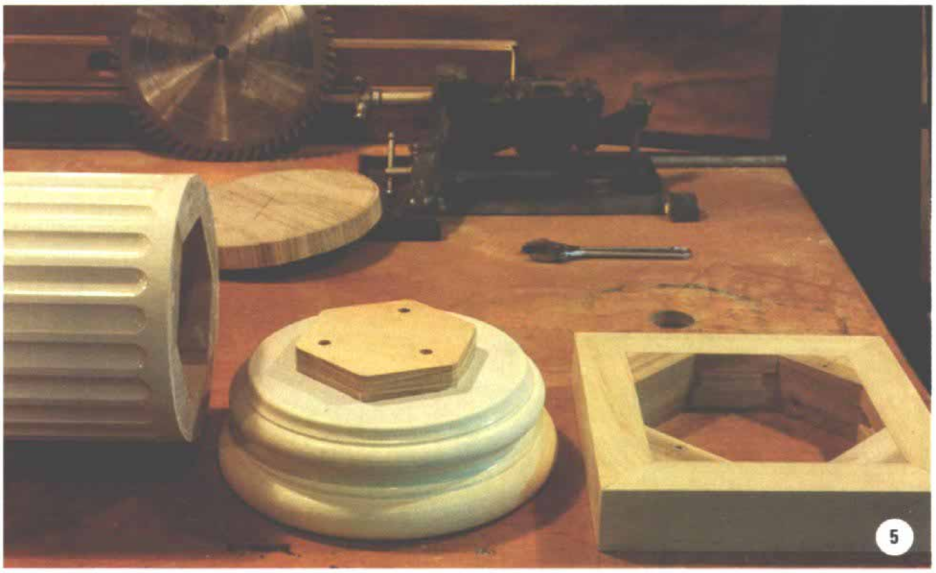
I laminated seven lengths of 1 3/8-in. thick poplar to make a cube almost 10 in. on a side. I crosscut the cube with a bandsaw to produce a short section for each echinus and a large section for each base. Because the long grain is discontinuous across the seven laminations, the sections should be relatively stable. They were screwed directly to the faceplate of the lathe, and turning was a straightforward matter of following the plan sketch.

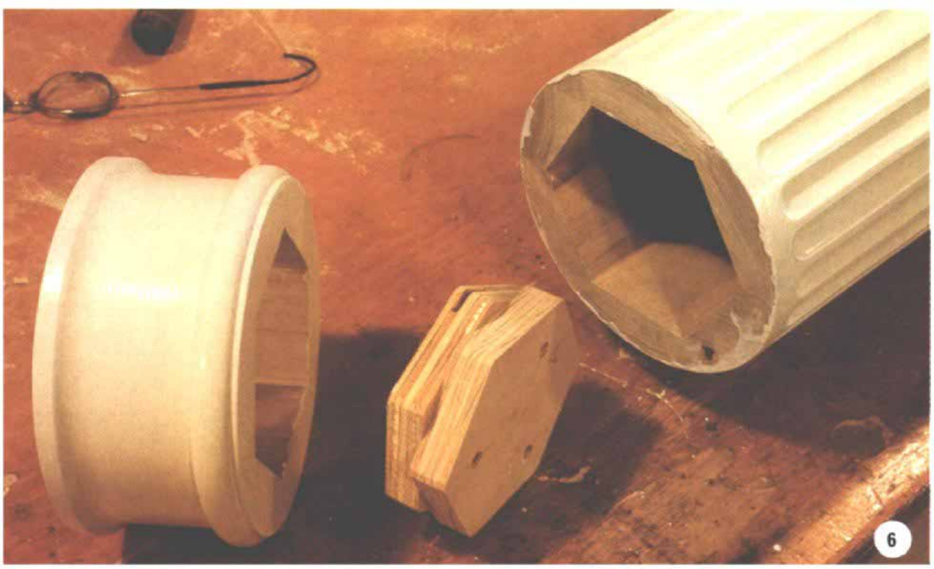
The bottom of each column base (called the plinth) and the top of each capital (called the abacus) is a square section. Typically,





Jigging and assembly. **The column shafts were turned and fluted with the use of a shop-built, benchtop router jig. The core of the jig was a 1/2-in. galvanized iron pipe that suspended the shafts between a pair of plywood turning centers. The hollow shafts were plugged at both ends with a combination plywood cap and wooden clamp that accommodated the axle and clamped the shafts to it (photo 1). For turning, the axle was fitted with a 12-in. pulley belted to an adjacent shop lathe (photo 2). At the opposite end, a 24-tooth circular-saw blade (mounted backwards for safety) served as an indexing head (photo 3).**





The router was fitted with a square plywood base and guided by a pair of rabbeted rails screwed to the plywood turning centers (photo 4). For dimensional stability and to hide the end grain, the base plinths (photo 5) are made of mitered frames reinforced with corner blocks. The abacus atop each capital is made the same way. To assemble each column, the author screwed the plinth and abacus to the adjacent turnings, then joined the rest of the components with friction-fit ¾-in. thick hexagonal plywood keys—double offset keys to join the neckings to the shafts (photo 6), and single keys to join the rest of the parts (photo 5).

these parts also would be made solid with the long grain horizontal, once again creating problems with dimensional stability. I turned to cabinetmaking methods to avoid trouble. Each plinth and abacus consists of a mitered frame made of 1⅝-in. high by 1½-in. wide poplar, with tongued diagonal corner blocks let into a groove ploughed around the inside perimeter of the frames (photo 5, below). The corner blocks reinforce the glued miter and fill the gap that would otherwise be exposed at the abutting turned sections. No end grain is exposed, and the narrow stock avoids the instability inherent in a solid block.

Using a shaper, I milled each abacus with a cove that ends at a shoulder to complete the top of the capital. The base plinths remain square, but were made slightly taller than I really needed to allow for trimming the columns to length later on.

Assembly—The six components of each column were assembled with hidden screws and hexagon keys. The plinth is screwed to the bottom of the turned section of the base through the corner blocks; the square abacus is screwed down through its corner blocks to the turned echinus. The remaining assembly has friction-fit hexagonal keys cut from ¾-in. plywood (photo 5). A key screwed to the top of the base engages the shaft, and a key screwed to the bottom of the echinus secures the necking. A pair of hexagonal keys screwed together align the necking with the top of the shaft (photo 6); the keys are offset by 30° to prevent them from falling into the shaft.

The keys center each component to its neighbor. They also ensure that a flute is perfectly aligned with the middle of the four square sides of the base plinth and the abacus. This is a traditional detail that seems trivial unless it's overlooked. A displacement will be hard to identify as a fault, but it gives the subtle and peculiar appearance of something not quite right.

The columns were primed, sanded, given a first finish coat and lightly sanded again before installation. At the site, I cut a measuring stick to fit at each of the two column locations. Each column was assembled on the floor and the base plinth trimmed until the column was a strong 1/16 in. taller than the measuring stick. I used a small hydraulic jack and a post to lift the header until each column tucked into place. When the jack was removed, the columns took enough load to hold everything solidly without the need for any further fastening.

The columns were given a final finish coat of oil-base enamel. The result gives a powerful, classic appearance to what before had been an attractive but incomplete design. A few visitors have noticed the columns at once, but most have stood back, puzzled at the dramatic but hidden change. "This looks great," one of them said. "What did you do—have everything repainted?" ☐

Joseph Seals is a designer and builder who lives in Marshfield, Massachusetts. Photos by the author except where noted.