One of the most challenging problems in the restoration of an old house is the replacement of broken or missing balusters.

Balusters

Years ago while visiting an art museum, I saw students copying paintings. I wondered, "What is the value of that?" Later when restoring balusters and porch posts, I found that copying masterworks of the past expanded my understanding of design. A century-old artifact such as a baluster provides a window into a former time when decorative architectural details were made by hand and customized for each building. For me, every architectural restoration job is an education in design.

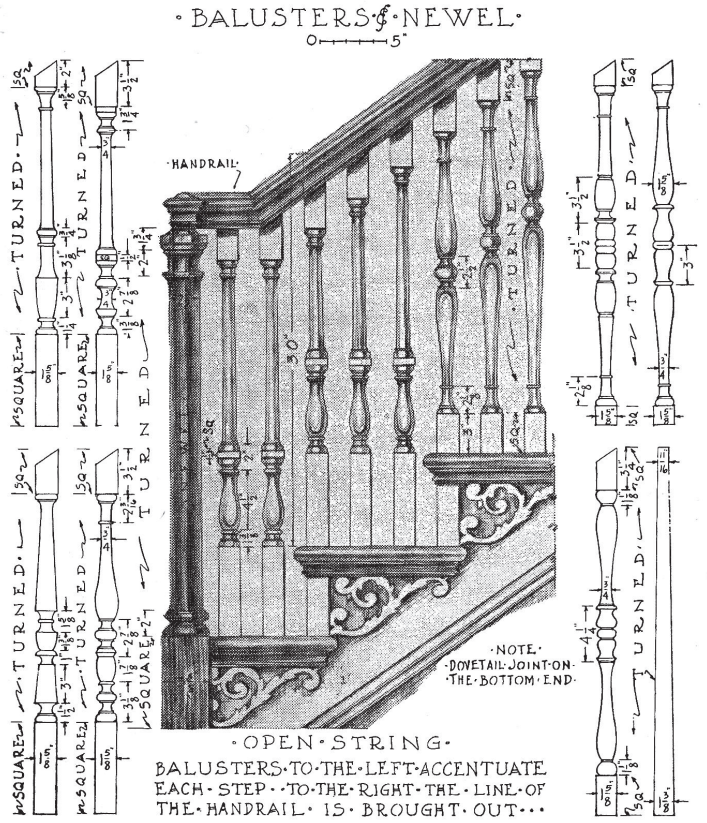
One of the most challenging problems in the restoration of an old house is the replacement of broken or missing balusters. Often in old houses there are three balusters on each step, and the total number can be in the hundreds. Inevitably there are a few broken ones, because the most stylish designs are frequently the most delicate—about 1⅜″ square, and the minor diameter of the turning can be around ¾″. So with kids playing on the stairs, vacuum cleaners, and inevitable accidents, some balusters get broken.

In this article I will take the reader through a typical baluster job—in this case ten balusters. Notice that there are three different lengths on the stairs, and a fourth length used for the balcony, or landing—More complex stairs with volute rails can have a multitude of lengths.) The original balusters from this job were chestnut, and the customer wanted to use oak, which has a similar grain.

The best quality open stringer installations use three balusters on each step. The illustration by William W. Klenke shows two different ways to do this. Notice that the length of the top and bottom squares are constant, and the length of the turned section varies. [Klenke illustration.

After the stock has been milled, the correct length is determined and the squares are sorted with the samples—Photo 1. I always make replacement balusters 1″ longer than the sample to allow for final fitting at the job site. Balcony rails are easy, but on the stairs the tops of the balusters are cut at an angle and careful fitting is necessary to make sure the balusters are plumb. Usually the bottom of the baluster is attached to the stair with a short tenon (turned) that fits into a drilled hole in the stair tread, but in this case the balusters are dovetailed into the end of the tread, and the joint is covered with a nose moulding. This joinery is used in higher quality construction, and is noted in the Klenke illustration.

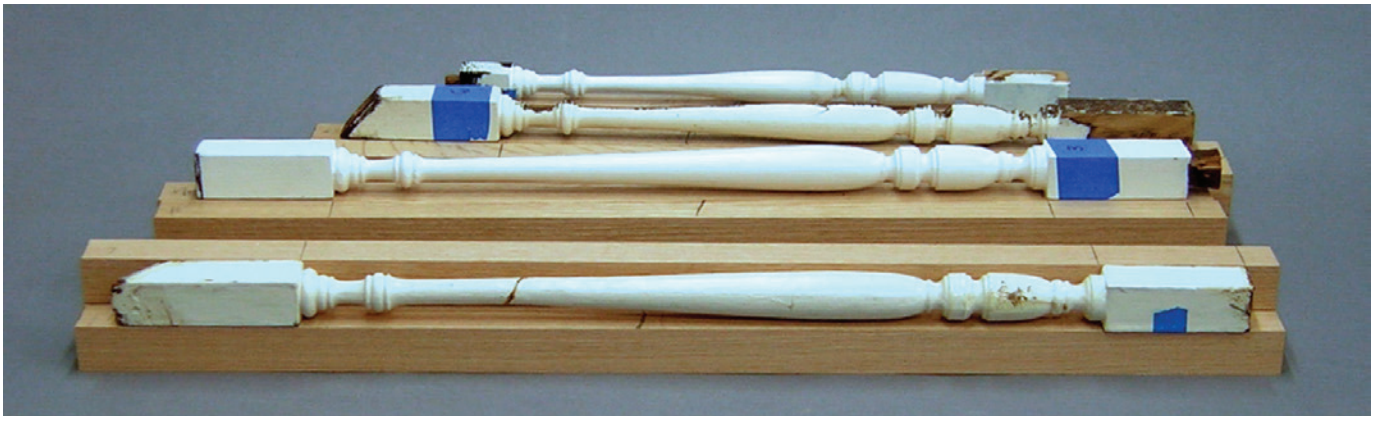
Two things make balusters difficult: 1) They are usually very



From *The Art of Woodturning* (1954, Chas. A. Bennett Co., Inc.) by William W. Klenke.

long and thin, so a steady rest is required to control workpiece vibration, and; 2) They are installed very close together, so small errors in duplication are noticeable. As you read this article, you will get information on both of these disciplines of spindle turning—how to use steady rests, and duplication methods.

The flat surfaces of the square parts (pommels) should be finished before turning, because it is very difficult to sand, scrape, or plane these surfaces without damaging the turned portion. In photos 2 & 3, the scraper is being pushed in the direction of the arrow with the narrow edge of the blade doing the cutting instead of the conventional way of leading with the face. Even though the rake seems to be positive, the edge will not catch because the blade is almost flat down on the wood. It is not necessary to flex the scraper because the curvature is ground into the shape of the edge. Many woodworkers are not familiar with this method, but I



1 Squares cut to length—The squares are cut to their final length plus one inch to allow for fitting at the job site.

learned it from a one hundred year old book. For a more detailed description see my article—*Re-Thinking Scrapers*, in *The Old Saw*, June 2007, Vol. 18, No. 5 available at *www.gnhw.org*.

After the length is cut (1″ extra) the squares are centered. The jib shown in Photo 4 consists of a fence and a hardwood block with a spike—both are clamped to the bench. This jig is fast and very accurate, even on ring-porous wood like oak or ash. It is probably not worthwhile to set up this jig for four table legs, but for eight or more pieces (16 ends), it is extremely efficient.

The spike consists of a wood screw with its head sawn off and ground or filed to a point. The block containing the spike is clamped to the bench on top of a wedge or shingle that provides height adjustment. The spike is not set exactly on center, but rather it is slightly low and inside. It enlarges the hole by pressing the wood into the corner against the bench and fence. This is the secret to its accuracy: it will not lift the wood off the bench or away from the fence.

When the workpiece is first mounted on the lathe, the centers establish their position. On ring-porous wood like oak or ash, the lathe center will tend to drift into the nearest soft layer instead of staying where it belongs. Corrections can be made by bumping the work at the end. The tailstock ram is then re-tightened as the lathe center assumes its new location and penetrates deeper. The ability to make fine adjustments of the location is what makes 60° centers superior to cup centers for precise work.

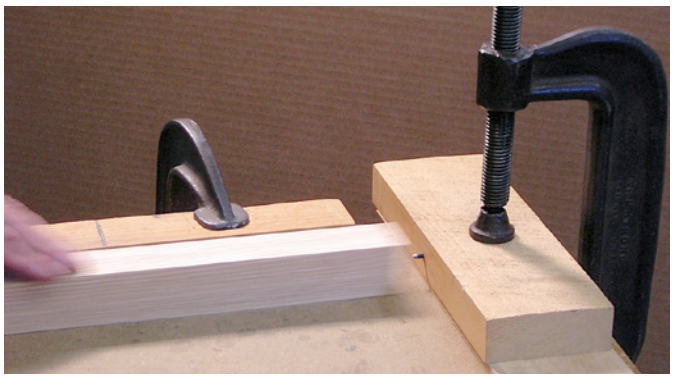
The Steady Rest

The first order of business is to create a smooth area (journal) approximately 2″ wide to accommodate the steady rest—Photo 5. The steady rest is positioned near the middle of the turning, because that is where the amplitude of vibration is the greatest. Use of the steady rest was covered in my previous article in *The Journal*, Summer 2011, Vol. 3, No. 3, that includes the following statement…

We should remember that a bow can play an infinite number of notes on a violin, serving only to stimulate the natural harmonic frequencies already present in the string. In the same way, every woodturning has certain frequencies that it tends to vibrate, and all we must do whilst turning is not encourage it—or failing that, at least not give it room to achieve significant amplitude.

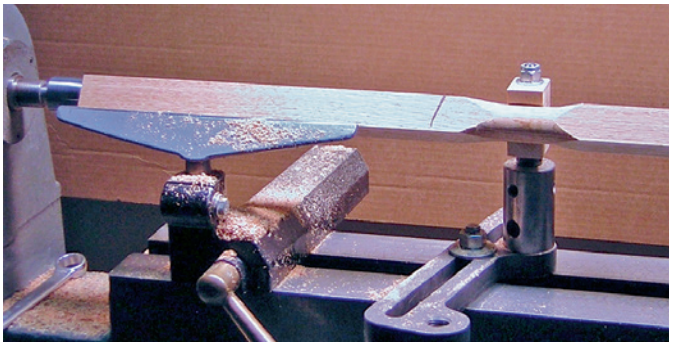
2 Scraping squares—After marking, the parts that are to remain square (not turned) are scraped to the final finish.

3 Not this way!—The conventional method of flexing the scraper is not suitable for narrow workpieces.

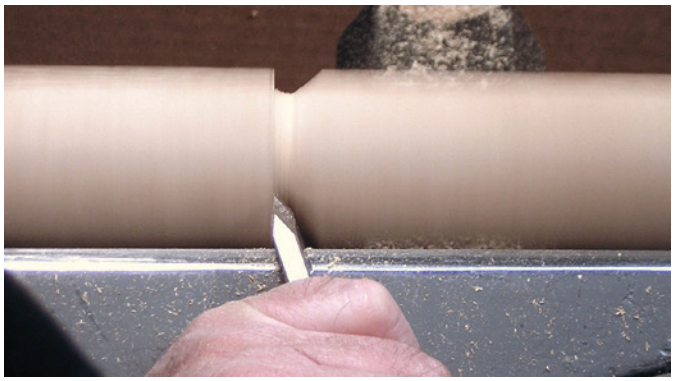


4 Centering jig—The square slides against the fence and into the spike four times and rotated 90° after each hit.

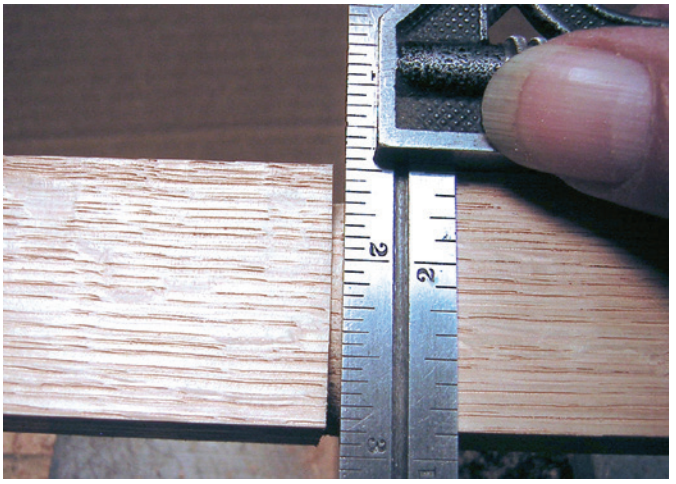
5 Preparation for steady rest—The area where the steady rest is to be placed must be smooth and totally free from chatter marks.



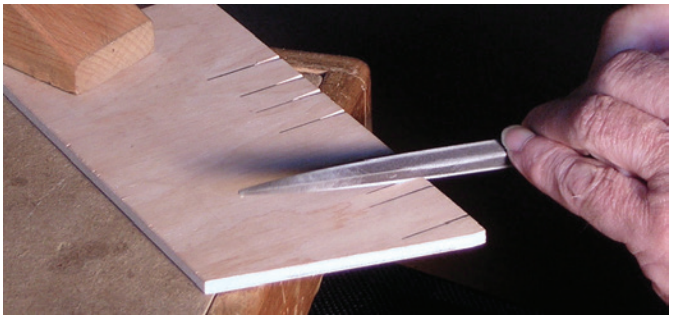
6 Steady rest engaged—Setting the steady rest is the first step, and after this is done there will be little or no workpiece vibration.



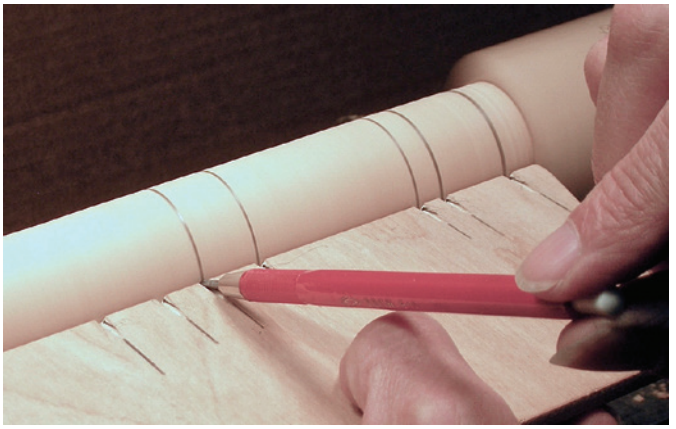
7 Cutting the square transition—Start the cut slightly inside the line, and sneak up on it with successive cuts as you reach the proper diameter. Notice that the left side bevel of the chisel is exactly in the radial plane (square to the axis.



8 Transition is a straight line—Check that there is no curvature of the line.



9 Filing notches in marking board—Use a triangular file to make notches in the marking board parallel to the grain of the top veneer.



10 Using the marking board—The board rides against the shoulder, and the pencil rests in the notches in the board.

After the steady rest has been engaged, the transition cuts and the roughing can begin— Photo 6.

Transitions Cuts

Square transitions are rarely used in furniture, but are frequently seen in balusters because they are derived from the architectural form of a classic column on a square plinth. Square transitions are more difficult to turn than the usual angled ones, because they require greater accuracy—Photo 7. The cut must be exactly square to the axis and when done correctly, the line is straight and has no detectable curvature—Photo 8.

Marking Boards

The use of marking boards was covered in my article—*Duplication*, *The Old Saw*, Volume 21, No. 2, November 2008. More than a "story stick", the marking board has physical indentations to receive the pencil. These notches are made with a triangular file—Photo 9. Notice that the grain of the plywood is oriented so the file marks are parallel to the grain of the top veneer. In use, the corner of the board rubs against the square at the transition. This method is very fast and accurate, producing identical markings every time—Photo 10. Some details are at a smaller diameter, and after secondary roughing the marking board is used again in an operation I call "making a remark"—Photo 11.

Other Turning Operations

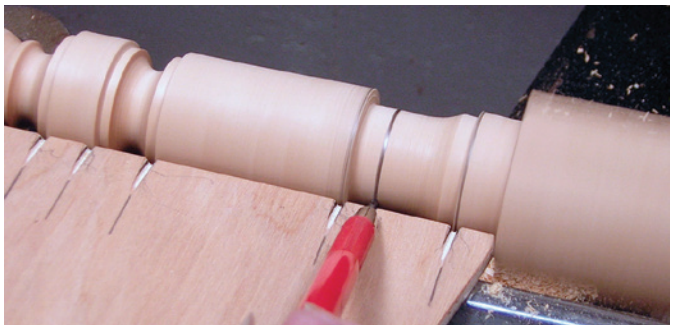
Photos 12 through 15 show operations that are routine to the turning process. Setting-out requires holding the parting tool in one hand and the caliper in the other—Photo 12. You know you have reached the correct diameter when the caliper falls through. This is a necessary skill for spindle turning. Photo 16 shows all the chisels I used for this project (some I made myself). The shapes are decidedly "old school", and none of my gouges have "side grind".

Working in Steps

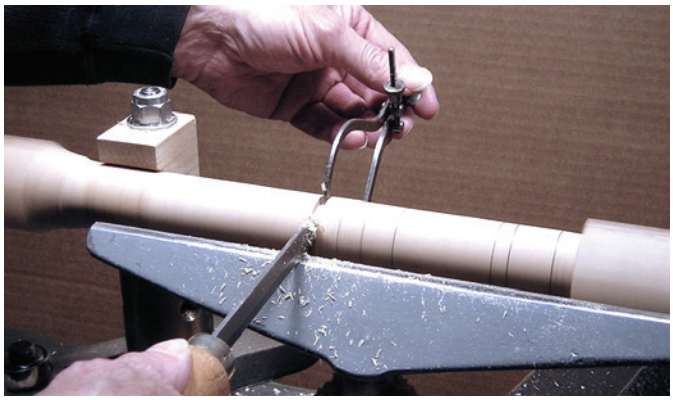
If you remember only one thing from this article, it should be this—*The key to duplication is working in steps.* Do not attempt to turn the entire piece in one set-up. Instead do only a small section of the work, take that piece off, and do the same small section repeatedly on all the pieces. There are many advantages to this method—some mechanical and some mental.

1. Fewer movements (re-adjustments) of the tool rest and the steady rest.
2. Fewer number of chisels being used at a given time.
3. Fewer number of calipers being used at a given time—reducing the possibility of mistakenly using the wrong one.
4. Fewer operations in a cycle, allowing faster memorization of the sequence, shapes and angles—leading to better duplication.
5. Easier sanding with the tool rest completely removed from the lathe.

For this project, each of the balusters was removed and



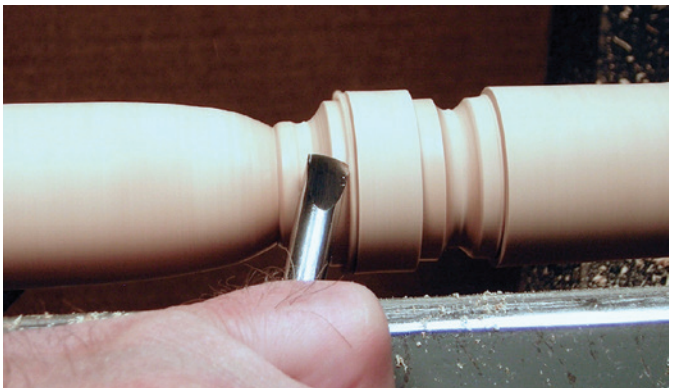
11 After secondary roughing, the marking board is used again.



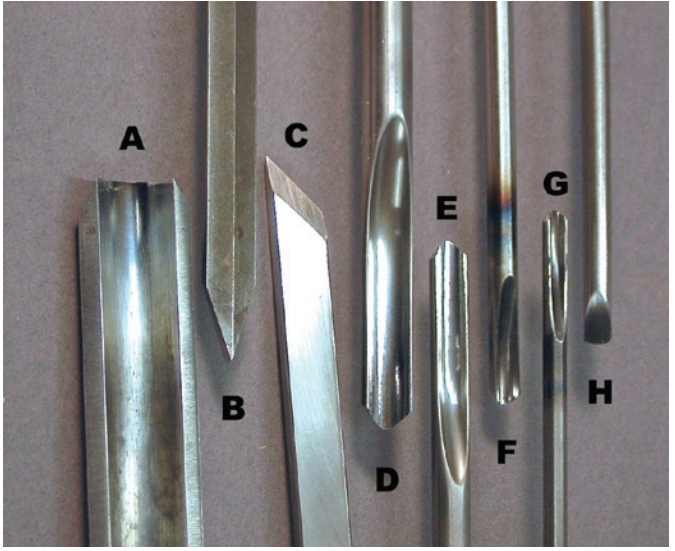
12 Critical diameters are set out with parting tool and caliper.

13 Material is removed quickly with ¾″spindle roughing gouge.

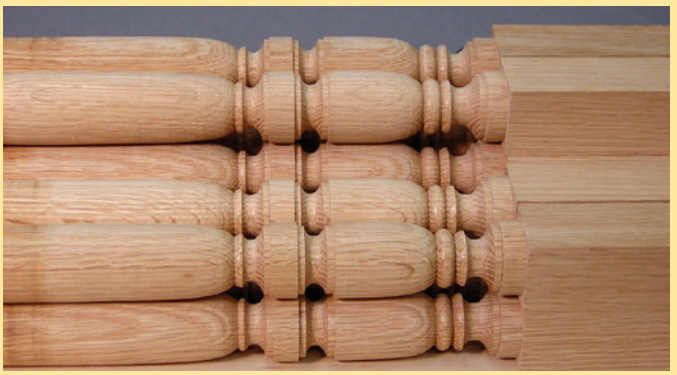
14 For finishing, the spindle gouge is used with a shearing "pull cut", which means that the handle is ahead of the cutting edge.

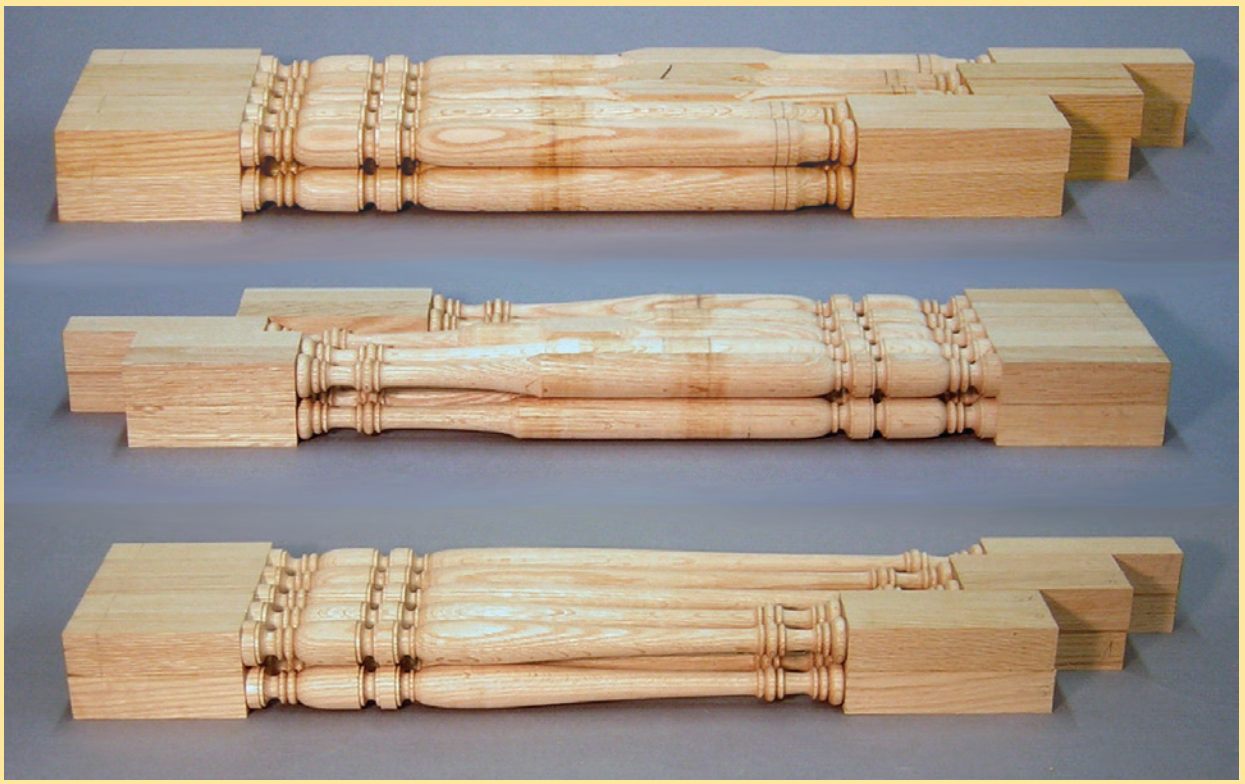


15 Inside corners are fixed with a skew chisel (this one has a 5/16″ round section).



16 These are the chisels used to turn the balusters: A—3/4″ spindle roughing gouge; B—parting tool; C—1/2″ skew; D—1/2″ spindle gouge; E—3/8″ spindle gouge; F—5/16″ spindle gouge; G—1/4″ spindle gouge; H—5/16″ chisel. F, G, and H, were made by the author from W-1 tool steel and heat treated to a hardness of Rc-63. See article in *The Old Saw*, Vol. 18, No 4, April 2007, *Woodturning Chisels You Can Make*.

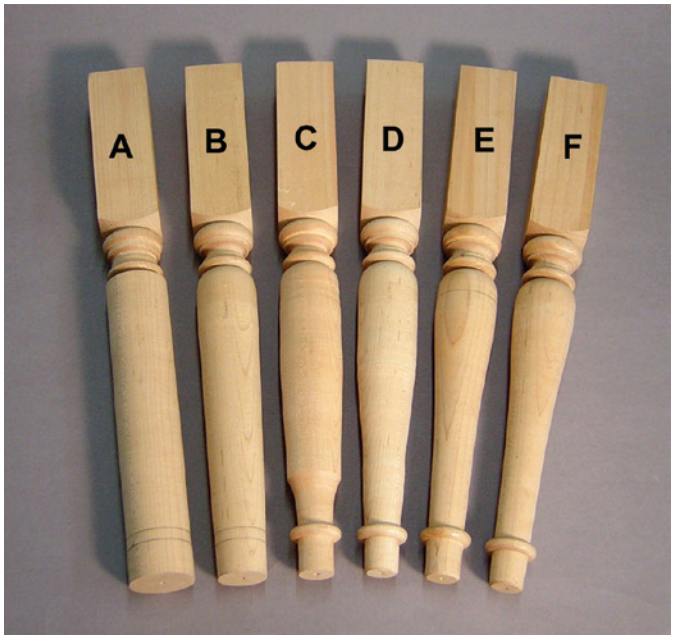




17–21 Second stage, third stage, fourth stage, fifth stage, final—These photos show some of the steps in the turning process.

replaced on the lathe (or reversed end-for-end) about 10 times—Photos 17–21 and Photo 22.

I know many experienced turners who do not use this method. I think they got into a bad habit of never removing the workpiece from the lathe until it's finished because they started out using poor lathe centers (and possibly are still using them). They know that if they take the piece off the lathe, it will be difficult to get it back on center again. However, well tuned lathe centers will allow you to remove and replace the workpiece, or reverse it end-for-end, any number of times—and always return it precisely to center without fuss and without fail every time. If you do not have this, then you are working at a great disadvantage.



22 Sequence of turning legs—This photo shows another example of turning in steps.

24 Square decorative element—Similar examples of a thin square element.

The Way It Is—And the Way it's Supposed to Be

One of the design features frequently seen in architectural wood turnings such as balusters and porch posts is a square decorative element in the middle of the turning. While these are emblematic of a sophisticated style (and noted in the Klenke illustration), it seems that in this case the turner simplified the original design by eliminating the decorative square element in the middle—Photo 23. I made an extra baluster with the design as I think it should be (and probably was originally), and added it to my collection—Photo 24. Photo 25 shows elongated square elements that incorporate decorative transitions—Photo 25. ■

23 Compare—With and without the square element.

25 Other examples of square elements.