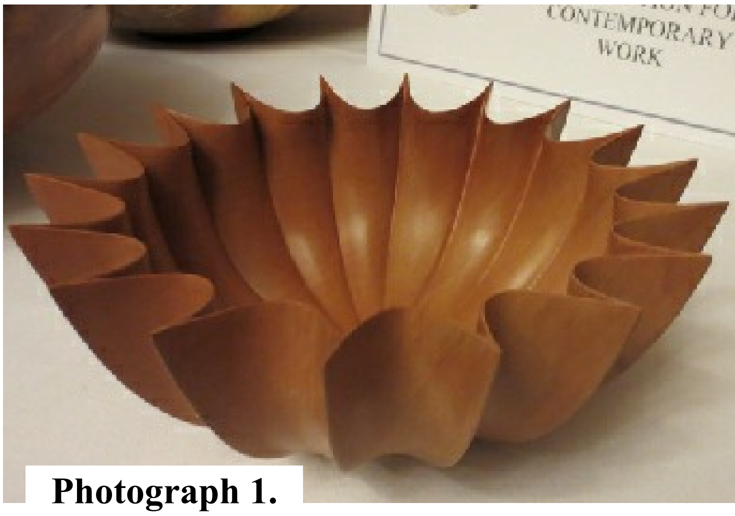
NEW - QUESTION AND ANSWER -
THE SPIRAL SPHERICAL SLIDE-REST

Q. I noticed on your website two prize-winning bowls turned by Andy Mason. How did he make them?

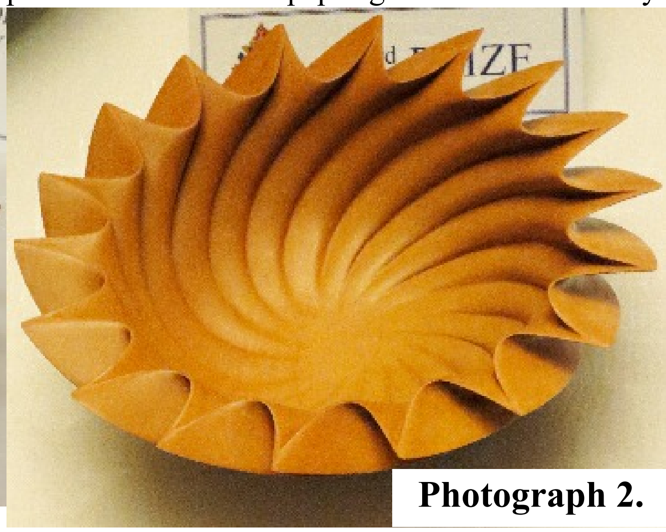
A. Like you I was most impressed with Andy's beautiful bowls so I asked him about them. I am sure this type of work could be done on an Ornamental Turning Lathe or a Rose Engine/ OT combination using a Universal Cutting Frame and a Spiral Spherical Slide-rest. However, Andy didn't have access to OT equipment, so I had assumed that he had made his own jig to hold a flying cutter, such as a router, and to swing it in an arc to make the cuts. This was not the case. His method sounds quite simple; but it needs someone who can use a computer-aided design package to generate parabolic curves which may be scanned onto paper, AND someone who also possesses good hand-carving skills.

Andy draws his curves, scans them and then makes templates from the scanned images. He turns the bowl to its overall profile then marks out radial lines at 20° intervals for the 18 scallop cuts both for the inside and the outside of the bowl. He then carves each scallop by hand until it fits the template. The tricky part is to align the scallops on the inside of the bowl with those on the outside (see Photograph 1).

The scallops on the second bowl (see Photograph 2) are carved with compound curves to give a swirling or spiral effect. The same method is used but here the radial lines are drawn on the bowl blank as curves and the difficult part is to move the centre of each curve consistently to ensure that all are perfectly aligned with each other and those on the inside are aligned with those on the outside. Remember, these are parabolic curves not simple circular curves, so aligning them requires some care.



Photograph 1.

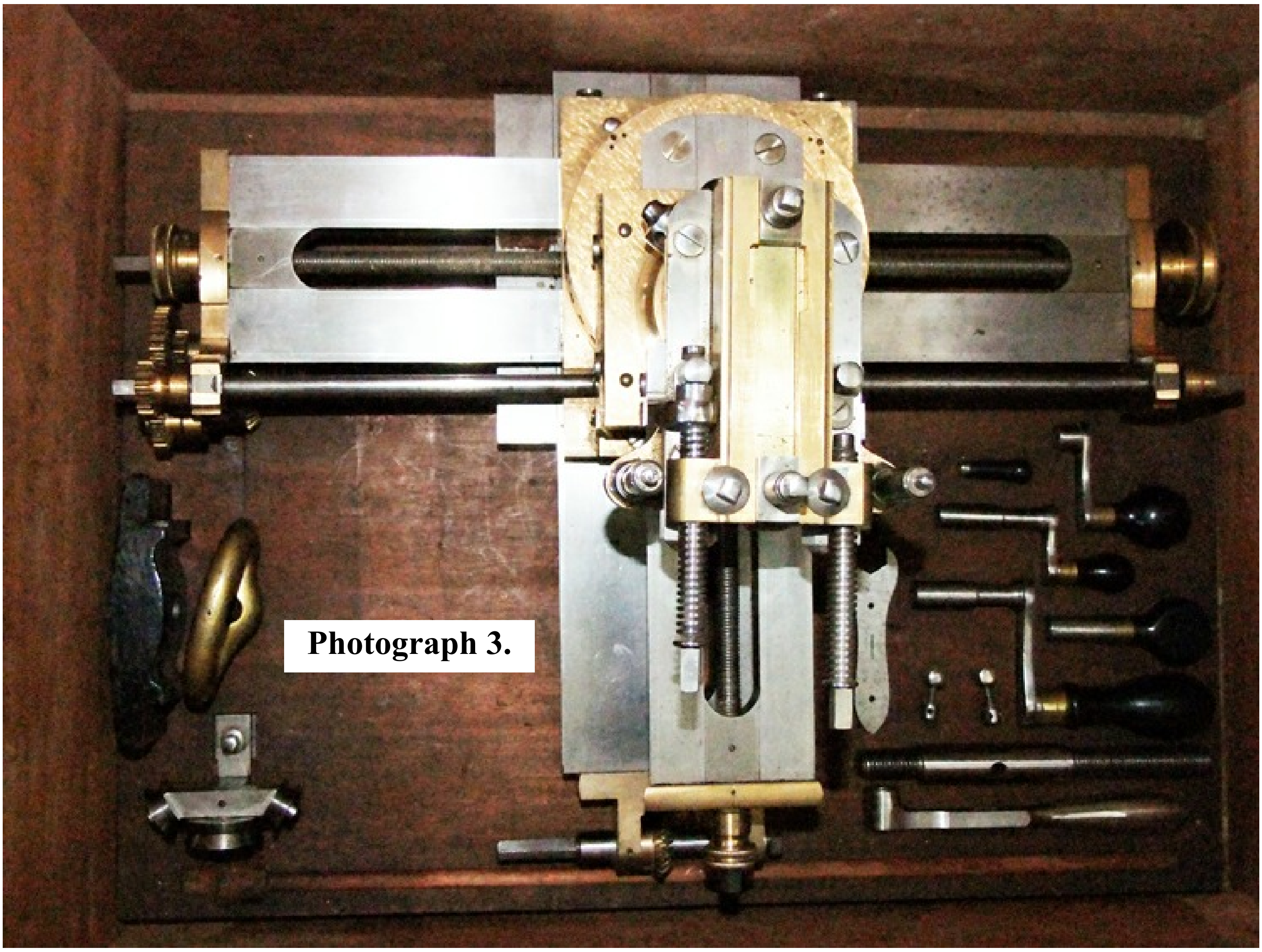


Photograph 2.

As an ornamental turner who lacks the hand-carving skill this method demands, I would first mount the bowl blank on the lathe so the outside may be turned to a rough profile; my next step would be to make some means of mounting it in reverse to enable the inside to be turned. My preferred method is a paper-glue chuck which may be split off afterwards (but cutting a step or recess can be just as effective).

Next I would set up the Spherical Slide-rest (or the Elliptical Slide-rest if a near-parabolic curve is desired). The Spiral Spherical Slide-rest (see Photograph 3) comprises three main slides: the first (bottom slide) to position the centre of rotation on the axis of the lathe or at some distance in front or behind it); the second (middle slide) to position the centre of rotation along the bed of the lathe nearer to or further from the headstock; the third (top slide) sits on a rotary table and carries the tool-slide such that it can be moved forward beyond the centre of rotation so that, when the top slide is rotated, the cutter will describe a concave arc; or the tool-slide can be moved backward behind the centre of rotation such that, when the top slide is rotated, the cutter will describe a convex arc.

The tool-slide holds a Drilling Spindle (router) or Cutting Frame (a tool that has a high-speed rotating cutter driven by a band from an overhead drive: usually an electric motor). The tool-slide has a guide screw and a stop screw: the guide screw enables the cutter to be advanced into cut and then retracted so that the work may be

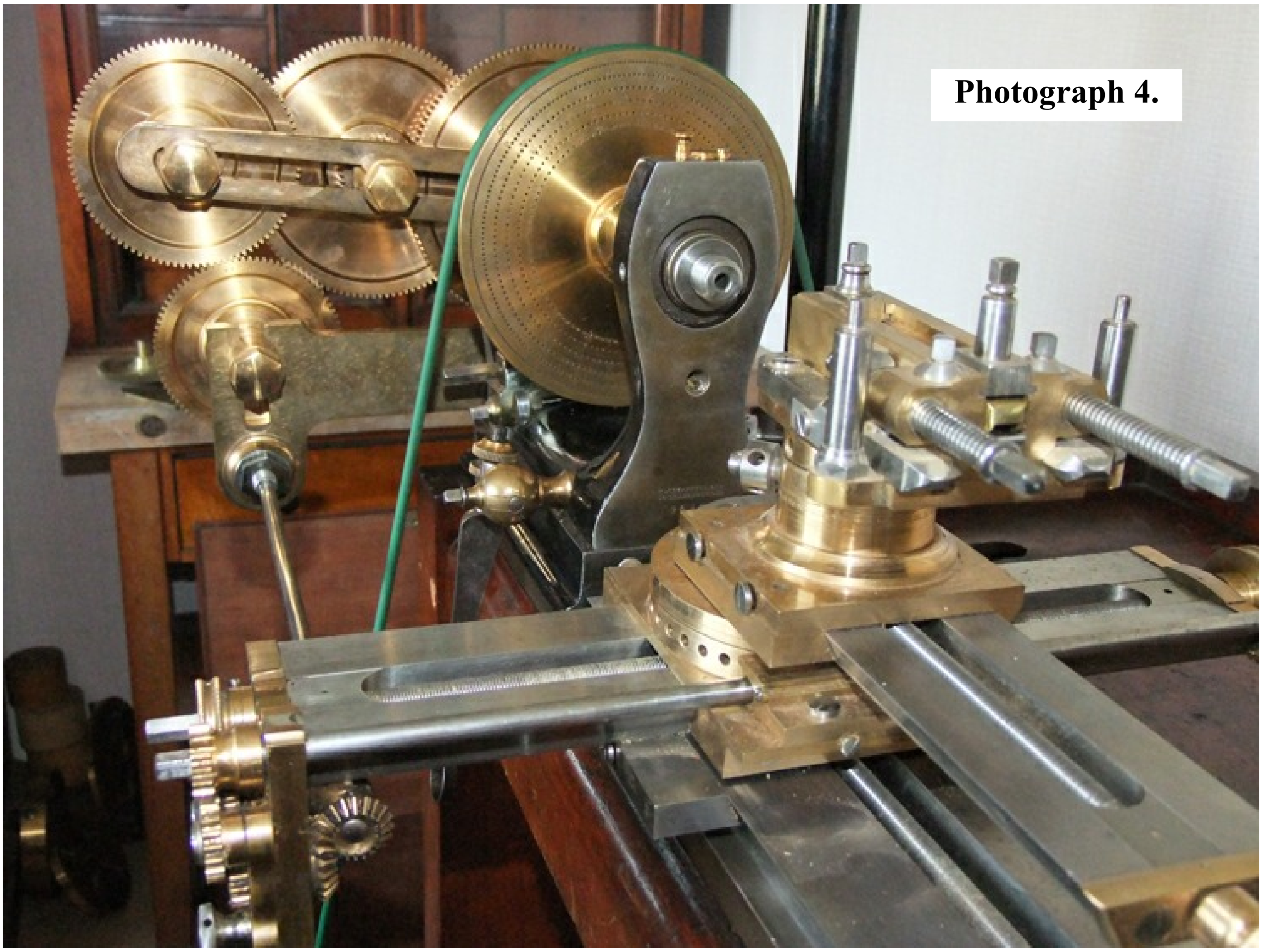


indexed for the next cut; the stop screw ensures that each cut is taken to precisely the same depth.

The cutting of the convex flutes (or scallops) on the outside of the bowl may be done with the Universal Cutting Frame with a large double-quarter-bead cutter (which would probably need to be home-made). The large size is necessary to cut the large radius of the beads at the rim of the bowl. As the cutter approaches the bottom of the outside of the bowl the flute will become more ‘peaked’ than the rounder, carved version and this may be partially corrected afterwards with abrasives. It is necessary to take several cuts in order to get each flute down to full depth at the rim of the bowl; the cutter must be very sharp and, even so, it will tend to struggle when at full depth. Again the round-nosed cutter for the concave inside flutes needs to be of large radius in order to cut the flutes to full width at the rim of the bowl, but as these flutes become narrower towards the centre, the cuts will overlap and the flutes will become shallower than those of the hand-carved version.

If, instead of a Universal (or Horizontal) Cutting Frame, a Router or Drilling Spindle is used the work will have a poor finish where the cutter goes against the grain of the wood. This can sometimes be remedied (if your router or Drilling Spindle is reversible) by making a pair of left and right handed cutters and finishing the pattern with the index moved very slightly so as just to cut away the rough side of each flute; the second cutter being run in the reverse direction. This will leave a tiny ridge in the centre of each flute which may be removed easily with abrasives. If using a Universal (or Horizontal) Cutting Frame, make sure it is cutting ‘downhill’ with the grain.

The second bowl has cuts that curve both ways to give a ‘swirling’ or spiral effect. This may be achieved by linking the rotational movement of the top slide and cutter with a very slow movement of the lathe spindle. In ornamental turning terms this would be to link the Spherical Slide-rest with the lathe spindle using a gear train called the Spiral Apparatus; this extended version of the slide-rest is described as a ‘Spiral Spherical Slide-rest’ (see Photograph 4). As the rotary table of the slide-rest is turned it drives a gear-train connected to the lathe spindle, causing the spindle to make a small part of a rotation during the cutting of a flute in the



work; thus making the flute curve spirally.

Another way of tackling this project would be to use a Rose Engine with an 18-bump dual rocking and pumping rosette. It is most unlikely that both outside and inside shaping can be completed in one setting, so both the bowl and the rosette would need to be reversed after the outside shape is cut. This is to ensure that a convex curved flutes on the outside can be matched by the concave curved flutes on the inside. This method would be quite time-consuming because the Rose Engine lathe spindle must be run very slowly. Several turns would be necessary to cut to full depth at the rim of the bowl and then the curve would need to be cut in very small steps going progressively nearer to the centre; and having cut the whole pattern it might be necessary to go back to the rim and take a final finishing cut. To make the result as smooth as possible each step should be not more than 0.100” wide, and even at this narrow width, removing the tiny ridges between the steps will require a good deal of hand-sanding with fine abrasives. Such a time-consuming process may be somewhat alleviated by using a slow geared motor to drive a worm & wheel which in turn drives the rotary table of the slide-rest very slowly. It is important to remember to fit a cut-out switch to stop the motor when the cutter reaches the centre of the work.

The difficulty in using a Rose Engine for this part of this exercise would be to make the second bowl with its swirling, spiral pattern. It would be necessary to have a geared linkage between the lathe spindle and the rosette barrel. Both would travel in the same direction but one must go very slightly faster than the other so that, as the cutter follows the contour of the rosette, to achieve a clockwise spiral the rosette must move a little faster than the lathe spindle (and vice versa). Few Rose Engines are equipped with differential gearing and this alteration would require the services of a skilled mechanical engineer.

A rough-and-ready alternative

Ornamental turning machinery is both complex and expensive but it should not be too difficult to make a crude spherical jig. First you need the facility to arrest the lathe spindle in any position and to index it around by a useful series of divisions of the circle; I have found the most useful are 96, 120 and 180 as these enable you to divide the circle by 2, 3, 4, 5, 6, 8, 9, 10, 12, 15, 16, 18, 20, 24, 30, etc. Next you need a platform that can be fixed anywhere along the bed of your lathe, with an upstanding spigot that can be positioned at any radius in front of or behind the axis of the lathe bed.

On the spigot you mount a ball-race and on that you mount a flat slide (you can make your first platform and slide from wood and, when you have arranged the design to your satisfaction, you may wish to build something more precise if you feel the need). Bore several holes in the slide so it can be mounted onto the ball-race in several positions (for cutting large or small concave or convex arcs).

Make a tool-slide to hold your Cutting Frame (or router) so that the cutter can be adjusted to be exactly on the centre line of the lathe head. Make the tool-slide with a lever and stop such that the router (or Cutting Frame) may be advanced and retracted between cuts. Clamp the tool-slide to the main slide, so that when the cutter is retracted it will not hit the work but when advanced to full depth it will cut an arc. You need to swing the main slide by hand gently and smoothly around the arc. You can unclamp and re-clamp the tool-slide to make your series of cuts progressively deeper until you are satisfied with them (or you can make an adjustable stop screw to control the depth of cut). The final series of cuts should be very light to give the best finish you can achieve.

For the Spiral Swirls you can attach to the back of the lathe spindle a bicycle sprocket and chain, held down by a weight at the back of the lathe and connected by a cable in front to the main slide so that, as you pull the slide around its arc, so the lathe spindle will rotate very slowly for a short distance. You will need some calculations (or a lot of 'trial-and-error') to get this right! For those with metalwork experience a rotary table and a train of gear wheels will make a more robust and accurate jig for spiral-spherical turning.

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