A Letter From David

As I previewed this issue of the Lindow Rose Engine News my mind was filled with thoughts of the OTI Symposium, and I was taken with what I saw in this issue. I attended my first OTI Symposium in 2006. There was certainly a tremendous amount of information given at that meeting, however, there seemed to be very few who were carrying it out. Those who were had virtually no help from the written page. Not only were more complex techniques shrouded in a cloud of mystery with virtually no written instruction, but precious little was available for either the moderately experienced turner (of which there were only a small handful) or the beginner who seemed to be peering into a great cavern with only candlelight. There were only a couple of machines at that meeting which were not demonstrated live and in action. Nearly 8 years later this newsletter stands in contrast to those days. Great strides have been made in available instructional material and multiple meetings have been held in the subsequent years with the rose engine demonstrated hands on. This represents great strides toward making the rose engine a usable instrument for even a modestly skilled practitioner.

As I looked through the list of articles in this edition what brought me the most pleasure was the fact that I have written none of them, nor have any been written by those few accomplished artists that presented back in 2006. This means that through their efforts a new generation is building on their shoulders. Many of you that have now entered into the practice of this art form have volunteered your time to contribute to the cause of furthering the body of written knowledge and instructions to give the next generation of ornamental turners a starting point well beyond that of ours. We are illuminating that aforementioned cavern for those who are coming. To be sure, we stand on the shoulders of those who came before us; although, at times we still seem to be looking from a lower vantage point. A big thanks goes to all who have contributed at all levels.

This edition contains a profile of Peter Gerstel. Peter has written some instructions that have been very helpful, but his contributions have been far greater than that. We’re all familiar with the documents by Brian Clarry that have helped us all. Peter has played an important role in preparing those documents. Many of them have been “proofed” by him, not for grammar and punctuation, but he has gone through them step by step to make sure they work well. Given his background in machine work he could easily skip steps, but he patiently tests the documents as they are written. He has been indefatigable in this endeavor, at times making more than a dozen pieces before getting satisfactory results. This is an example to all of us who often get frustrated with failure in the first or second instance. His perseverance shows in his work. His use of finials which stand out on their own merit also instructs us on bringing other disciplines into coordination with our ornamental turning to enhance both in a synergistic manner. His help as a demonstrator at various meetings has also been legion. He has brought the skills of a lifetime of teaching to bolster the cause of ornamental turning. We can’t thank him enough for the help.

Roy Lindley’s article is another fine example of the improved information we can now access. No longer do we need to approach a particular pattern by trial and error desperately trying to remember how we accomplished it the last time. He has developed a formula for quick success and shared it’s “secrets” with us additionally illuminating that proverbial cavern.
My travels this year have been exhausting, but they’ve allowed me to see and visit with many of you. It has been a pleasure. I thank those who have helped me by organizing meeting places, arranging accommodations, loaning machines, making phone calls and sending emails for arrangements, and the list could go on. I wouldn’t dare try to list everyone that has helped as the names are myriad, and I would undoubtedly miss someone who did something of importance. None of this would happen without all of you, and what has been going on in the world of OT will become obvious as you look through John’s masterful newsletter for which we all thank him.

I hope you attended the OTI Symposium in Columbus, OH in October. It was not only fun but a learning experience as well.

*Ed. Note: If you are a member of OTI you saw a generalized form of this project in the recent edition of the OTI Newsletter. That article used this project as part of an article on the use of pumping in OT. Brian originally wrote this article specifically for the LRE so we are publishing it here to give our readers the details specific for the LRE.*

Ornamented Patterns on a Cylindrical Box
Brian Clarry

This project describes a method for cutting different patterns that can be used on a cylindrical box. They are a pattern on the bottom of the inside of the box, a barleycorn and wave pattern for the outside of the box, and several patterns on the underside of the box. The cutters used in this project are 60, 90, and 120° drilling cutters made and sold by Jon Spencer thru Lindow Machine Works. The rose engine used in this project is a Lindow Rose Engine (RE) using:

All patterns
- Pattern 1—Inside of the box
  - 24 Pumping Rosette with pumping spring and thrust bearing
  - #24 Rubber Drilling Frame with a special ground 120° drilling cutter

Pattern 2—Shoulder patterns and barleycorn on the side of the base
- 24 Pumping Rosette with pumping spring and thrust bearing
- #24 Rubber
- 2" Expansion Chuck
- UCF with a 3/16" right-hand cove cutter
- Drilling Frame with a special ground 90° drilling cutter (to cut the barleycorn), and 120° drilling cutter (to cut the patterns on the shoulder).

Pattern 3—Underside of base
- D8—250 Rosette
- 45° point Rubber
- Drilling Frame with an end mill (to remove the tenon), and a special ground 60° drilling cutter (to cut the pattern).

1. **Round wood stock for the box.**

Wood—African Blackwood

Approximate Dimensions,
- Tenon—3/16" wide x 1 ¼" diameter
- Height of box—1 3/4" including shoulder
- Shoulder—½" wide x 2 ¾" diameter
- Outside of box—2 ½" diameter
- Inside of box—2" diameter

The box blank after being dimensioned and ready for mounting on the rose engine.
2. **Pattern 1—Inside of the box**
   a. The design uses a 24 pumping rosette and a #24 Rubber with the pattern phased by 50%. The depth is increased by 0.010" on each cut.
      i. Install the box blank in the holding chuck.
      ii. Install the 24 pumping rosette and #24 Rubber. To ensure a sine wave use the side of the rubber with the lowest radius against the rosette.
      iii. Install the pumping spring and thrust washer.
      iv. Set the Crossing Wheel to 24.
      v. Install the sliderest with the Drilling Frame inline with the spindle. Install the 120° drilling cutter in the Drilling Frame.
      vi. Check that the height of the drilling cutter is at the center of the spindle. Refer to Lindow Rose Engine Alignment Procedures document Section—2 2.2 for more details on finding the exact center height.
      vii. To ensure the pattern is cut centrally and at the same depth lock the headstock at top dead center, and check the base axially and radially. Refer to Lindow Rose Engine Alignment Procedures document Section—1 1.1 and Section—1 1.5 respectively.
      viii. Lock the #24 Rubber into the 24 bump pumping rosette and ensure the spindle is pumping smoothly.
ix. **First cut**—to cut the first pattern move the drilling cutter as close as possible to the side. Cut to a depth of 0.030". Set the lower slide dial to zero and move the drilling cutter away from the surface.

x. **Rest of cuts**—move the drilling cutter toward the center by 0.050" (100 divisions on the Hardinge dial), and move the Crossing Wheel by one notch (50% phase). Cut to a depth of 0.020", then cut a further 0.010". Move the drilling cutter away from the surface. Repeat the process above cutting consecutive patterns deeper by 0.010" until about 3/16" from the center, or the side of the drilling cutter is in-line with the center.

xi. **Cut at center**—remove the #24 Rubber so the pumping is stopped and the spindle rotates on axis. At the same time move the drilling cutter in and move the bottom slide towards the center until a smooth button is cut.

**Alternative design:** The first cut is the same as above. The rest of the cuts are as follows: The next seven cuts are i. move the drilling cutting in towards the center by 0.050", ii. phase by 50%, and iii. cut only to a depth of 0.020". The rest of the cuts in the series are the same as the seven cuts, except each cut is deeper by 0.005". This creates a curved funnel rather than just the angled funnel of the first example.

xii. Completed pattern.

### 3. Pattern 2—Shoulder patterns and barleycorn on the side of the base.

- **a.** Insert the Expansion Chuck in the base and install on the Leveling Chuck.

  *Ed. Note: If you prepared the blank on a lathe other than your RE and you have upgraded your LRE to the MT shaft you can use a MT adaptor attached to your expansion chuck to transfer the work between lathes. However, since the box must be remounted to cut the various patterns you may still find the leveling chuck useful to maintain the greatest accuracy.*

- **b.** To ensure a consistent depth of the barleycorn pattern lock the headstock at top dead center, and check the base radially. Refer to *Alignment Procedures* document [Section - 1 1.1](#) and [Section - 1 1.5](#) respectively. Leave the headstock locked at top dead center.
c. Step 1—Cutting the cove
   i. Install the UCF with a 3/16" right-hand cove cutter.
   ii. Position the cutter to the left hand side of the shoulder, and cut a cove so it is approximately 1/16" above the surface of the side of the base.

Step 2—cutting the patterns on the shoulder.
   i. Install the Drilling Frame with the 120° drilling cutter and place the drilling cutter against the shoulder. Set the bottom slide dial to zero.
   ii. Install the 24 Pumping Rosette with a #24 Rubber. To ensure a sine wave use the side of the rubber with the lowest radius against the rosette. Install the pumping spring and thrust washer, and ensure the pumping action is running smoothly.
   iii. Cut three patterns side by side to a depth of 0.050" approximately 0.150" apart as shown in the example.

Step 3—cutting the barleycorn.
   i. Install the Drilling Frame with the 90° drilling cutter and place the tip of the drilling cutter next to the cove. Cut a groove approximately 0.050" deep. Do not let the drilling cutter touch the cove.
   ii. To accurately cut the barleycorn it is first necessary to measure the amplitude of the 24-pumping rosette. Set a dial indicator as shown right and turn the spindle. In this project the amplitude measured was 0.045".
iii. Set the Crossing Wheel to 24.

iv. Move the drilling cutter to the left to cut the first side of the barleycorn. Place the drilling cutter tip against the wood blank, and set both sliderest dials to zero.

v. The barleycorn pattern is cut from the shoulder to the rim of the base. To cut the first barleycorn cut the right hand side of the barleycorn to 0.100" deep.

vi. Move the drilling cutter towards the rim by 0.100". (calculated as twice the amplitude plus i.e. 2 x 0.045" plus) and phase the rosette by 50% on the Crossing Wheel.

vii. Cut the left hand side of the barleycorn to the same depth of 0.100".

viii. If the top surface of the barleycorn is not a straight edge reverse the procedure and re-cut both sine waves deeper until a sharp edge is cut. Note new depth of cut.

ix. Repeat v. and vii. above using the new depth of cut until all the barleycorns have been cut.

4. Pattern 3—Underside of base

a. Use an end mill in the Drilling Frame to first remove the tenon and smooth the complete face of the base.

b. Install the 60° drilling cutter in the Drilling Frame and ensure it is on center with the spindle.
c. Install the D8-250 Rosette with the 45° rubber.

d. Align the headstock so there is equal movement of the headstock on both sides of top dead center. Refer to *Lindow Rose Engine Alignment Procedures* document Section—1 1.2.
e. Position the rubber in the valley of the rosette with the drilling cutter in the center of the base. Set the bottom slide dial to zero.

**Central pattern**

a. Move the drilling cutter in to start cutting the pattern. When the top of the eight shapes look like barleycorn and the top of the shapes is below the surface stop cutting. Set the top slide dial to zero, and move the drilling cutter away from the base.

**First five cuts of the pattern**

a. Cutting the first 5 cuts of the pattern without phasing:
   i. Move the drilling cutter outwards, or towards the operator by 0.050" (100 on the dial).
   ii. Phase by 3° i.e.1 ½ turns on the Crossing Wheel worm, or 1 turn of the Auxiliary Rosette Holder.
   
   *Note: If the phasing key is turned clockwise the shape of the pattern is right-handed. If turned anti-clockwise the pattern is left-handed.*

   iii. Cut the next pattern until top slide dial reaches zero. Do not phase.
   iv. Move the drilling cutter away from the base, and repeat a. i. thru iii. above until all 5 cuts have been made.

b. Cutting the rest of the pattern.
   i. Repeat a. i. thru a. iii. above making each cut deeper by 0.005".
   ii. Continue cutting the pattern until the pattern is just under ½" from the edge when the rubber is in the valley of the rosette.
Heart Shaped Patterns

a. Position the rubber in the valley of the rosette.
b. Move the drilling cutter close to the side of the last cut in b. ii. above.
c. Position a dial indicator against the headstock, and set the dial to zero.
d. Plunge the drilling cutter in to the desired depth approximately 0.100”.
e. To cut the heart shape, first move the rosette so the rubber is to one side of the valley until the indicator reads 100, second move the rosette until the rubber is back again in the valley, and third move the rosette so the rubber is on the opposite side of the valley until the dial indicator reads 100. Adjust the depth of cut accordingly.
f. Repeat procedure with the rest of the 7 hearts using the same dimensions.

g. Completed underside of base.

5. Examples of the patterns and project completed by Jon Spencer/David Lindow.
Turner Profile—Peter Gerstel

Peter is a multifaceted individual who is a woodworker, ornamental turner, machinist, tool maker, teacher, outdoorsman, and all around nice guy. He has shared photos of his 600 square feet shop which has seven lathes, table saw, shop saw, two milling machines, desk, 8 foot x 3 foot workbench, metal shaper, and all the accessories for each machine. Peter has utilized all of his shop space very efficiently. You’ll also note that he is serious about safety and his health. He’s installed a hard-piped vacuum system and has safety equipment readily at hand. Peter lives in Poulsbo, Washington where he and his family enjoy all the area has to offer including wind surfing on the Hood River. Peter’s wife, Mary, often accompanies him to meetings and expresses her talents as a quilter.

I asked Peter a series of questions about his shop and his work. He sent the following responses and information. “I was born and raised in the Chicago area and went to Stout State which is a part of the Wisconsin university system studying to become a machine shop teacher. I grew up working on my father's sailboat and did a fair amount of woodworking and maintenance on it. I worked in a screw machine factory for a number of summers where I did packaging of screws and bolts as well as tending a heat treating furnace and doing production on various bolt threading equipment. I paid for most of my college doing this kind of work during the summer.”

“I started teaching in 1966 schools in Chicago. I building construction and My wife, Mary, was a sewing teacher in another of the Chicago vocational schools. We moved from the Chicago area to Wisconsin and then to Poulsbo, Washington.”

“We left most of our furniture because I wanted to build craftsman style furniture for our new house and I got to buy all the necessary tools. After building about 50 pieces of furniture, I decided to try a course in woodturning at the local Woodcraft store in Seattle. I, of course, was hooked on turning and that was about 6 years ago. I went to the AAW convention in Portland where I first saw a rose engine and attended a seminar by Jon Magill. After thinking about what I really wanted to do I decided to purchase a Lindow Rose Engine.”

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“The work I enjoy most is the kind that keeps my mind in turmoil and wakes me in the middle of the night to write down a solution. Most of my work involves finials and boxes. I have done hollow forms with finials and small boxes. I like to make fixtures that make it easier to do this kind of work and make it more enjoyable. For example, the fish pattern is really a measuring project and a tool grinding project. As such it was great fun to do. My machine shop tools make it easier for me to make various parts of my OT projects.”

“The OT equipment I have is a Lindow Rose Engine with most of the accessories. I also have an elliptical cutting frame, an epicycloidal cutting frame, and a rose engine frame from the 1870's which I am learning to use. I have made a cutting head that can be installed on Holtzapffel type equipment that will allow me to use a power head while keeping the speed of the cutting frame at a minimum. I consider most of the metal turning equipment that I have to be OT equipment. The metal lathes allow accuracy that is easier to accomplish than on other equipment.”

“My favorite item to make is a half round box with an inset lid and a tall finial. I start on the regular wood lathe and get the outside and inside complete then I go to my metal lathe and finally to the rose engine. All my chucks will fit all my machines (metal and wood) so I do not have to change anything and can work with little or no adjustment for alignment. I have a website, petergerstelwoodworking.com, which I started but spend very little time on. For those of you who have a 3520 Powermatic lathe I have free drawings on my site for the best swing away tailstock available which can be made from scrap metal and bolts from the hardware store. The tailstock never has to be removed and swings behind the headstock if the headstock is at the end of the lathe.”

“I do not sell my work but I have tried. I realized that I do not want a job and, for me, it would take the fun out of it. I like giving my pieces away on occasion and the rest just get stored on shelves.”

“I like to restore old metal working equipment such as Rivett lathes, and I like to windsurf on the Columbia river in Oregon for 2 or 3 weeks a year. I find that I really like to stay home and play in the shop. My wife has a sewing studio where she makes quilts and other projects.”

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Peter also makes use of his metal working skills and equipment to produce a goniostat that he has available for sale.
Peter’s shop and some of his work including his half round boxes with inset lids and finials.
Finial Tailstock for the LRE

Peter Gerstel enjoys making projects using long, slender finials. He has developed a new tailstock designed to hold the point of the finial after the initial cut to stabilize it and keep the work from vibrating when undercutting the top to a diameter of about 0.075 to 0.100”. It is used when making the second or even third undercut until the UCF is cutting a taper toward the headstock of the RE. He will make a tapered center that will fit into the tailstock and it will be available from Lindow machine. At the present time the only finials that can be done with this tailstock are straight finials. The photos below show Peter’s initial design.

Patterns and Phasing

John Tarpley

I’ll begin with a statement that you may wish to debate, “Most of us got interested in rose engine work because we enjoy creating complex patterns of decoration that enhance our turnings.” I know that I’ve been interested in patterns and the designs they create for as long as I can remember. That does not mean that I’m good at interpreting patterns, but I do enjoy them. Calligraphy and designs like Celtic knots have always fascinated me.

Perhaps you are already beginning to wonder what this has to do with phasing and the rose engine. Phasing on the rose engine is defined as changing the orientation of the lathe spindle, and therefore the work piece, in relation to the rosette. Thus we are able to take simple patterns made of units smaller than the entire pattern and use them to create more complex patterns by repeating the smaller units. Complex patterns are often made this way so rose engine phasing is just a way to do this with a cutting tool to create a pattern in the material being cut.

Figure 1 shows a Celtic design. 1A is the completed
design and 1B highlights two elements of the design that are rotated, or phased, around the central elements to create a more interesting, complex pattern.

We start doing phasing as children playing with toys. Do you remember the Etch A Sketch? Figure 2 shows a drawing done with this toy. You can clearly see that the pattern making up the tree is created from repeated units that are phased around the central axis of the tree trunk. I must confess that I was never very good with my Etch A Sketch. I just could not develop the knack of drawing curved lines, but I spent many enjoyable hours trying to create images.

Perhaps the toy that is closest to phasing on the rose engine is the Spirograph. I had a small version of the toy, but as often happens I managed to break parts and then my parents decided to discard my childhood toys when I went to college. Fortunately, my wife has a Super Spirograph which has remained almost complete. She obviously took better care of her toys. I have used it to create a simple design for this article to illustrate phasing. Figure 3 shows the setup for this design. Just as with the rose engine I began by choosing a pattern I wanted to produce and the rosette needed to produce that pattern. I selected an appropriate disk and circular frame for the size pattern I desired. I used the inner teeth on a circular ring and then chose to use the number 1 pen position for each of the drawings. Just as with the rose engine you could vary the distance from the center of the pattern to vary the width and length of the resulting shapes producing a more complicated pattern. I think using this toy will show phasing by isolating it from all of the other considerations we have when using the rose engine. Figure 4 shows the first step of drawing this pattern. Just as with the rose engine we mount our cutting frame, in this case a pen, and rotate the rosette making cuts until the pattern is complete. The result is an interesting yet simple pattern. There are two basic ways to make this pattern more complex and perhaps more interesting. The first would be to choose a more complicated rosette, which will cut a more complex pattern, but as we all know there are limitations in the design and subsequent following of a rosette. With more bumps for the same diameter, the bumps must be closer and there are limits to the dimensions and shape that can be accurately followed by the touch and therefore the cutter. Rapid transitions can cause the cutter to jump when the touch can not accurately follow the rosette. We can overcome some of these problems by phasing a simpler rosette to create a more complex pattern.

Figure 5 shows the setup I used to create the final pattern which I drew in colors to allow you to see the individual elements of the pattern. This pattern was made from four phases. I moved each pattern by the same number of teeth which will give the same number of degrees or percentage of phasing for each element of the pattern. Just as we often phase forward and backward on the rose engine I did this for the drawn pattern. Now it was simply a matter of drawing each element and phasing between
drawings as shown in Figures 6-8.

As you can see in Figure 8 the completed pattern is more complex and interesting than the simple pattern shown in Figure 4 and the difference is a repeated pattern using phasing.

We typically speak of phasing in the number of degrees or by a percentage which refers to the amount of movement around a circle. For example a rosette may be phased by 50% which is 180° before cutting the next pattern. I asked David to add his considerable expertise to this discussion. His comments are, “There are a couple of different ways to express the amount being phased. Engineers often prefer to notate the amount in degrees whereas many others prefer to think in percentages. Accepting the term period for the distance of one complete wave, i.e. peak to peak or valley to valley, it can quickly be seen that the use of either of these notations is simply designating a portion of that wave. For instance, if you were doing the classic barleycorn or, perhaps, a basket weave you would want the peaks to be where the valleys were in the previous cut. You would need to index one half of the complete wave which would be translated as either 50% or 180°. Regardless of which method you choose as your designation, either system must then be translated into whatever method you are using to do the phasing. For instance, if you are using the worm to phase on the LRE you would take a 360° circle and divide it by the number of bumps on the rosette to calculate the total number of degrees encompassed by each wave or as some say the peak to peak distance. This, of course, can be confusing at first, especially when coupled with the fact that many people use the term 360° to notate one wave. For example, if you have a rosette with 24 bumps each wave will encompass 15°. This 15° represents 360° of phase. If you want to do a spiral that is phased 25% with each subsequent cut you phase 90° or 1/4. In order to figure out how much you need to move the worm you must divide the 15°, which in the terms of phasing is the 360° of an entire wave, by 4 which is 3.75°. Since the worm wheel moves 2° per revolution you would make 1 7/8 turns with the worm, not a particularly handy number.”

When I purchased my LRE I didn’t appreciate the power of phasing and how often I would use this technique. David had recently introduced the crossing wheel and it was still an option. Being somewhat thrifty, read cheap, I decided to purchase the engine without a crossing wheel. So I began by manually phasing. Figure 9 shows the rose engine with and without a crossing wheel. In 9A you’ll notice that the rosettes are directly attached to the spindle and are held on by a large nut. I want to thank Steve White for supplying this photo. In 9B the rosettes are on the crossing wheel barrel and the barrel is held in position by the spring loaded detent (bird). With this ingenious setup phasing is a simple matter of releasing the bird and allowing the rosette stack to rotate with the barrel to the new position while the spindle stays in position. For those of you who may never have done manual phasing it was done using the 96 index holes on the main pulley. Nine of the index wheel holes were marked in a numeric sequence. With the pin in hole #1 the large nut on the pulley hub was loosened which released the rosettes and the rubber was set into the valley of the rosette. To phase, the index pin was moved to a different hole and the
rubber reset again to the valley by again loosening the rosettes with the large nut. If you wanted to phase a 12 lobe rosette by 50% you divided 96 by 12 which equals 8. Half of this is 4 so you went back and forth between hole #1 and hole #5. To phase a 24 lobe rosette by 50% you used holes #1 and #3. As you can see this was effective but very limited and time consuming. To be honest I had forgotten the procedure and had to ask David to remind me for this article. This explanation should help you understand what happens when we simply move the crossing wheel to phase. I soon decided to add the crossing wheel to my lathe and David had another set of rosettes to re bore to accommodate the barrel of the crossing wheel.

Again I asked David for his input on using the crossing wheel so he continued his example using a 24 bump rosette, “We can phase using the notches in the crossing wheel. In the case of a 24 bump rosette the number of notches is divided by the number of bumps, and using the 96 set of notches the result is 4. To phase the 24 bump rosette 25% or 90° you move one notch in the 96 notch set on the crossing plate. (4/ 25%=1) This can be confirmed by taking 360° and dividing it by 96 which is 3.75°. In this example the 192 or 288 notch progressions could be used as well. You would use two notches of the 192 progression or three of the 288, and both of these would also equal 3.75°.

As you can see each method works so you can use the one that works best for you. However, if you don’t understand the notations that others are using miscommunication can occur. As with many things in this avocation the more you use the systems the better your mind will become translating from one notation to the other. Regardless of the system you personally choose to use, keep records so that positive results can be repeated and not so good ones can be avoided which helps flatten the learning curve.”

I hope this article has given you some additional understand of this fundamental process used in most rose engine turning. I think we often become so used to doing something that we forget the underlying principles which can limit what we want to accomplish and also limit our creativity.
Lindow Crossing Wheel
Brian Clarry

The Crossing Wheel allows very quick and extremely accurate phasing of rosettes; it changes the relative position of the rosette to the spindle/work piece. For engine turning the Crossing Wheel is a must.

The Crossing Wheel Assembly is constructed of four main parts:

**Barrel**—the barrel rotates on the spindle and holds the rosettes.

**Crossing Wheel**—the Crossing Wheel has a set of three notches for each of the 12, 18, 24, 36, 40, 48, 60, 72, 84, 96, and 120 count rosettes. There are also three sets of graduation slots for 96 divisions, 200 divisions, and 300 divisions. In the latest Lindow RE Crossing Wheel the 200 divisions and 300 divisions have been replaced by 192 and 288 divisions respectively. These two new divisions will work better with numbers like 18, 32, and 72. A spring-loaded detent, shaped somewhat like a bird, is inserted in the notches to secure the Crossing Wheel.

**Worm**—The worm turns the worm wheel using a detachable handle. Each full turn of the handle moves the worm wheel 2°. For even more accuracy the worm itself is divided into 10 divisions.

**Worm Wheel**—the worm wheel has 180 divisions cut into the wheel surface. If the worm is turned 180 times the worm wheel is moved 360°, one complete circle.

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**Phasing Using The Crossing Wheel.**

**Phasing using the 12, 18, 24, 36, 40, 48, 60, 72, 84, 96, and 120 slots.**

A simple example of phasing is to insert the detent into the notch that corresponds to the count of the rosette that is being used in the phasing process. For example, if you want to phase using a 24-count rosette insert the detent into the 24 notch. By moving the detent to the notch on either side of the 24 notch the phase is changed by half or 50% of one valley or bump of the rosette. Moving the detent backwards and forwards in the notches can make basket weave and barleycorn patterns.
The basket-weave in these examples used an 18-count rosette and the 18 notch on the Crossing Wheel. The first row was cut and the cutting frame moved to the next row. The detent was moved one notch before cutting the second row. By moving the detent between these two notches for each row, the pattern was moved 50% for each row of the basket weave.

**Phasing using the 96, 200, and 300 divisions.**

Using the graduation notches of 96 divisions, 200 divisions, and 300 divisions basket weaves, herringbones, chevrons, and many other designs, can be made.

In the example at right the spiraled basket weave has 24 cuts around the circumference of each row, and each row is phased to create a spiral. The spiral is first created in each of 4 rows and is repeated every fifth row; i.e. the fifth row is the same as the first.

For the 24 cuts a 24 count-rosette was used. To produce the spiral the detent was first inserted in the first notch of the 96 division. 96 notches was divided by 24; i.e. 96 divided by the number of cuts per row. It takes 4 rows to complete one set of the basket weave as each row was phased 25%.

After the first row was cut the detent was moved to the second slot, and the second row was cut and phased by 25%. This process is repeated until the fifth row was reached. At this stage the detent was moved back to the first notch, and the first row of the second sequence was cut.
The pattern at right was created using a 12-count rosette as an indexer to cut 48 incisions. In the design every fourth division has been skipped.

The detent was inserted in the 1st notch of the 96 division on the crossing wheel, and using the 12 count rosette 12 circular incisions were cut in the disc. The detent was moved to the 5th notch, and 12 more incisions were cut in the disc.

The detent was then inserted in the 3rd notch of the 96 division and 12 incisions were cut in the disc.

Notch 7 was skipped to give the pattern above.

A similar pattern is shown at right with the variation that every 4th incision was cut deeper. Also, instead of skipping the 12 incisions of the 7th notch they are cut somewhat deeper than the other 36.

These two watch dials are also examples of spiral designs. The higher numbers on the crossing wheel are more for engine turning using harder materials that will take finer details. The spirals on the watches were done by moving forward and back with the Crossing Wheel using the higher number slots. Chevron and herringbone designs are both done in this manner.
The worm is not only used to make designs using odd numbered rosettes and making moirés; but it is also used for quick alignment of the spindle, especially when using the Dome Chuck, Double Eccentric Chuck and Straightline Chuck.

Crossing Wheel Pre-Development
Steve White

Ed. Note: Steve recently sent the following photo and information about the early development days when David and he were designing and beginning development of the Rose Engine. It seems to fit well with all the phasing information in this issue.

When David and I first started we were focused on keeping the price of our rose engine under $3,000. That meant no crossing plate. By 2009 Dave let his employee, Paul, make 4 Phasing adapters. I believe the cost was going to be around $400 each. This fixture allows phasing off the front with no crossing plate. As seen in the photo, it was well made and I was very excited to get it in the mail. It would be great for some things, but it has its limits with tooling. So just like the Plus One, this idea went to the backburner and would later look a lot like the tooling to phase off the back. These are both ideas that had merit but never saw the light of day. This is one reason it is so hard to make a living manufacturing Rose Engines. The time it takes to make a widely useful tool and the many versions of that tooling require a great deal of time and development expense before you are happy with a new idea. I have several of these ideas still stashed away and in the next issues I will bring some to light. Before they are recycled into a new project.
Editor’s Chips
—John Tarpley

“—Putting the cookies on the lower shelf”

Since we are now entering our fifth year of this publication it seemed to be an appropriate time to reflect and what we intended this publication to do and how we’ve done. Can you remember when you were a kid and your Mom kept your favorite treats in a place you couldn’t reach to keep you out of them? You could see them, but couldn’t quite get to them. This is how several of us saw OT and Rose Engine work when we wanted to start the art. The cookies were just out of reach. Our goal with this publication and related efforts is to move the cookies to the lower shelf so everyone can reach them if they just make a reasonable effort.

When I recently did the index I was surprised to realize that in our first four years of publication we have printed 100 articles not including announcements of upcoming events. I am very pleased by this and I look forward to the upcoming publications and the articles that you will submit.

When we started we wanted to improve communication between LRE owners and also the larger rose engine community. A lot of us were, I still am, a novice in this art so we needed information in all areas. David and Steve had done some of this through the DVDs they produced and Brian has certainly helped with all the detailed instructions he has written and continues to write. However, we needed a better vehicle to disseminate this information to everyone. The result is the Lindow Rose Engine News.

(Cont. on Page 31)
OT at the 2014 AAW Symposium

There were several OT presentations at the recent AAW Symposium in Phoenix. This photo essay was shared by Charles Waggoner. We hope to have some detailed information for the next edition of our newsletter.
Settings for Sine Wave Series
Roy Lindley

After watching linked sine wave demonstrations, I set out to add this pattern to the center of the bowl in Figure 1. The lingering question was the relationship of phasing (degrees) and the radial (or axial) motion required for the sine curves to perfectly touch and create the best possible spiral. Now having actually cut some patterns, trial and error does work and can yield good results but experience is needed to understand how different settings change the outcomes. The intent of this article is to provide examples to illustrate the relationships between different combinations and to provide the reader a basis to repeat these outcomes for any sine amplitude and number of rosette bumps. For those interested in the mathematical basis, this is also provided.

Figure 1 Sine Wave Pattern on Bowl Base

Relationship of Phasing to Radial Movement for Repeated Contacting Sine Wave Patterns

Figure 2 is a graphical presentation of the desired relationship and Table 1 provides exact coefficients. To properly use the table and figure, explanations are important. The first point is to know the value of the total motion a sine generating Rosette produces. (Also note that generating a true sine wave requires the proper rubber for whichever type of Rosette is used.) This can be measured by placing an indicator on the side of the RE headstock at the centerline determining the mathematical difference between the maximum and
minimum. Another verification action is to assure the Rosette and rubber combination are actually generating a true sinusoidal pattern. The vertical axis of Figure 2 (and the right hand column of Table 1) are interpreted as a multiplier of this total amplitude. The horizontal axis of the figure (and the left hand column of the table) are the fraction of the available angle for phasing. The available angle for a 24 bump rosette is 15° but only half of this is used for phasing. If one were to phase an actual 3° (reference case as measured at the indexing worm) from one pattern setup to the next, this would be 20% or 0.2 on the horizontal axis or left hand table column (3/15=0.20). The corresponding radial multiplier is 0.588 which makes each radial separation 0.035" if the total measured rocking amplitude is 0.060 (0.060x.588=0.035).

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Table 1 Numerical Relationship of Phasing to Radial Motion (Sine function)

Figure 2 Relationship Between Phase Angle Factor and Radial Displacement Factor
Graphical Examples

Figures in this section show cutter pathways and have been generated in an Excel™ spread sheet. The figures illustrate how pathways change based on variable changes and differences. In each instance, quarter section or whole, the overall diameter of the finished pattern is 2". From these figures some general observations are:

- Increasing the phase angle, and thus percentage of phase angle used, increases the width of a given number of sine traces (outside diameter minus inside diameter). Compare Figures 3 and 4 with Figure 6. Also Figures 7 versus Figures 5 and 4.
- Reversing the direction of phasing from right hand to left hand inverts the helix appearance formed by the common intersections. Most cases shown are right hand motion of the outboard phasing worm. Compare Figure 9 with 6.
- Small phase angles leave finer spaces between the successive sine curves than large phase angles and thus create almost a three dimensional wave look. Compare Figures 7 and 8 versus Figures 4 and 6.
- Increasing the number of Rosette bumps for the same total motion magnitude requires fewer traces for a given width provided the larger bump Rosettes available angle is more than the base phasing angle used. Compare Figure 8 versus Figures 3 and 4.

Figure 3 is a full section of a defined reference pattern and figure 4 is a quarter-section which shows expanded detail. Each setting is a unique color, thus one can observe how successive patterns intersect with each other. Also, RH -3° means turning the outboard Lindow lathe worm one full turn clockwise (3°) with the clock key.
Figure 5 Phasing at 50% of Reference Case

Figure 6 Phasing at 133% of Reference Case

Figure 7 Phasing at 33% of Reference Case (1°)

Figure 8 Reference Case-36 Bump Rosette-Fifteen Traces instead of 20 for Reference Case
Mathematics

Assume the following variables:

\( \Theta \) = angle theta (radians) for generating a sine motion. \( 2\pi \) radians (360°) creates a full sine wave cycle. The full cycle occurs from one Rosette bump to the next bump.

\( A \) = total overall amplitude of actual sine curve from Rosette measurement.

\( y \) = value of sine (sin) for any angle theta (Visualize \( Y \) as vertical and theta is in the direction of lathe spindle rotation-horizontal in a sense).

\( R \) = radial (vertical) displacement for two curves to contact at common points and at an equal angle from horizontal for each cycle of the full sine wave.

\( \Delta \) = incremental phase angle for sine wave (radians or degrees) between successive sine wave rows.

\( M \) = slope of sine curves at any point (Cosine function). This is the first derivative of the sine function.

The general equation for the first series of sine waves is:

\[ Y_1 = 0.5A \sin(\Theta) \]

The general equation for the second series of sine waves is:

\[ Y_2 = [0.5A \sin(\Theta + \Delta)] - R \]

Assume both curves contact at a point with equal slope (angle from horizontal) at the same value of \( y \).

The slope (first derivative) for the first series is:

\[ M_1 = 0.5A \cos(\Theta) \]

The slope for the second series is:

\[ M_2 = 0.5A \cos(\Theta + \Delta) \]

Two equivalences result from equating slope and vertical distance equation:

\( \cos(\Theta) = \cos(\Theta + \Delta) \) and \( R = 0.5A[\sin(\Theta + \Delta) - \sin(\Theta)] \)
For the first equation let $\theta = 180 - 0.5\Delta$ and substitute in the first equation. This is a trial solution based on knowledge of how the sine and cosine functions vary through the quadrants of a single 360 rotation. For example, the sine is positive in the first quadrant and goes from zero to 1.0. The cosine function is negative in both the second and third quadrant and have the same numerical values at a given number of degrees plus or minus from 180 degrees. Intuitively this seemed like a likely possibility.

The result is:
$$\cos(180-0.5\Delta) = \cos(180+0.5\Delta).$$

Using the trigonometric identities for $\cos(x+y)$ and $\cos(x-y)$ the previous equation becomes:
$$\cos(180)\cos(0.5\Delta) + \sin(180)\sin(0.5\Delta) = \cos(180)\cos(0.5\Delta) - \sin(180)\sin(0.5\Delta).$$

Since the $\cos(180) = -1.0$ and the $\sin(180) = 0$, this reduces to:
$$\cos(0.5\Delta) = \cos(0.5\Delta)$$

This proves that the slope based equation has been satisfied by the substitution. Now, substitute the same relationship for theta into the second equation for radial distance $R$. The equation becomes:
$$R = 0.5A[\sin(180+0.5\Delta) - \sin(180-0.5\Delta)].$$

Using the trigonometric identity for $\sin(a+b)$ and $\sin(a-b)$ the previous equation becomes:
$$R = 0.5A[\sin(180)\cos(0.5\Delta) + \cos(180)\sin(0.5\Delta) - \sin(180)\cos(0.5\Delta) + \cos(180)\sin(0.5\Delta)].$$

Since $\sin(180) = 0$ and $\cos(180) = -1.0$, this equation reduces to:
$$R = A\sin(0.5\Delta)$$

which is the equation of the plot shown in Figure 2. Thus Figure 2 is actually one-fourth of a full Sine cycle. Using degrees, this means the radial multiplier fraction as shown is $\sin(360*\text{azimuthal phasing fraction})$.

Independently I validated this result numerically using the original relationship. Again the “phasing fraction” is the proportion of the available degrees for a full sine cycle. For example, $15^\circ$ is the available degrees for a 24 bump Rosette=360/24.

**Conclusions and Miscellaneous Comments**

The pattern shown in Figure 1 was done with a $90^\circ$ included angle carbide drill. A $60^\circ$ included angle would increase the relief a bit while a $120^\circ$ included angle would lessen the relief height.

I generated a table which provides accumulated total settings as a function of the number of cut settings. Table 2 is an excerpt for the reference case in this article. Because of the diametric aspect of the Hardinge cross slide the diameter column is calculated and totaled based on twice the actual radial motion needed. Note the 0.035 is a rounded value thus numbers are not always exactly 0.070 diametric.

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<th>Diameter</th>
<th>Total Deg.</th>
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Table 2. Cross Slide and Phasing Totals for Reference Case
This article is written expressly for a radial pattern. However, the same relationship occurs for a pattern generated from a pumping Rosette except that the moves between setups are axial rather than radial. One difference is that radial patterns have convergent effects whereas the pumping bands are consistent if done on a pure cylinder. There is also the possibility of placing pumping patterns on a conical like surface. This might be a unique experiment but at this point I cannot attest as to how settings should be done and whether both pumping and rocking should occur and be phased together.

As I indicated at the onset, the wave pattern can be done by trial and error. However, using the exact values provides very crisp and the best possible aligned lines from the points of contact. The foregoing is adaptable to any number of Rosette bumps and Rosette amplitudes in either rocking or pumping modes. Finally, this article should provide some insight on the pattern a particular setting pairing will generate and most of all obviate the need for a lot of trials and possible frustration when the intersections do not occur as planned.

(Editor's Chips Cont. from p. 20)

Ornamental Turning has faced several issues in the past. First, that ideas that it is somehow an elitist art done by solitary turners who have no desire to share their methods and techniques with others., Second, that there is no skill involved because the lathes do all the work. Third, that new turners are discouraged. Fourth, that you must own antique lathes. Fifth, that you must be a machinist to do OT work. While several companies tried to overcome the equipment problem, David and Steve developed the first modern lathe that took care of the equipment problem with the development of the lathe we owners use. They made and David continues to make accurate, affordable equipment available for a price that serious turners could afford. At a similar time Jon Magill also interested many new people in the rose engine by freely sharing the design for the MDF lathe which they could build themselves and many LRE accessories can be used on an MDF lathe.

We still needed to tackle the other issues. Unfortunately some of these impressions probably came about because until recently there has been very little modern writing about Ornamental Turning. All of us certainly appreciate Holtzapffel’s works, but they are not my idea of light reading for a winter evening. The result was the idea that OT people were very secretive about their work and didn’t want to share. It was our hope that the LREN would help solve this perception and help us grow as turners. Also, as information reaches the larger turning and art communities, we hope they will come to understand that the lathe doesn’t do the work, but just as with plain turning the artist uses proper techniques and also exercises creative control and inspiration. While antique equipment is still greatly admired, prized, and effectively used; with the advent of modern, available equipment more turners can join the party and produce beautiful work. Also, since the machinery can now be purchased it is not necessary to build your own equipment if you don’t desire to do that. Being a machinist is no longer required though some basic machining skills are helpful and are usually learned along the journey just as most plain turners learn some tool making skills along the way. The first four years of LREN have been great and I’m excited to see what develops over the upcoming years. Remember that this is a reader driven publication. It cannot continue to exist without your support and input. It is entirely a volunteer effort. I want to again thank everyone who has contributed articles, photos, or other content. I look forward to seeing what everyone will contribute in the future. You have no idea how daunting it is to sit down and stare at a blank issue and know you have to somehow fill it with meaningful content. I’m looking forward to meeting more of you as your art grows and you decide to contribute and give back to the RE community. Happy turning! — John
Lindow Rose Engine and MADE Rose Engine at NAMES

David Lindow

The model engineering world was formally introduced to ornamental turning at the North American Model Engineer’s Society (NAMES) Exhibition, [http://www.namesexposition.com/expo.htm](http://www.namesexposition.com/expo.htm), this April with the presence of both the Lindow Rose Engine and the MADE lathe, [https://www.facebook.com/MADElathe?ref=hl](https://www.facebook.com/MADElathe?ref=hl). During the two day show Mike Stacey, David Lindow, and John Harm demonstrated different aspects of ornamental turning, including guilloché work, to a world that is completely immersed in mechanics and mechanical devices yet almost completely devoid of even rudimentary knowledge of OT. The machines grabbed the attention of the audience, and what they produced kept many watching for long periods of time. David had a selection of turnings on display, and several pieces were produced and distributed during the show. David delivered a lecture on the history of the rose engine and ornamental turning.

There were some familiar faces attending the show such as Mike Foydel with his always cheerful greeting. There were a few members of OTI but most of the attendees were new to ornamental turning. It was delightful to see the interest and excitement from those who’d never seen a rose engine in action and thought they’d “seen it all.” The NAMES Exposition has for many years been the premier gathering for those interested in the art of model engineering. These models include almost any small mechanical device from small replicas of machine tools to working model steam engines in various sizes. There were also two booths devoted to the demonstration of engraving and the sale of engraving tools. If you have not been to such a gathering it is highly recommended.
The MADE lathe held interest to these model engineers on several levels. It’s a work of art and engineering in itself. It is also able to produce intricate and beautifully designed objects. Above and below left Mike Stacey demonstrates some of the capabilities of the lathe. The photo below left shows that several attendees were able to get up close and personal with the MADE.
Submit Articles for future issues of the Rose Engine News to
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jjtarpley@comcast.net