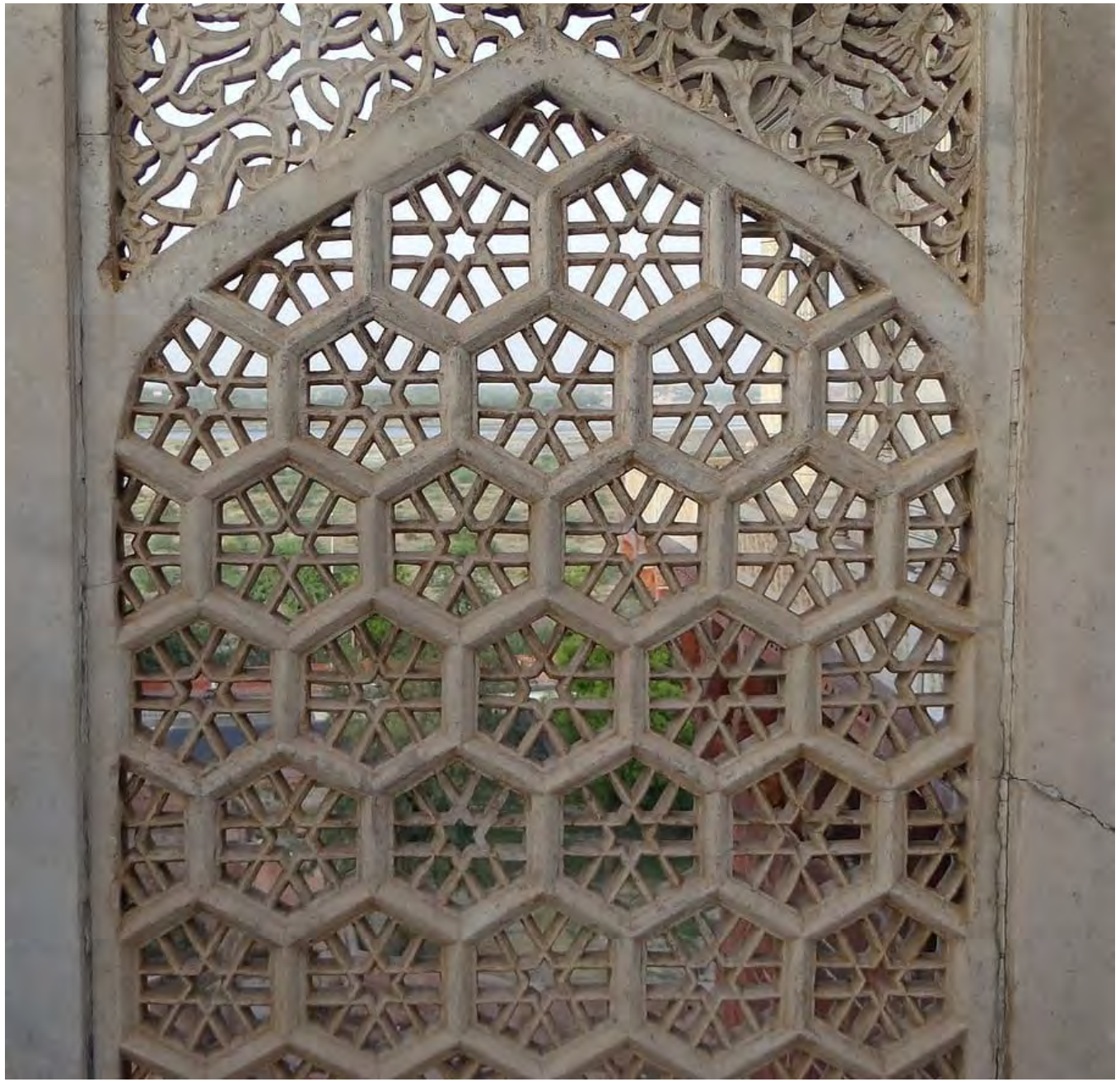
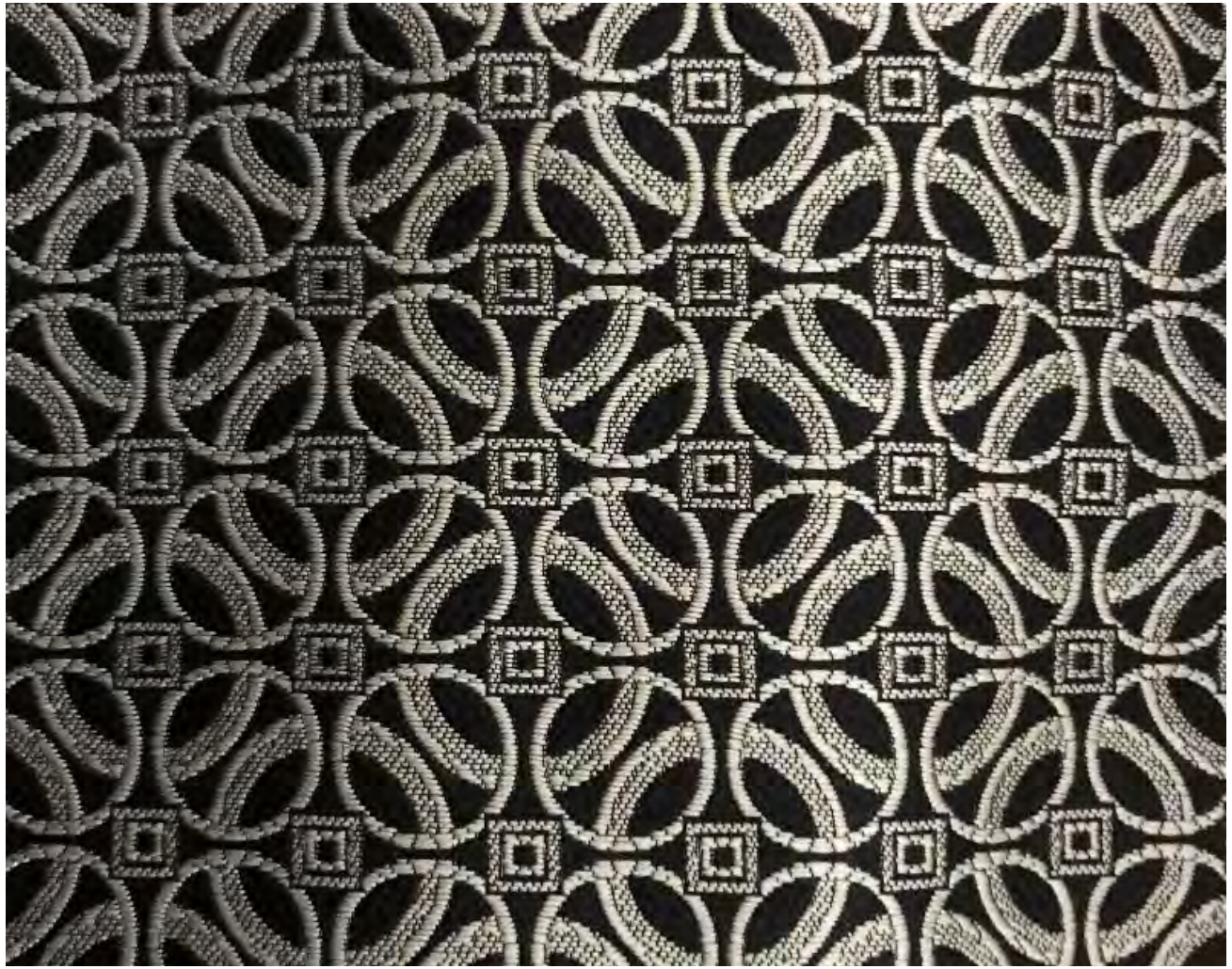
Lattice Patterns
in Ornamental Turning

Indian marble latticework

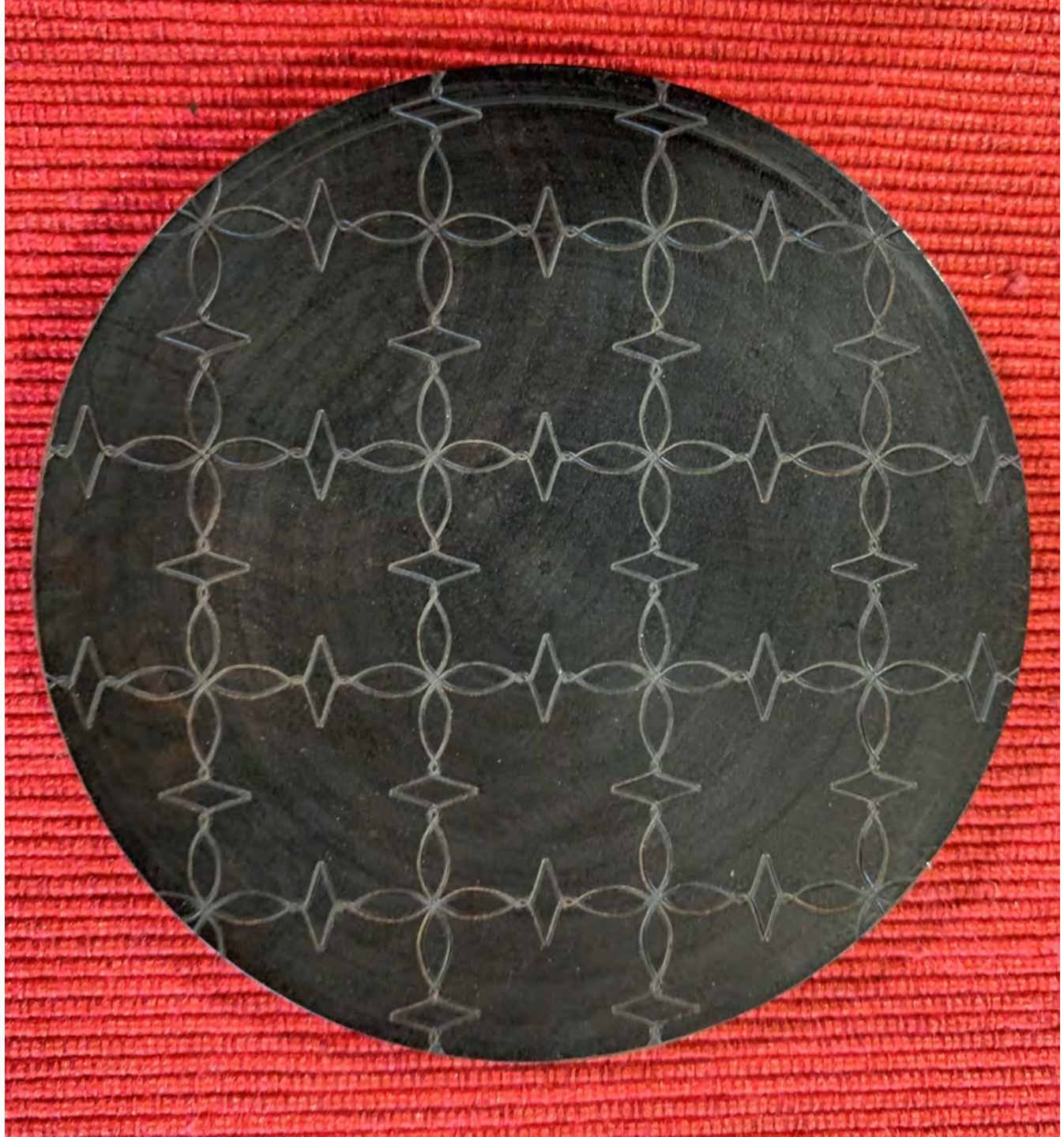


Antique quilt

Arthur’s waistcoat
(that dapper devil!)



Rectangular lattice pattern using an Archie 4 rosette

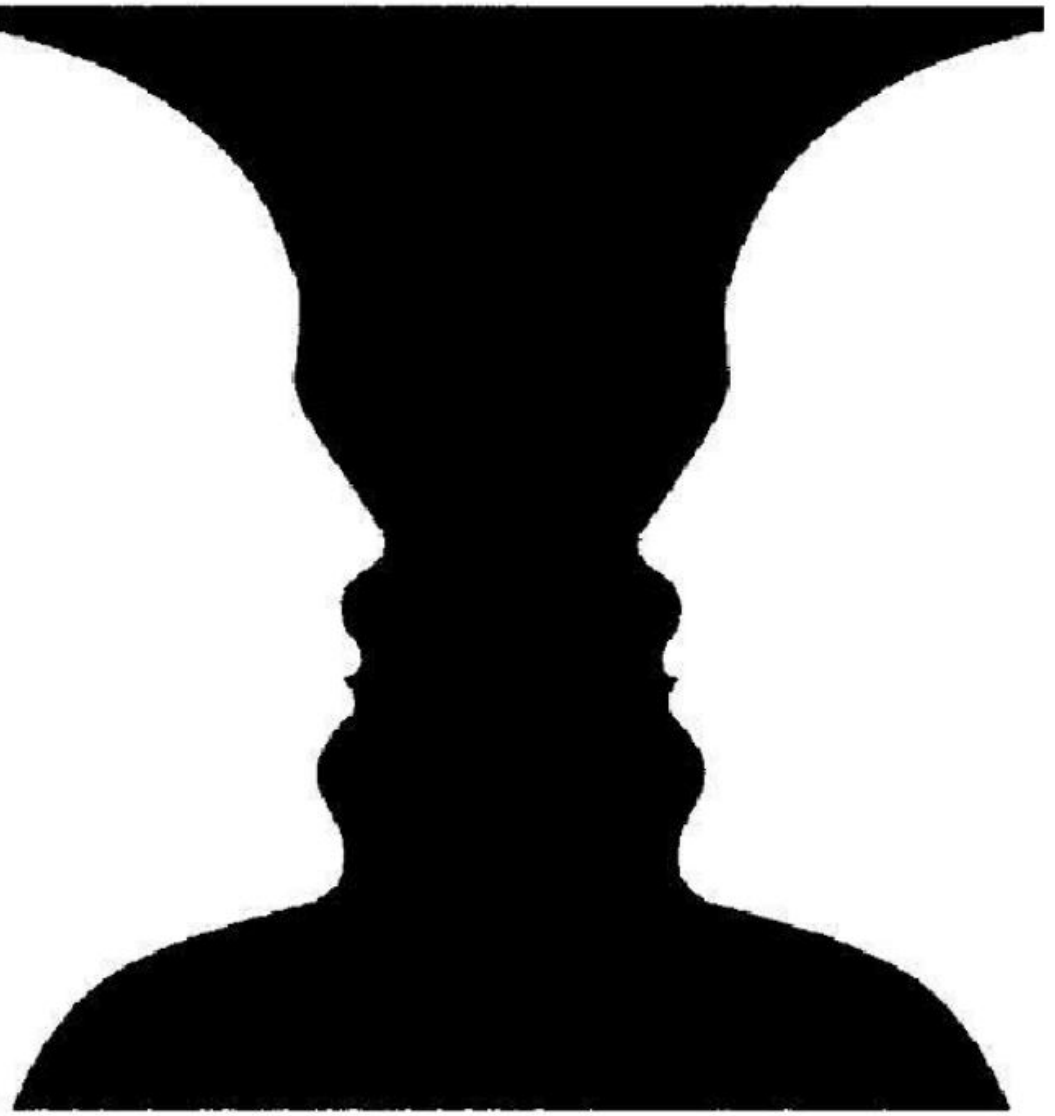


Lattice Pattern in Ornamental Turning

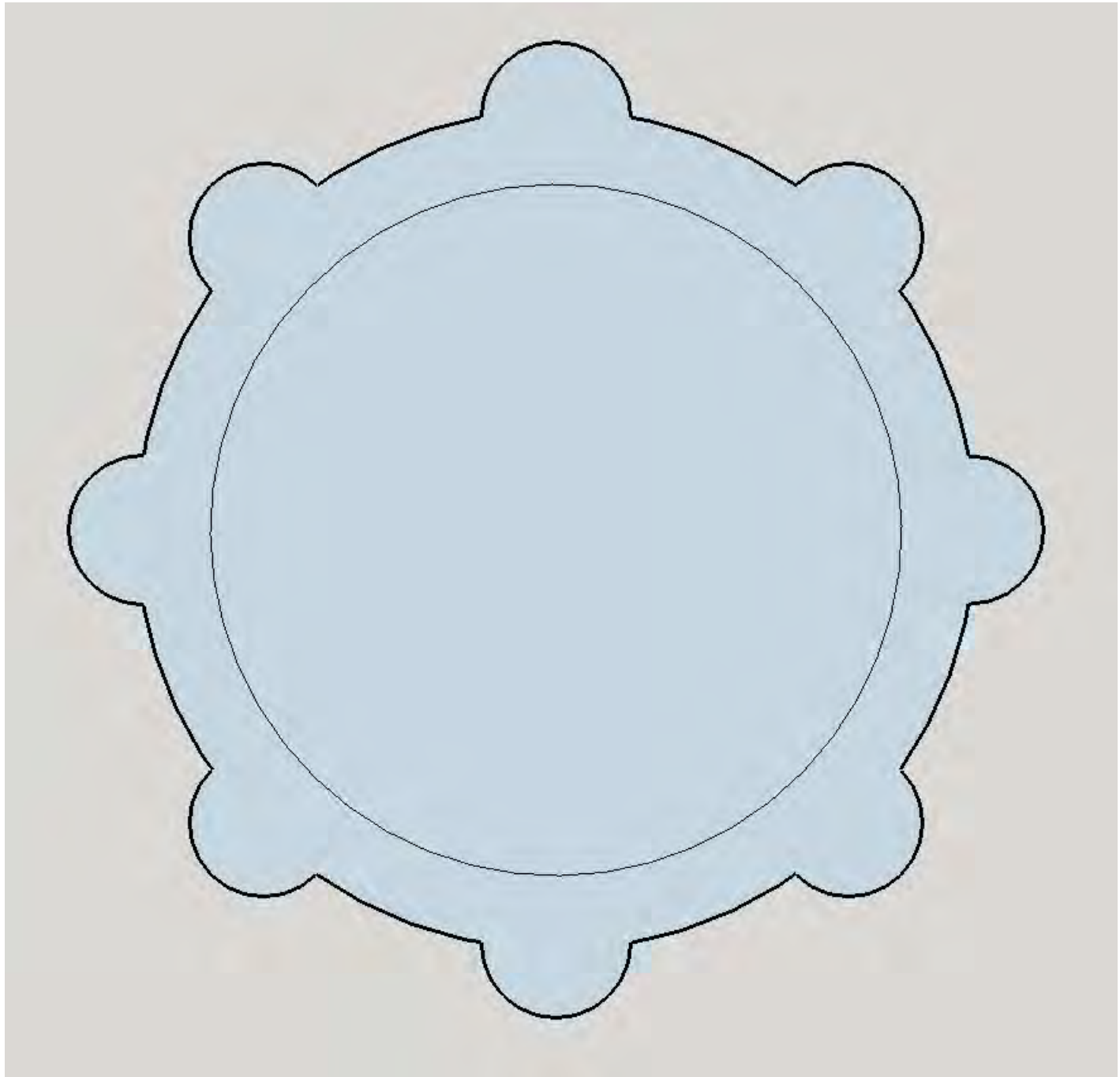
- A pattern of overlapping rosette profiles in a rectangular or hexagonal (honeycomb) array
- Technique developed by Christian Lindow at the Plumier Foundation
- Not aware of any similar ornamental turning work done in the past

Optical Illusion

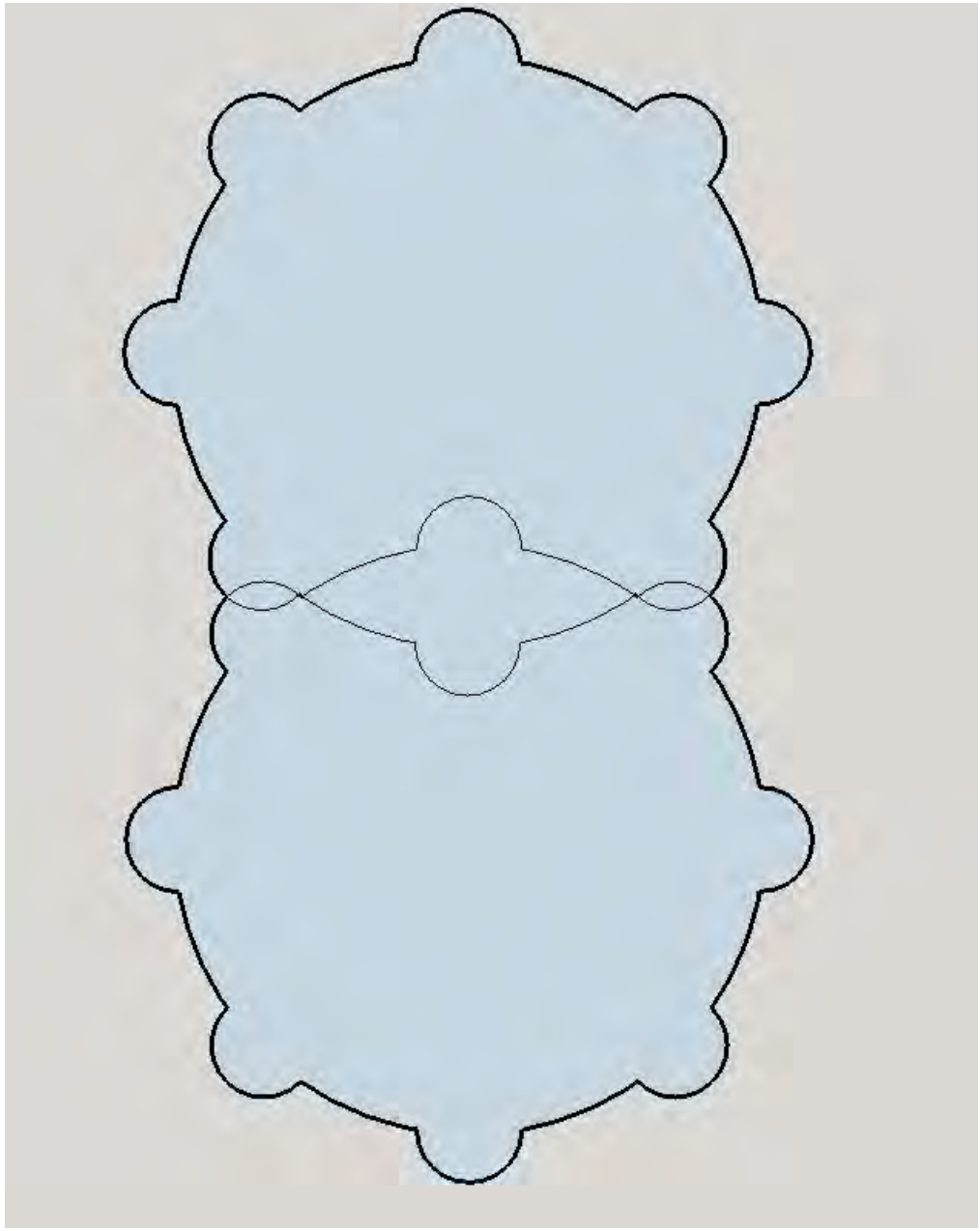
Rosette profiles disappear and a new pattern emerges



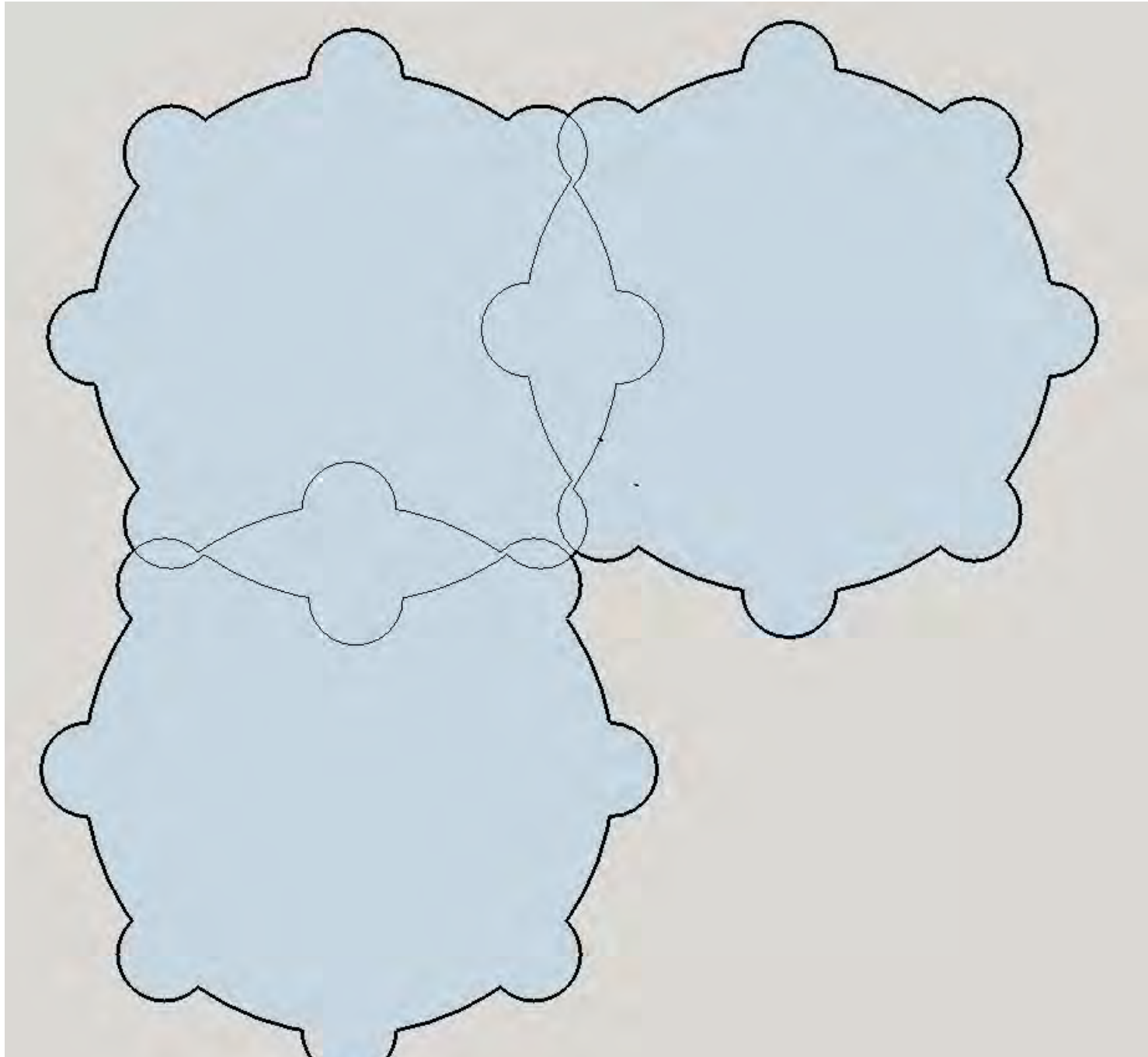
A Simple 8-lobe Rosette



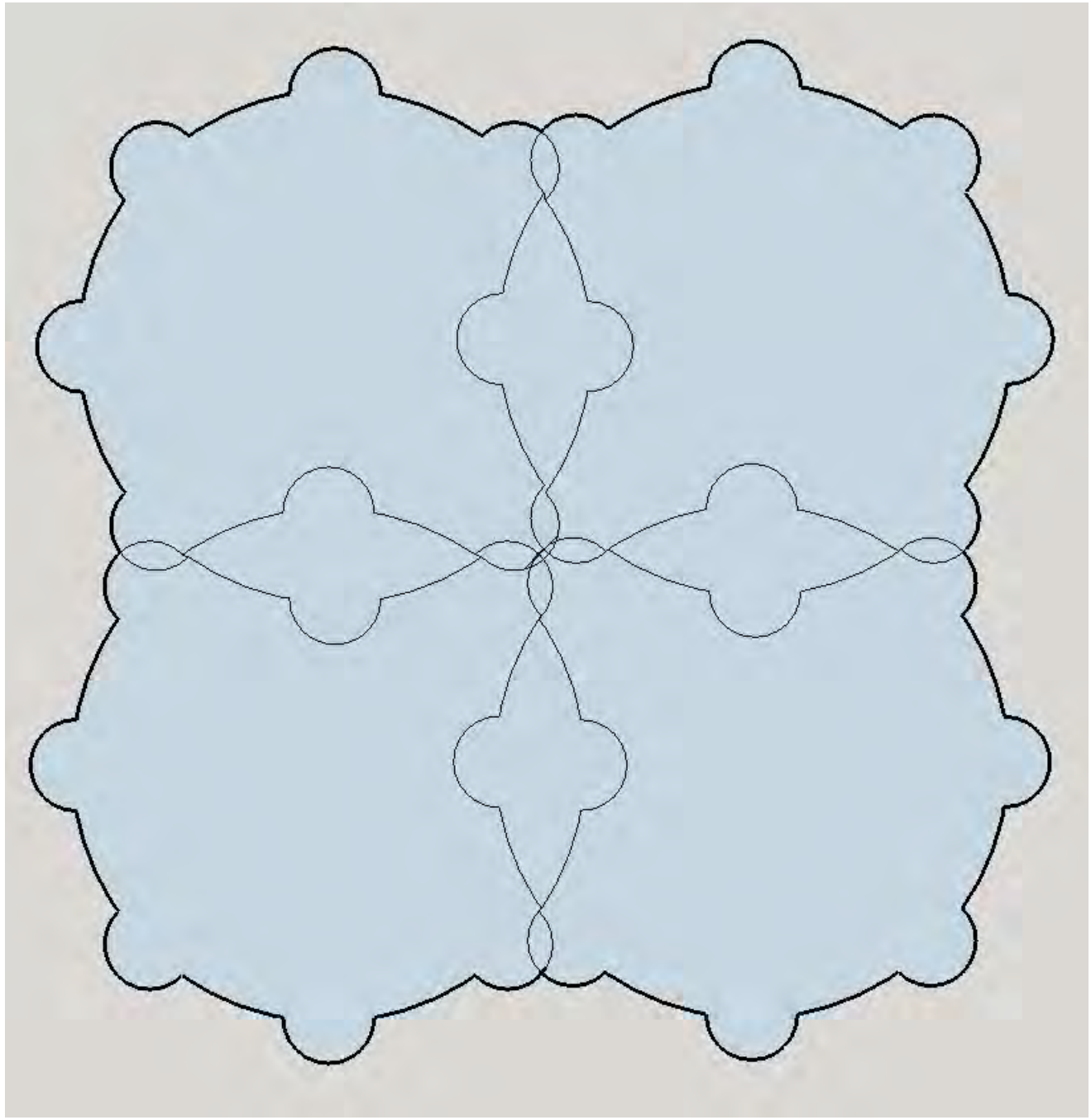
A pair of overlapping rosettes



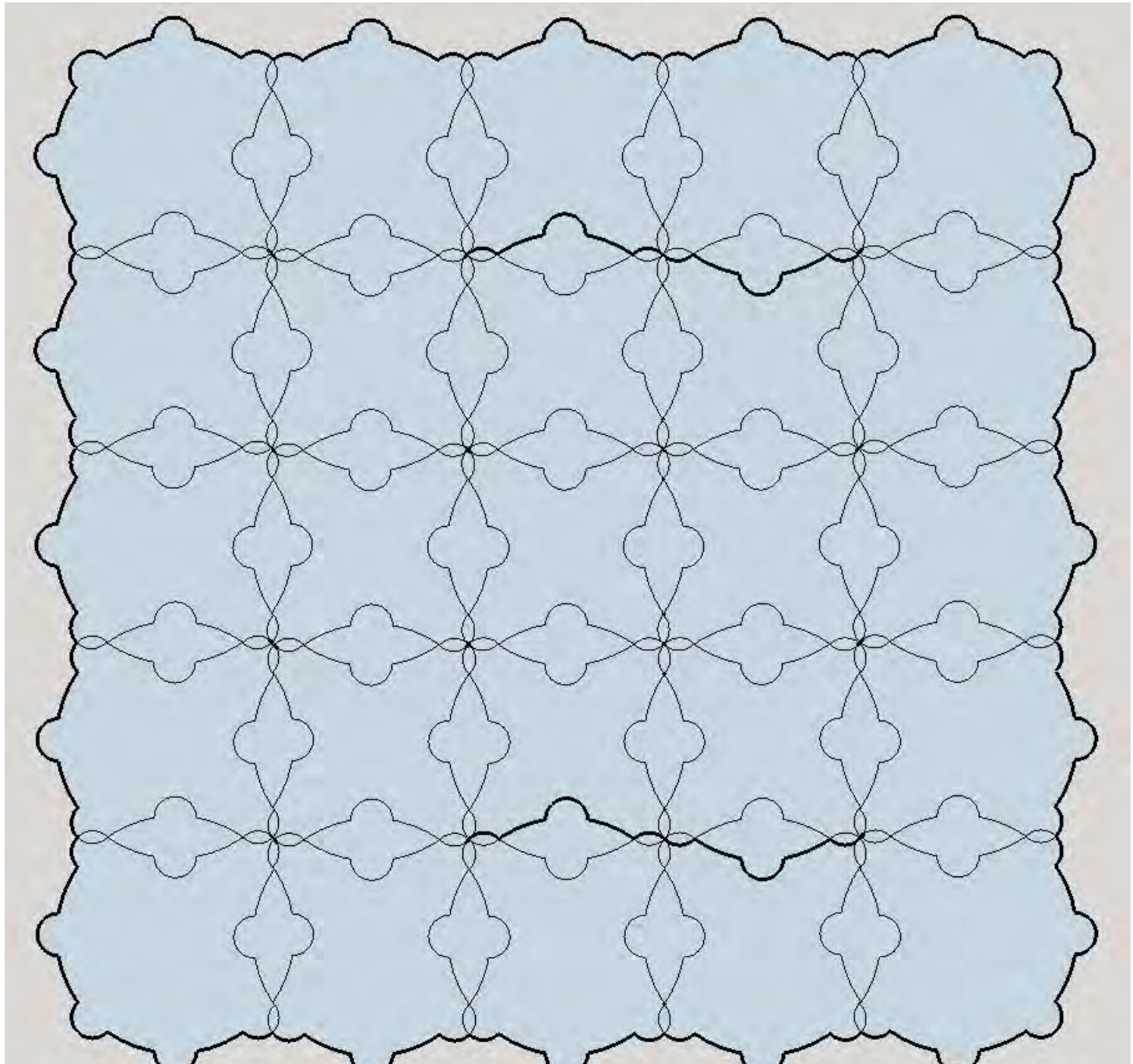
Adding a third rosette



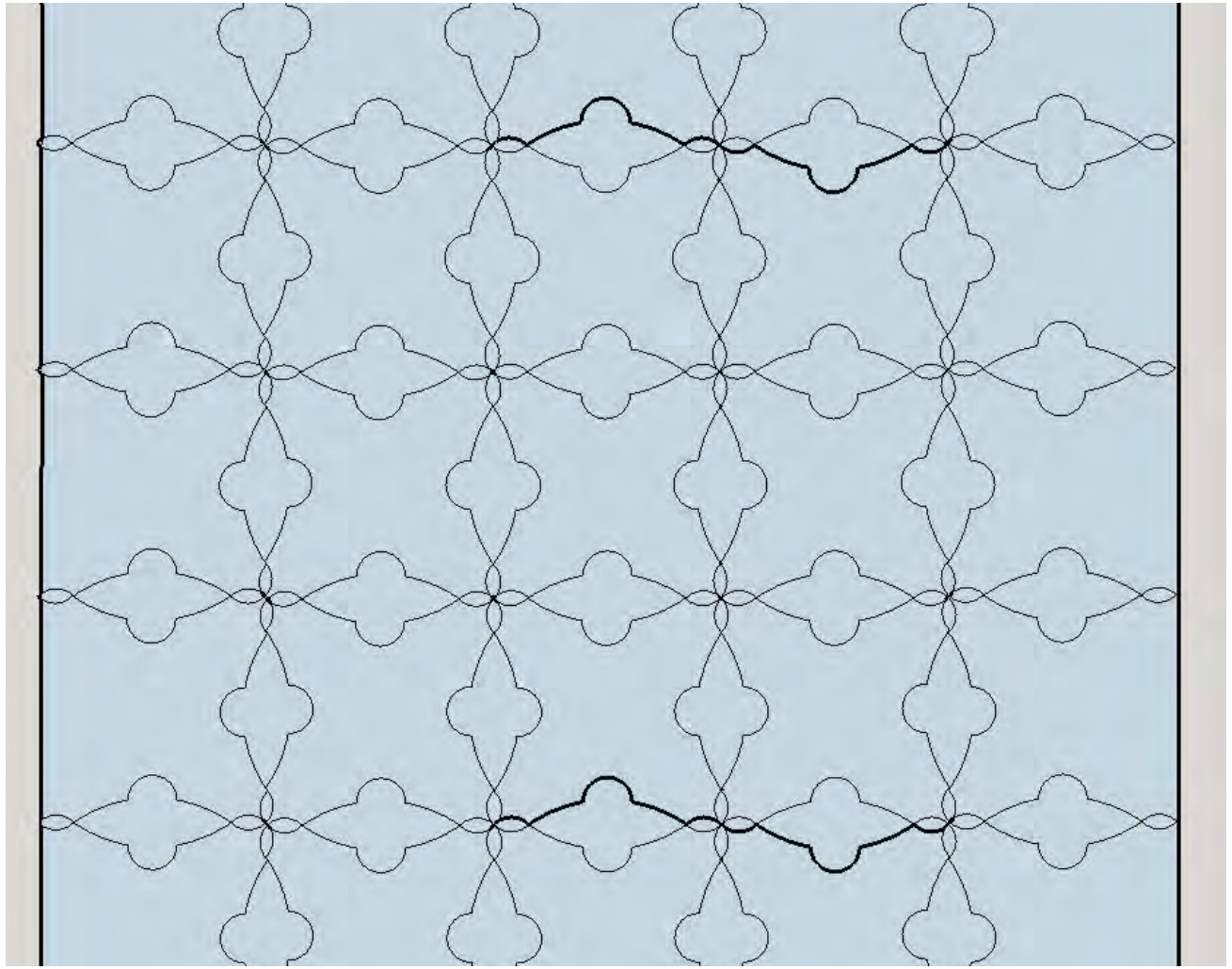
And now the fourth rosette



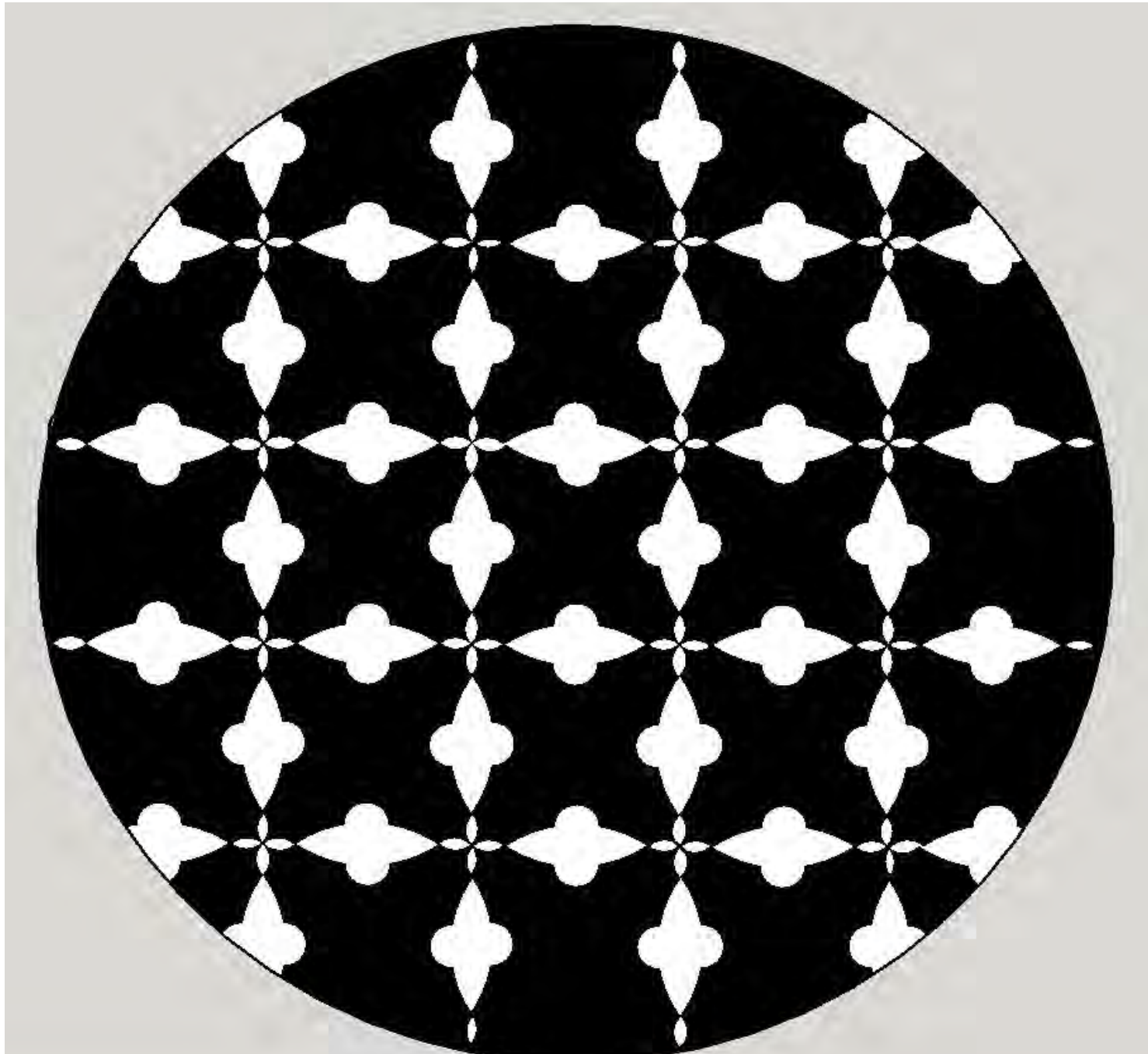
A 5 x 5 rectangular array



Edges of the array trimmed off

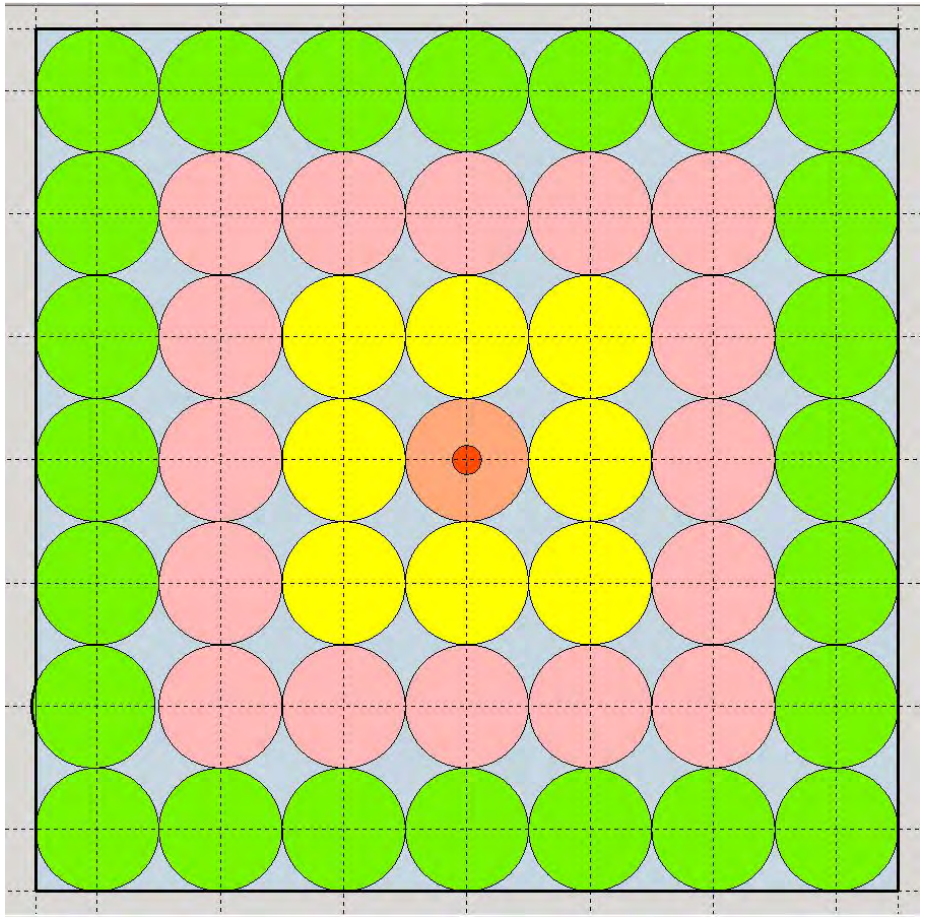


A round excerpt from the array in contrasting colors



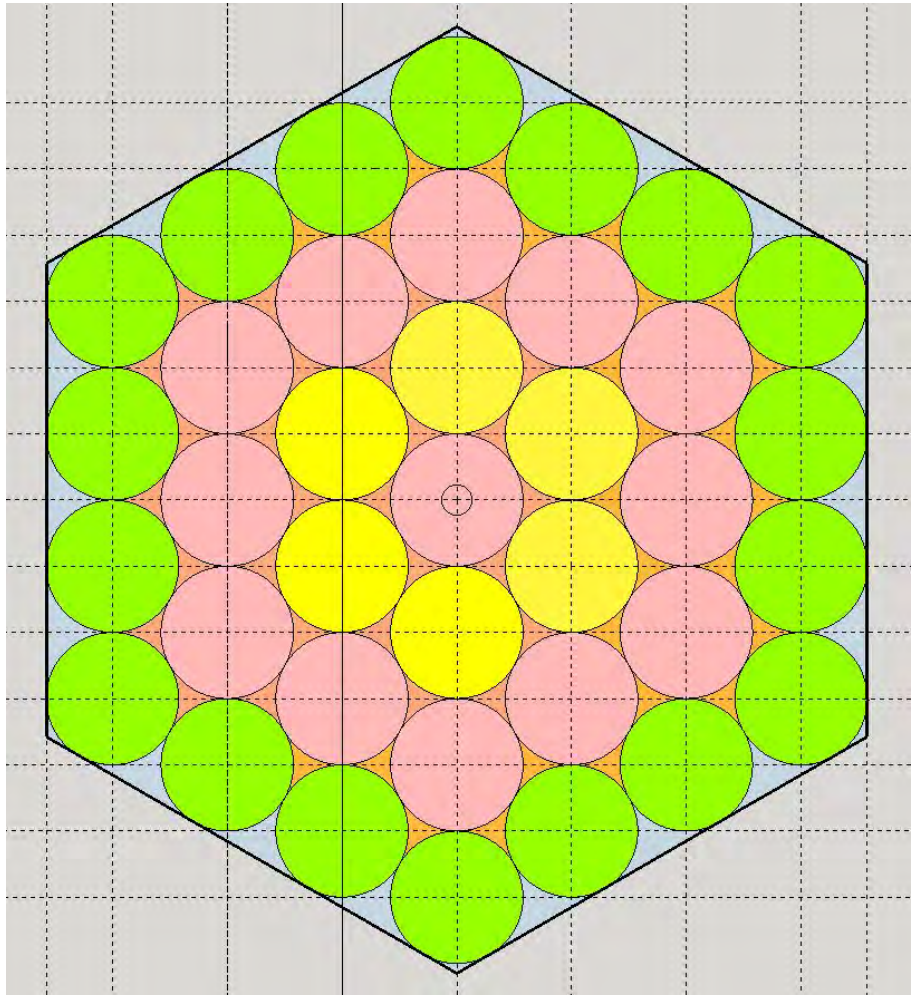
Rectangular array – basic form

- Map for rectangular lattice pattern
- Rows of base circles around a central base circle
- Centers of base circles will be the centers of overlapping rosette profiles
- Base circles don’t appear in lattice pattern



Hexagonal array – basic form

Rows of base circles surrounding central circle to form a hexagonal "honeycomb" pattern

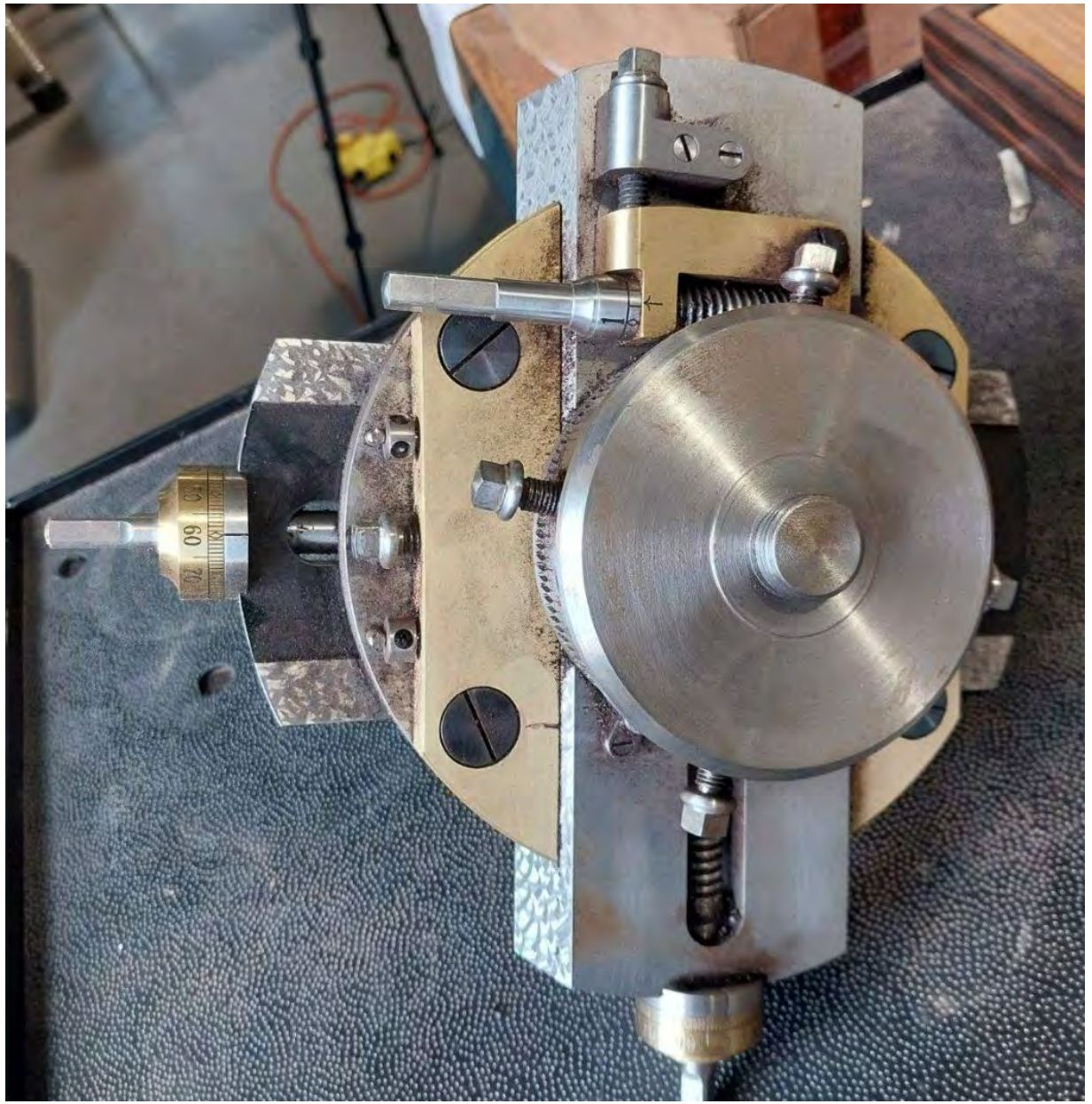


The Challenge

- Create a regular pattern using overlapping copies of a single rosette profile
- Determine the appropriate size and density of the lattice pattern
- Calculate the correct geometric relationships among the rosette profiles in the pattern
- Maintain OT level of accuracy
- Accomplish the pattern with available OT equipment

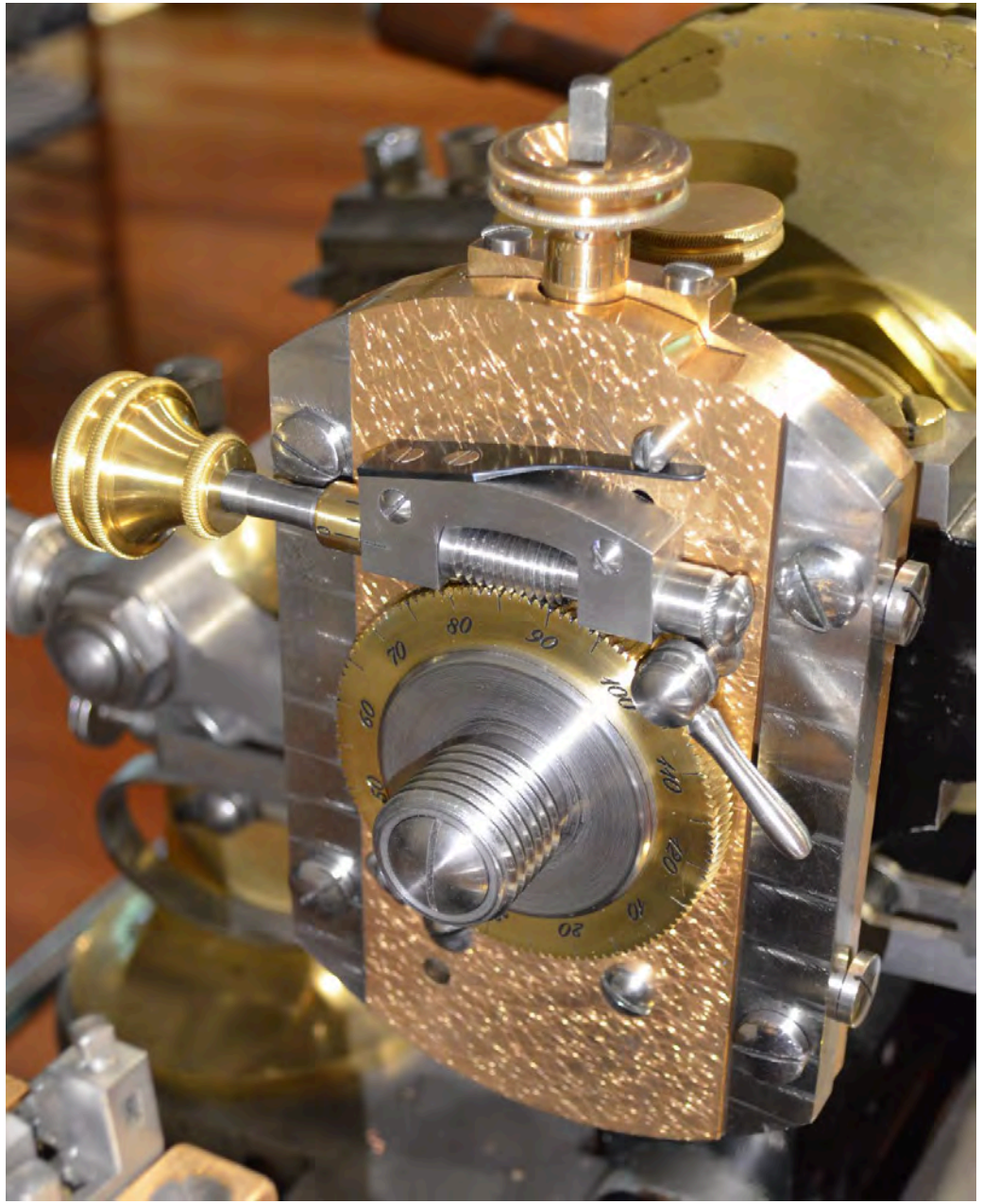
Christian's Double Eccentric Chuck

- Two slides capable of eccentric movement
- Christian uses a Cartesian (X and Y coordinates) approach to mapping the pattern elements
- A lovely, but somewhat rare piece of kit!



Plan B

- Traditional single slide eccentric chuck with a worm wheel on the nose for angular adjustments
- Can map base circle pattern using polar coordinates!



Required:

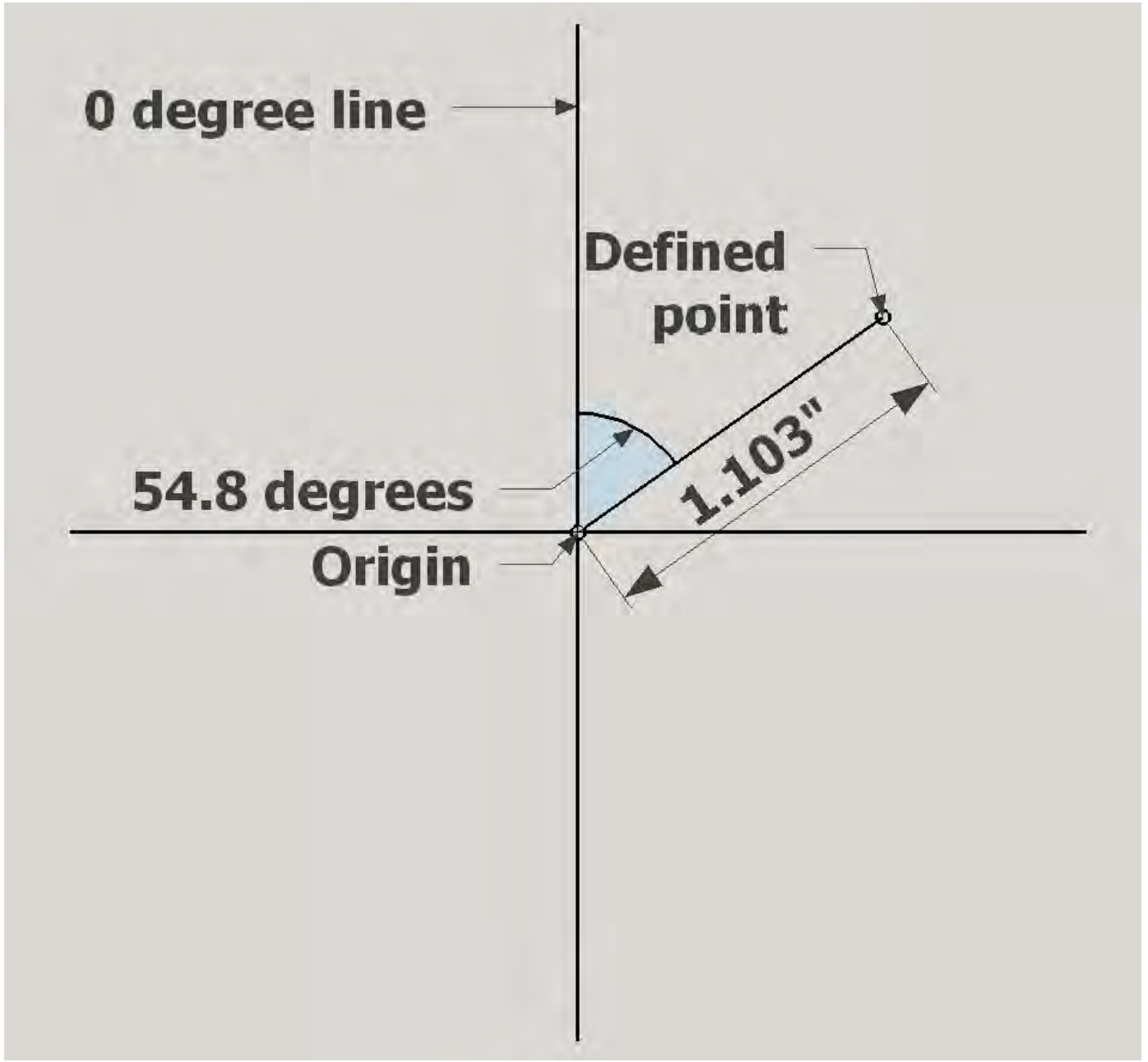
- Rosette with lobe count divisible by 4 (for rectangular pattern) or 6 (for hexagonal pattern)
- Eccentric chuck with worm wheel
- Worm wheel for phasing rosette barrel
- Tool slide

Polar Coordinates

Locate point (the base circle center) by:

1. Setting angle from 0 degree line (use worm wheel on eccentric chuck)

2. Set distance from origin (use slide on eccentric chuck)

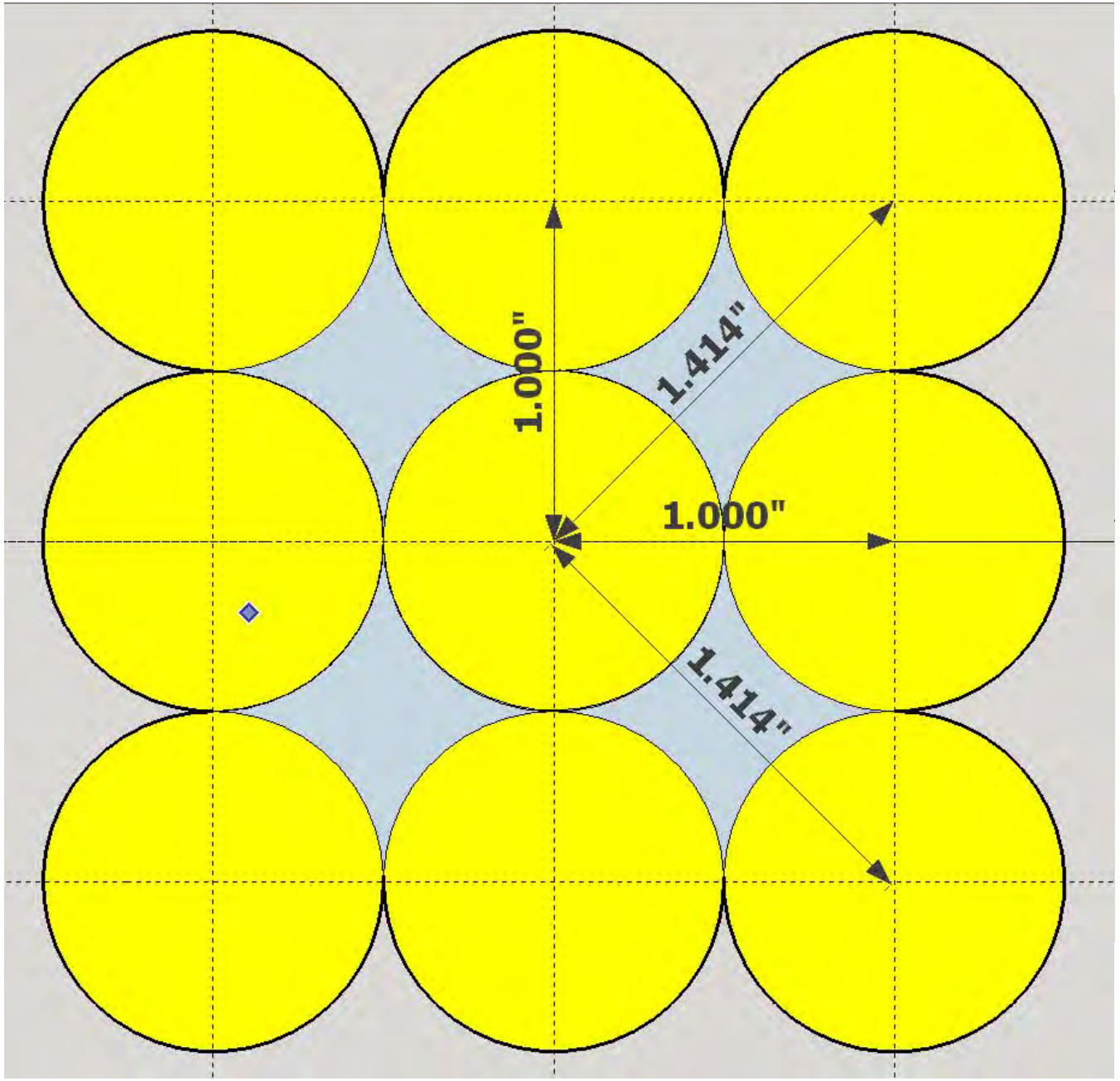


Polar Coordinates

Base Circle Dia.: 1.0

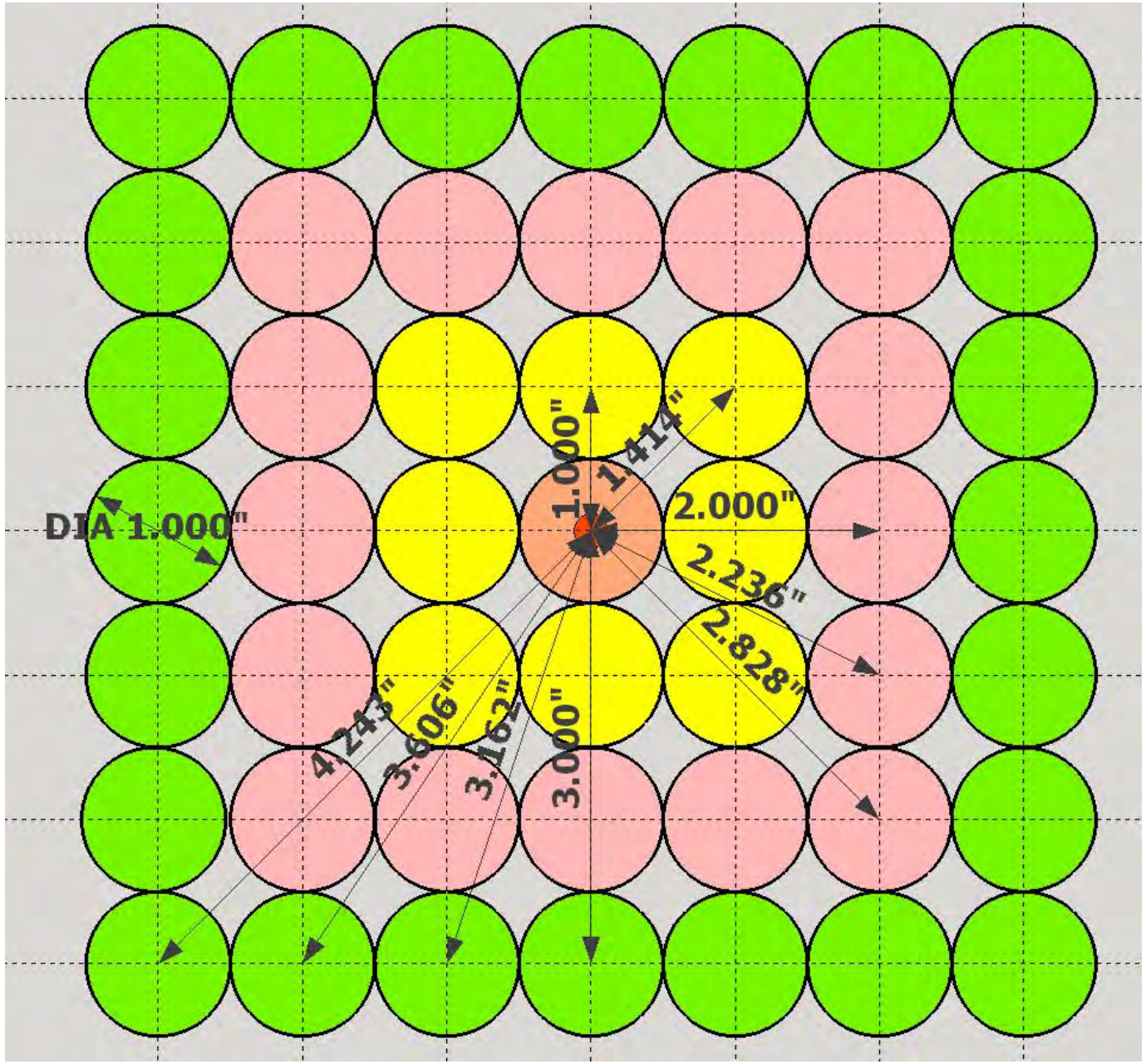
Tool Slide set at 0.500

Angular Settings	Eccentric Chuck Settings
0	1.000
45	1.414
90	1.000
135	1.414
180	1.000
225	1.414
270	1.000
315	1.414



Rectangular array with 3 Rows

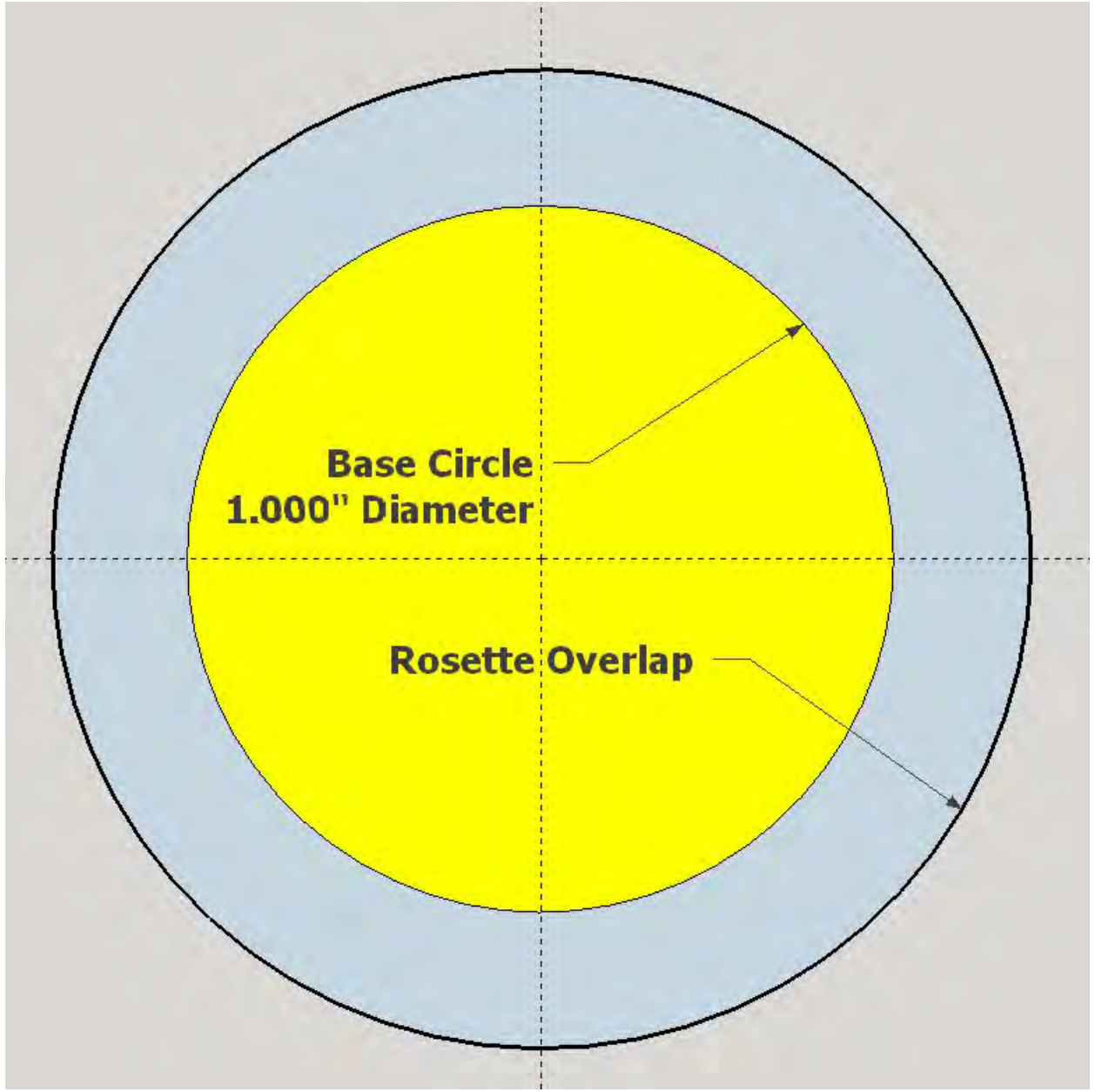
- Note repeating pattern of linear distances occurring in each row
- All angles easily calculated using simple trigonometry
- Use linear distances and related angles to map centers of base circles with polar coordinate approach
- Centers now established for rosette profiles



Single Base Circle

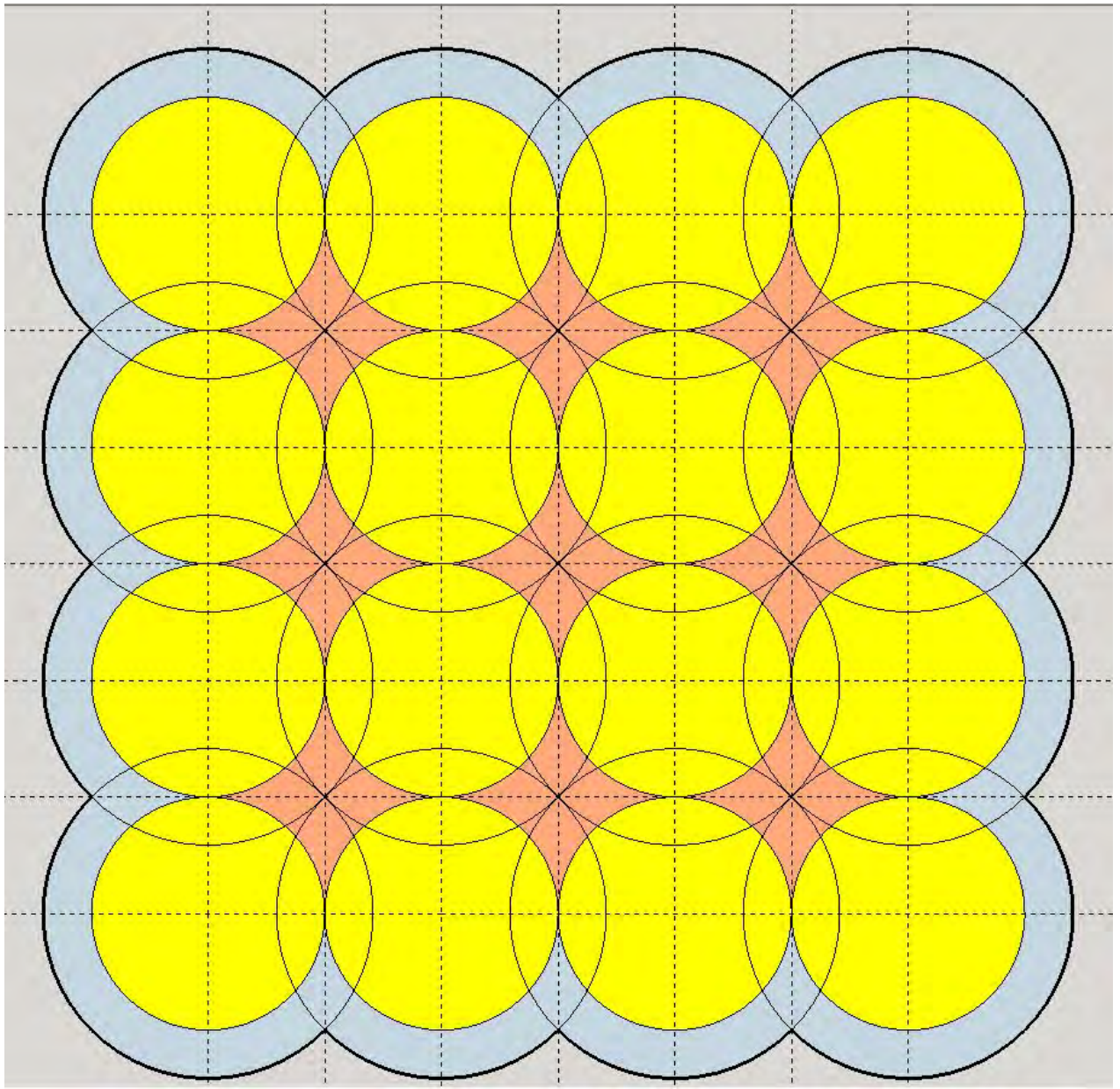
- Pattern density – wide open, tightly detailed, or something in between is determined largely by the size you select for the base circle diameter.

- Need to decide how much the rosette profile will overlap the base circle



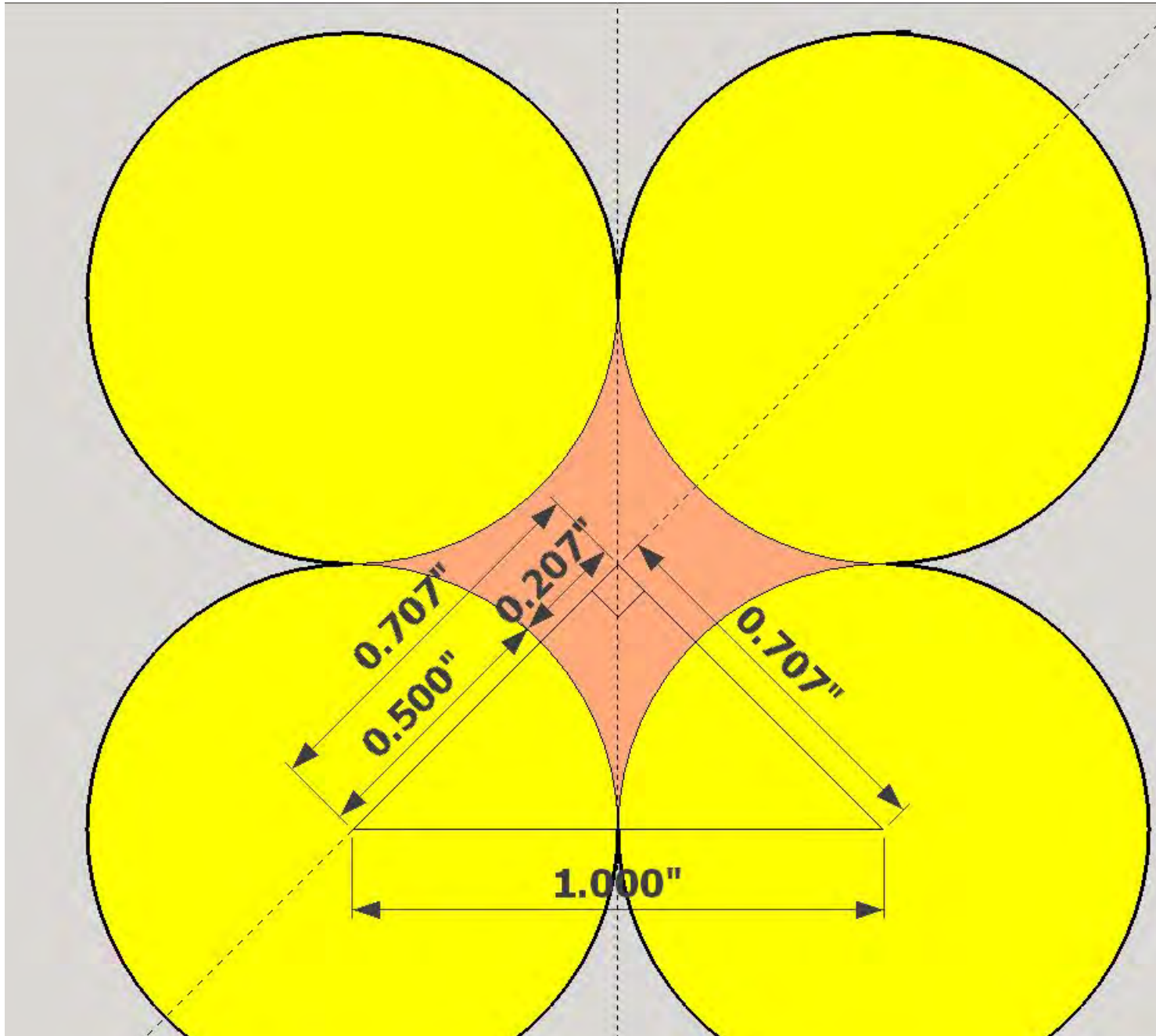
Points of Intersection

- Any amount of overlap can be used
- Amount of rosette profile overlap is suggested by base circle size

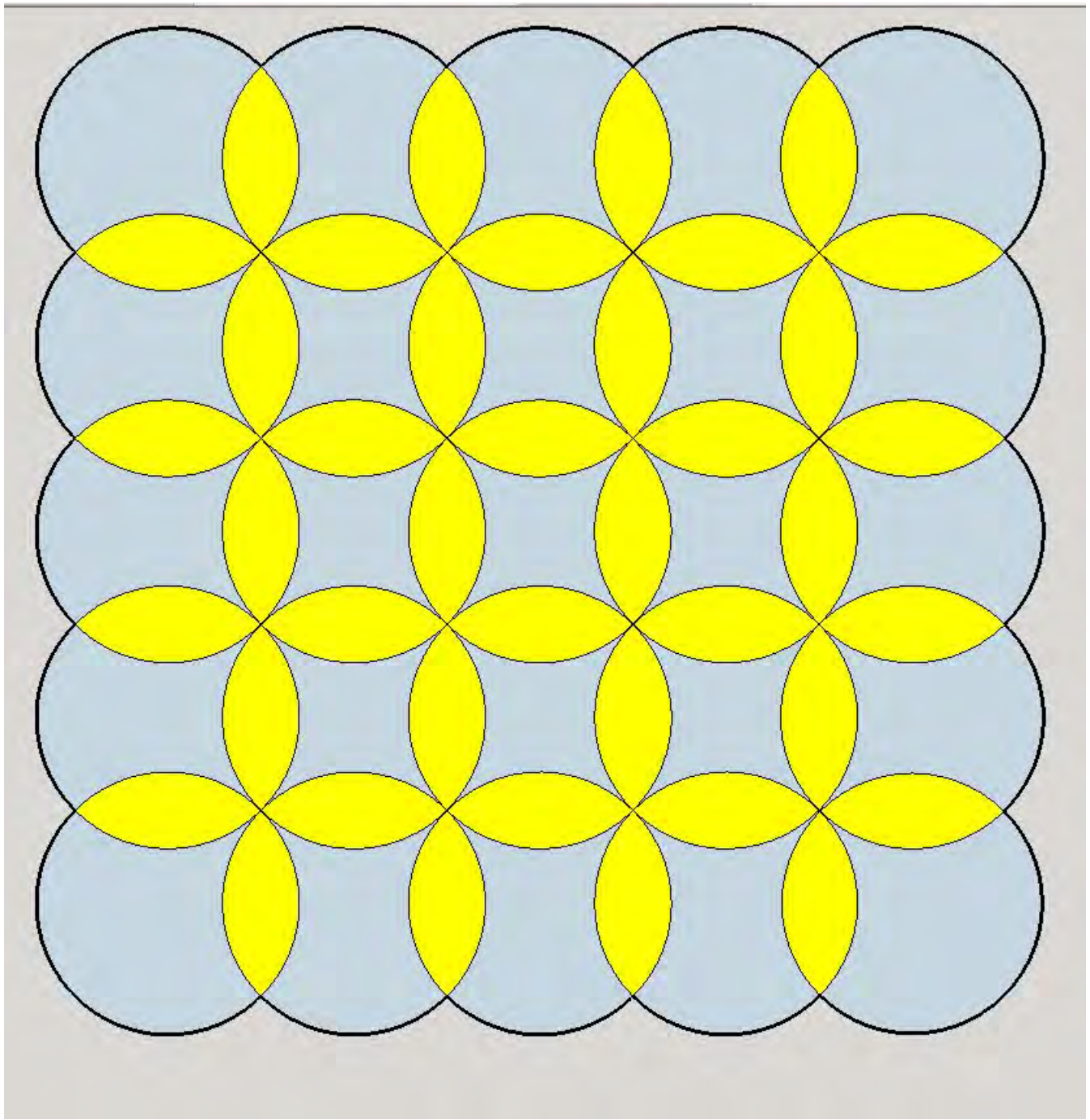


Calculation of Tool Slide Setting for <u>Rectangular array</u>

- Objective: Rosettes overlapping the base circles and intersecting at the center of the open space in the pattern.
- It’s not required that the intersection of the rosettes be where shown, but the distance to the center of the void is a logical place to try the first tool slide setting.



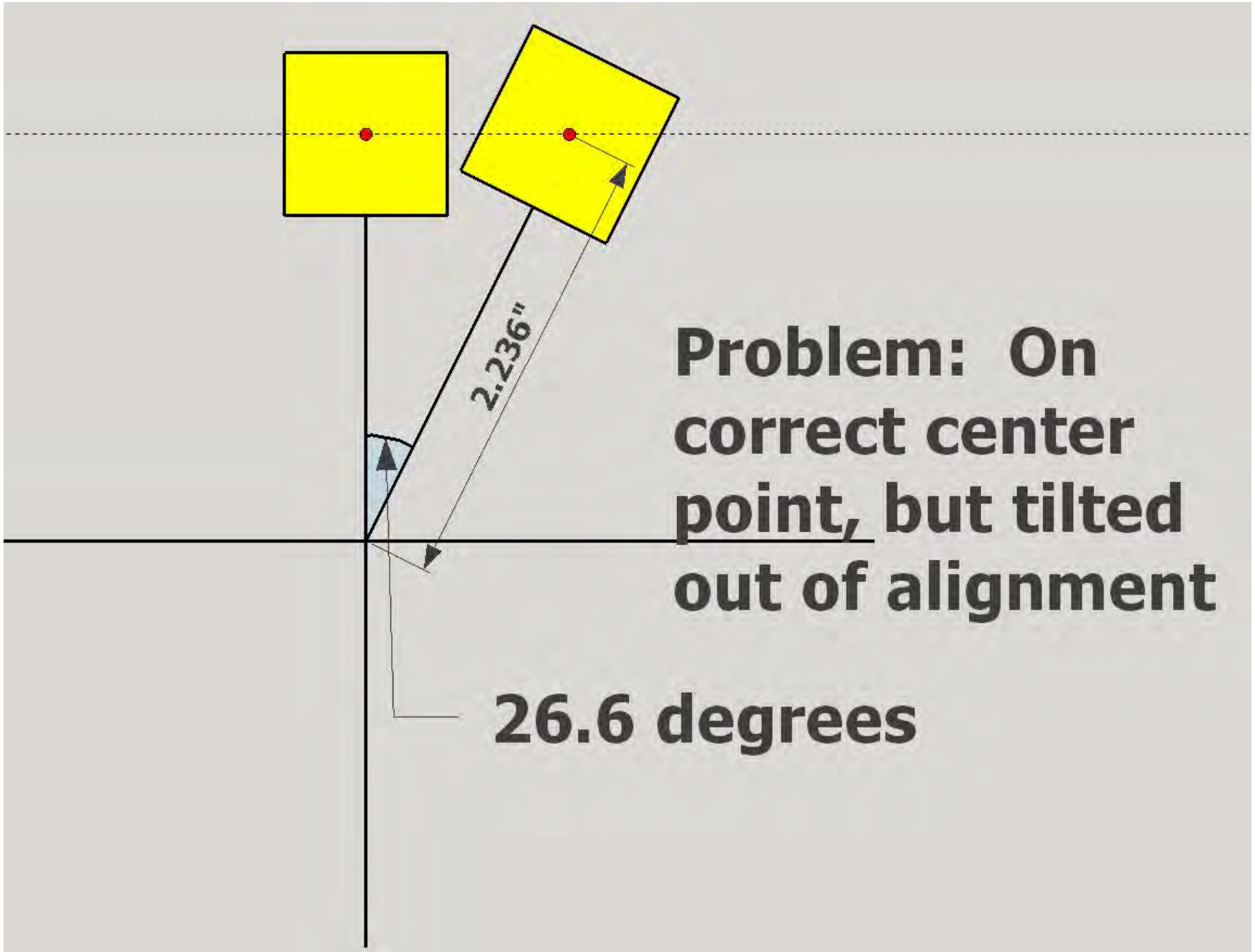
When your rosette is a simple circle with no lobes, the pattern of intersections would look like this.



Initial positioning of the rosette

Touch needs to be on a high point of the rosette profile

Set chuck level to lathe bed, then adjust rosette/touch relationship using worm on rosette barrel


2.236"
Problem: On correct center point, but tilted out of alignment
26.6 degrees

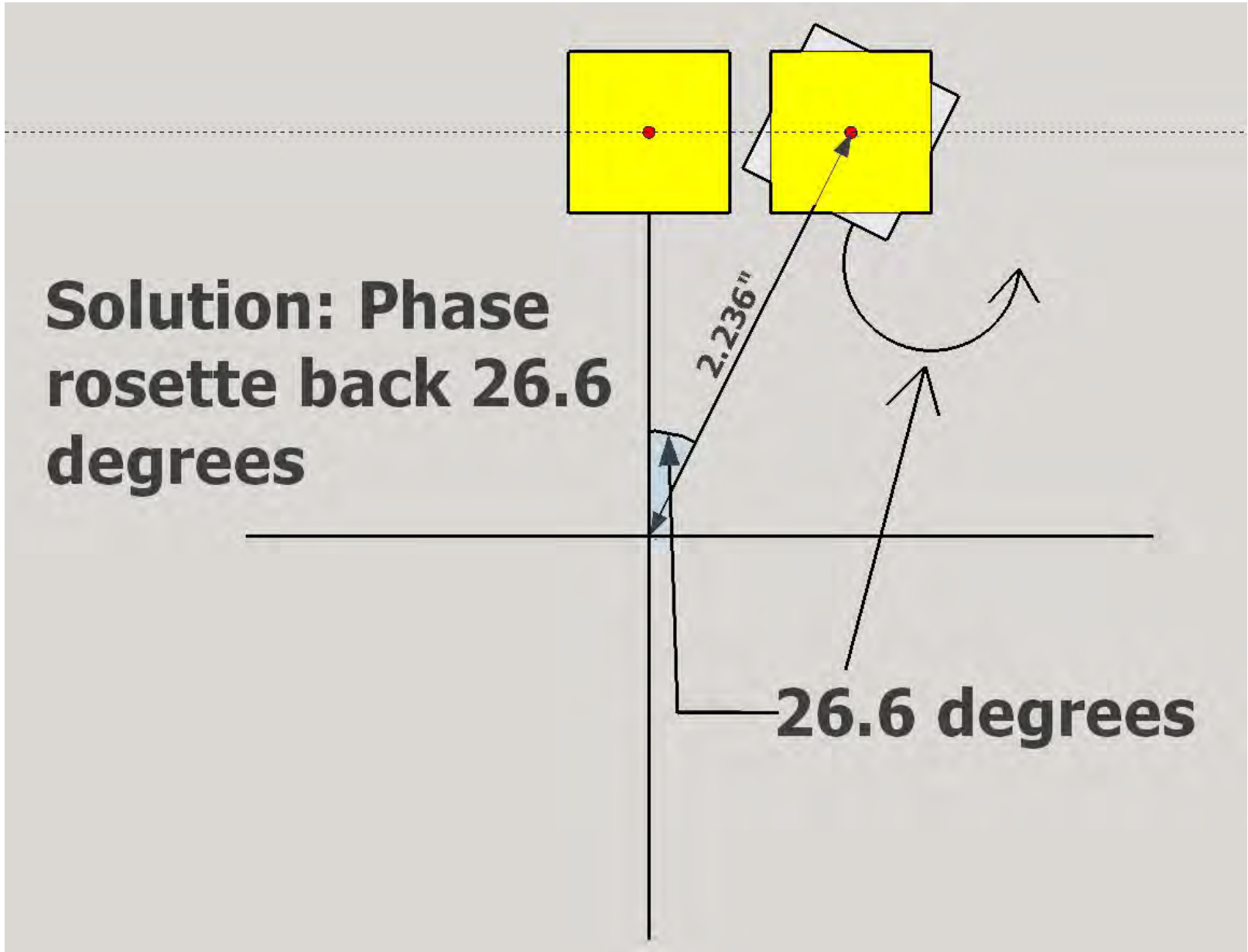
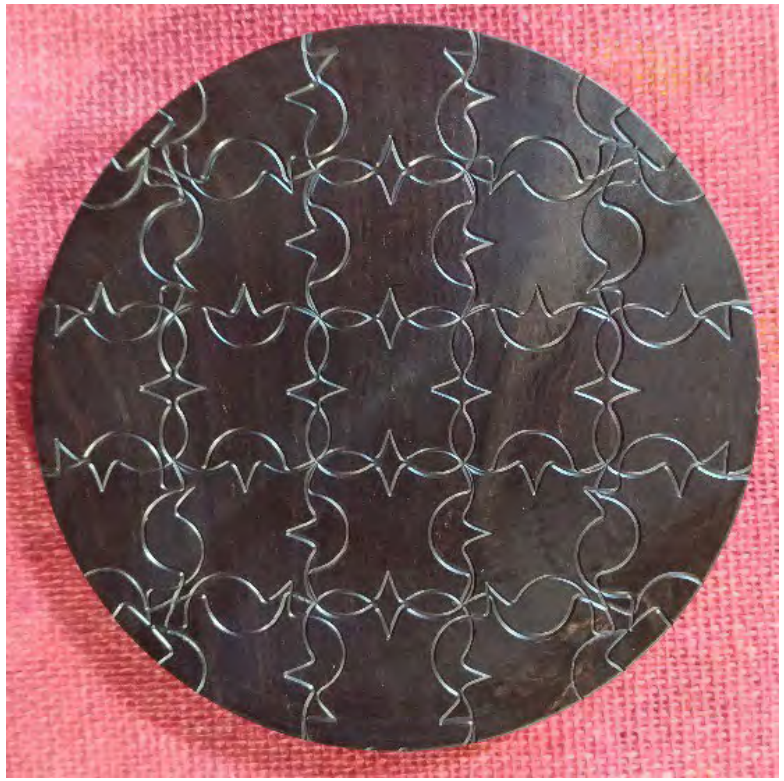
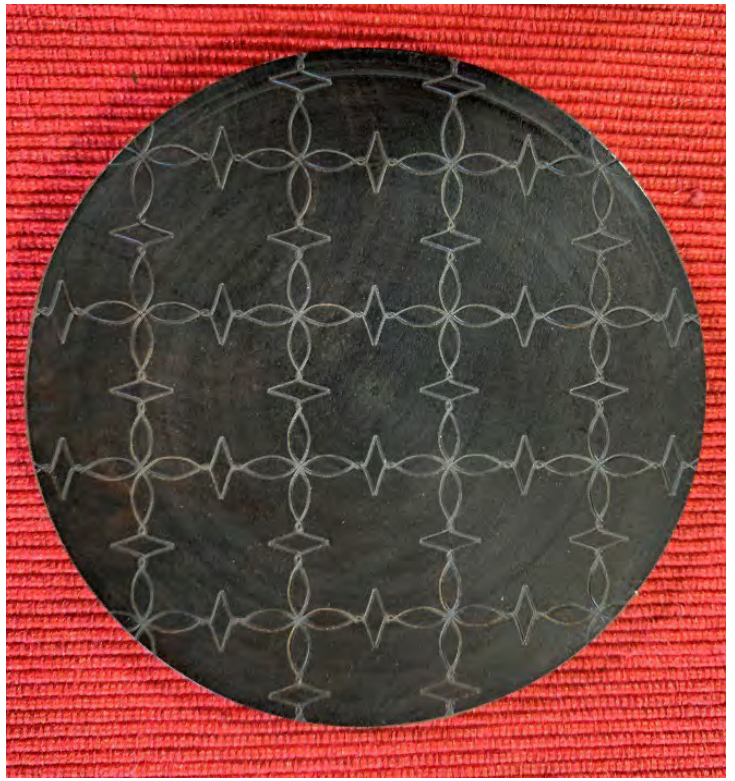

Solution: Phase rosette back 26.6 degrees
2.236"
26.6 degrees

Illustration of Angular Adjustments

Uncompensated



Compensated



Steps

- Center tool, then set radius of rosette profile on tool slide (this setting does not change)
- With chuck level to lathe bed, use rosette worm wheel to set touch on high point of rosette profile.

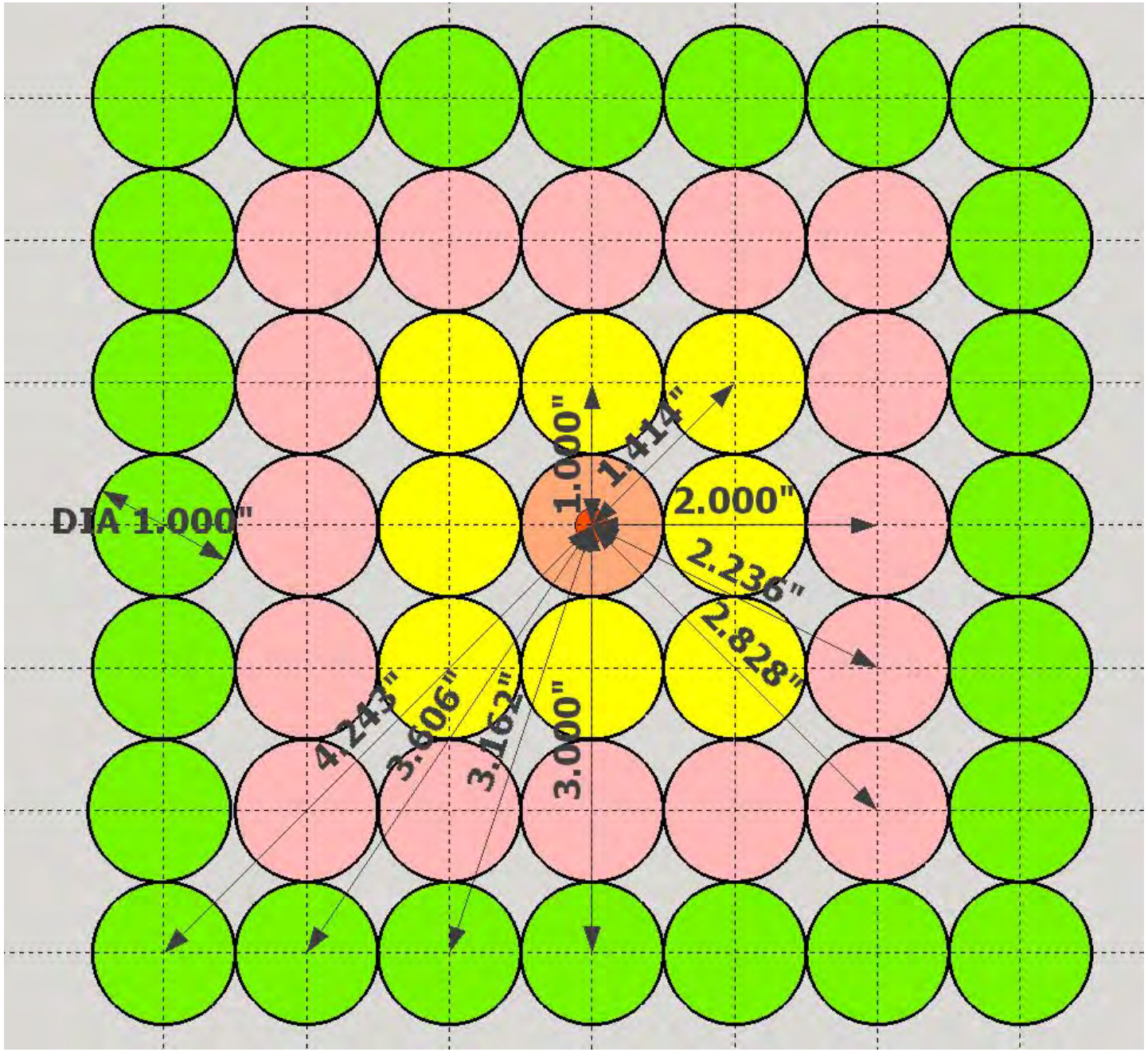
1. Set eccentricity on chuck slide, per table.

2. Set angle with worm on chuck spindle nose, per table.

3. Phase rosette an equal angle in opposite direction, per table.

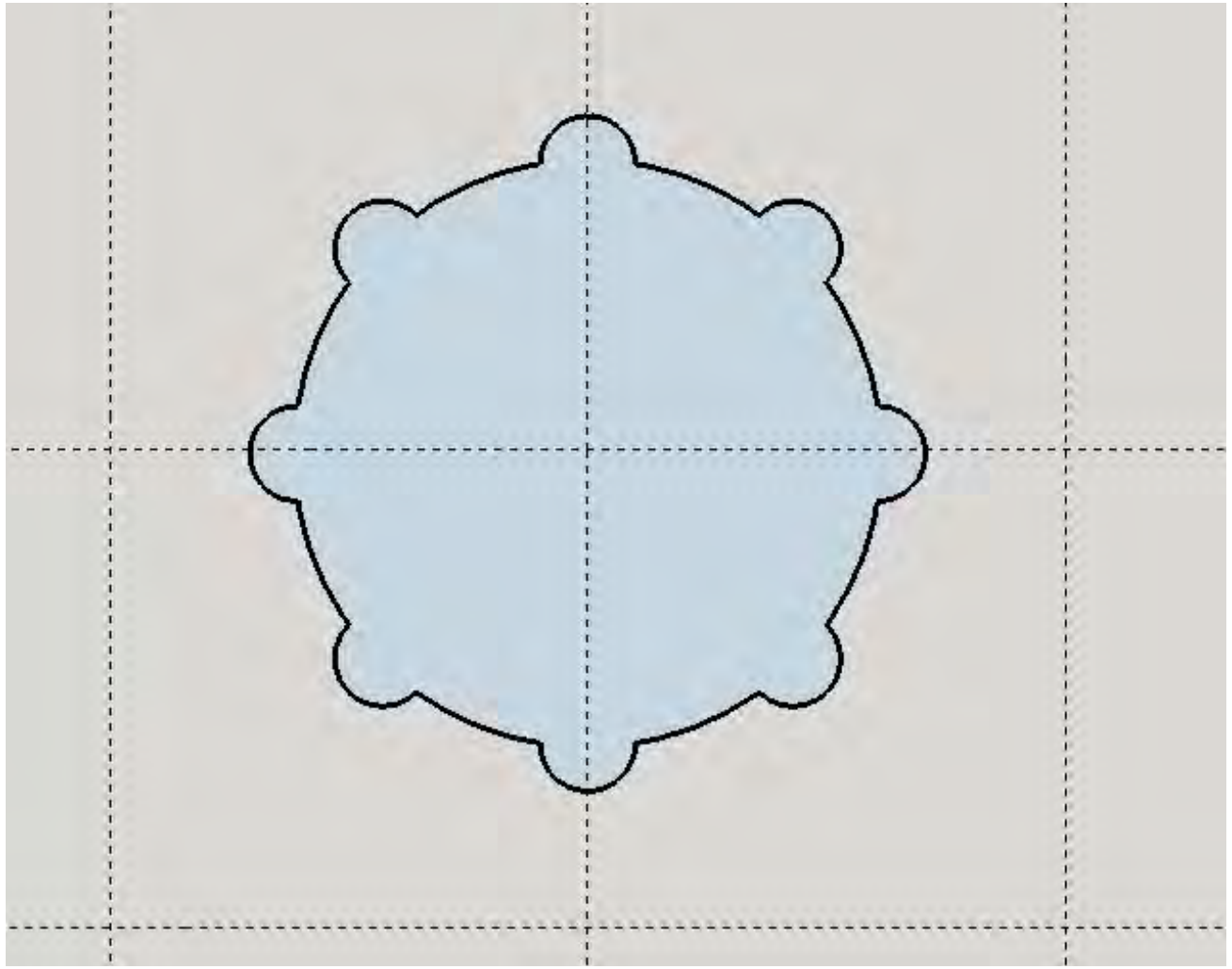
Rectangular array

Settings for eccentric chuck slide



1st step

- Put tool on center
- Set tool slide to rosette radius of .707”
- Make first cut to establish center profile of array



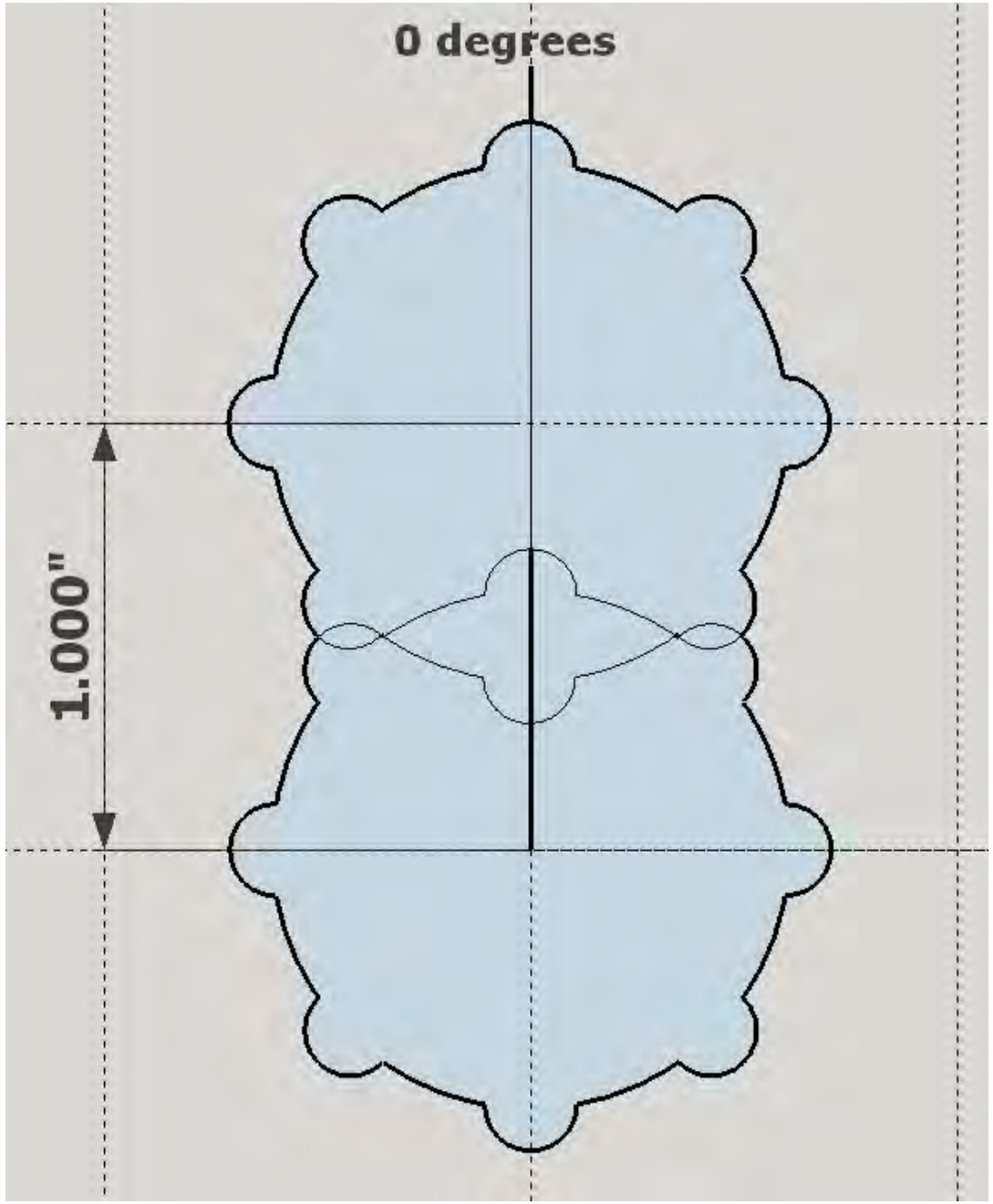
Row 1: For rectangular array with 1.000” diameter base circles, tool slide radius set to .707”

Eccentric Chuck Slide	Eccentric Chuck Worm Wheel	Worm Wheel On Barrel
1.000	0	0
1.414	45	-45
1.000	90	-90
1.414	135	-135
1.000	180	-180
1.414	225	-225
1.000	270	-270
1.414	315	-315

2nd Step

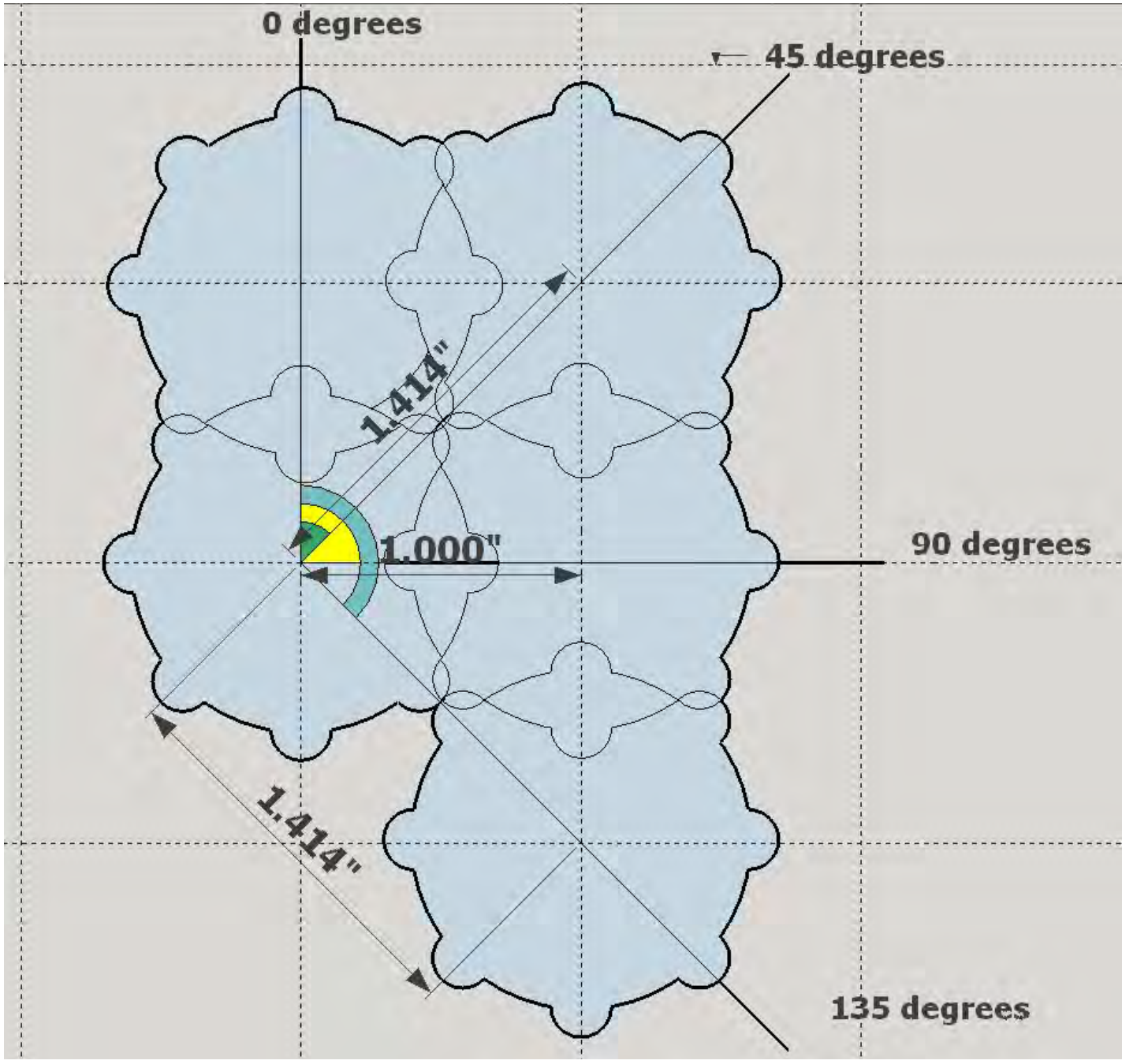
First table entry for Row 1 is 1.000” at 0º, so:

- Move eccentric chuck slide from 0 to 1.00”
- No change to angle settings

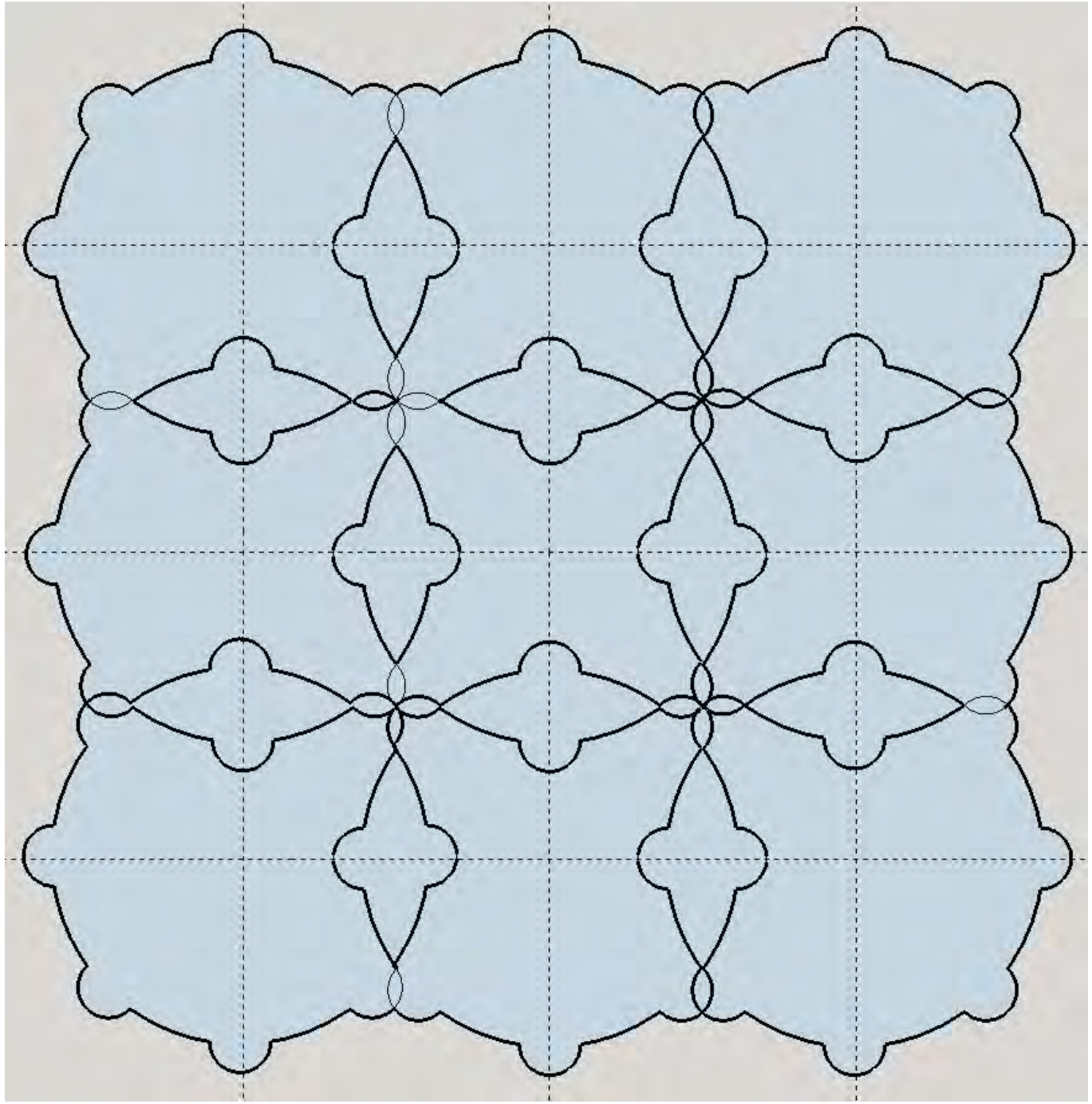


Next Steps

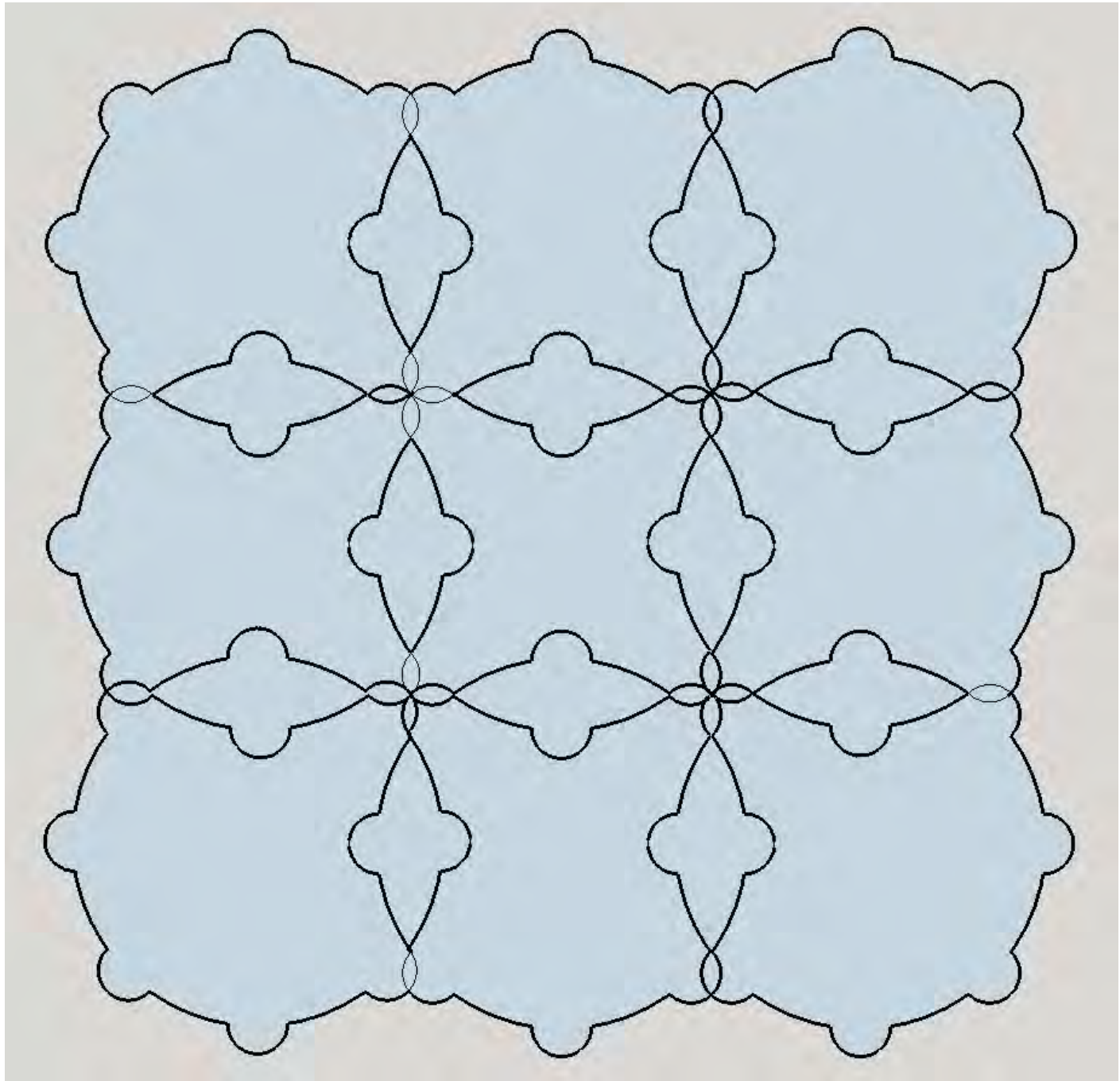
- A couple more iterations from the table show the pattern emerging.
- Note how the base circle centers (the grid) control the placement of the rosette profiles.



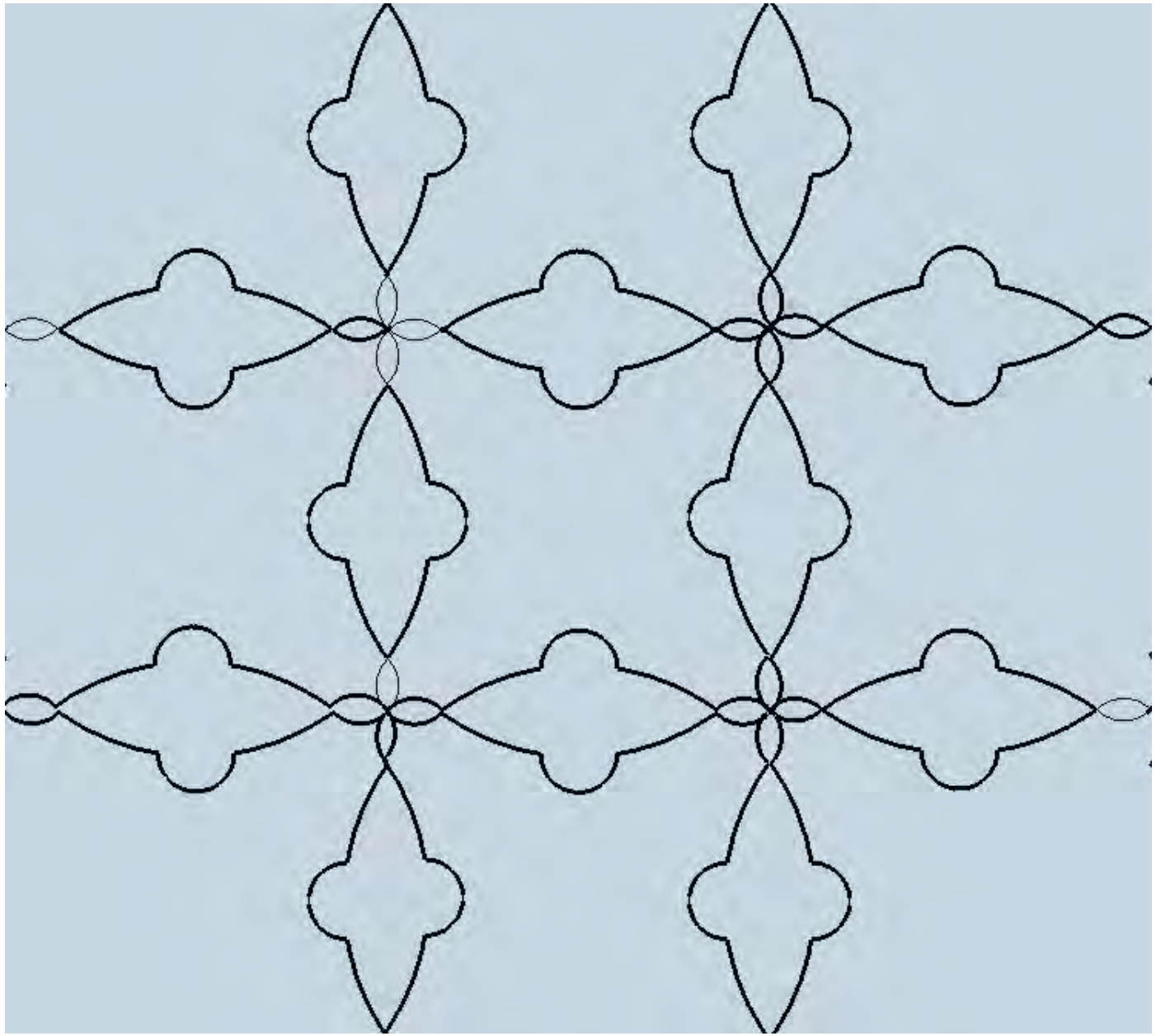
First row completed



First row with base circle grid removed

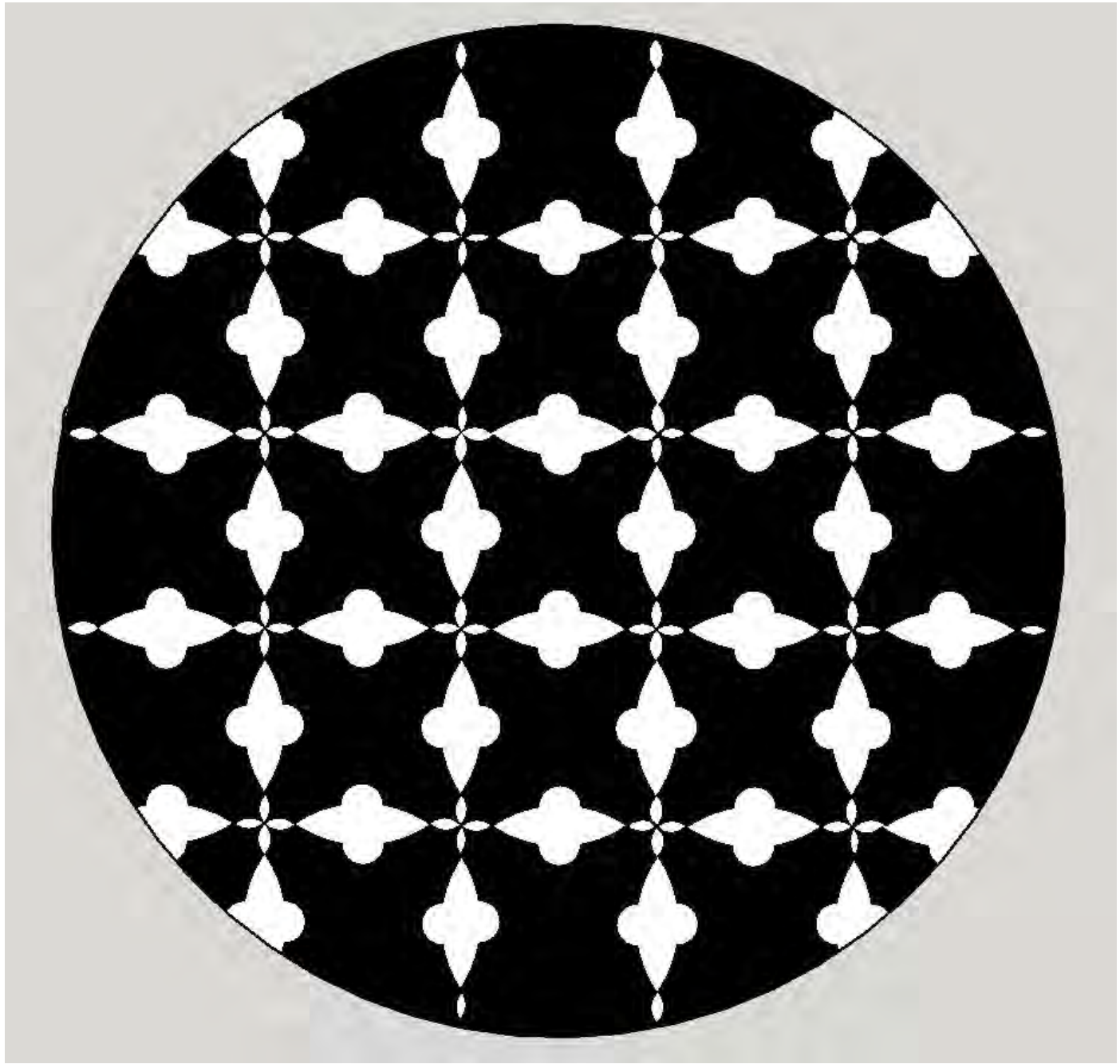


First row with border trimmed away

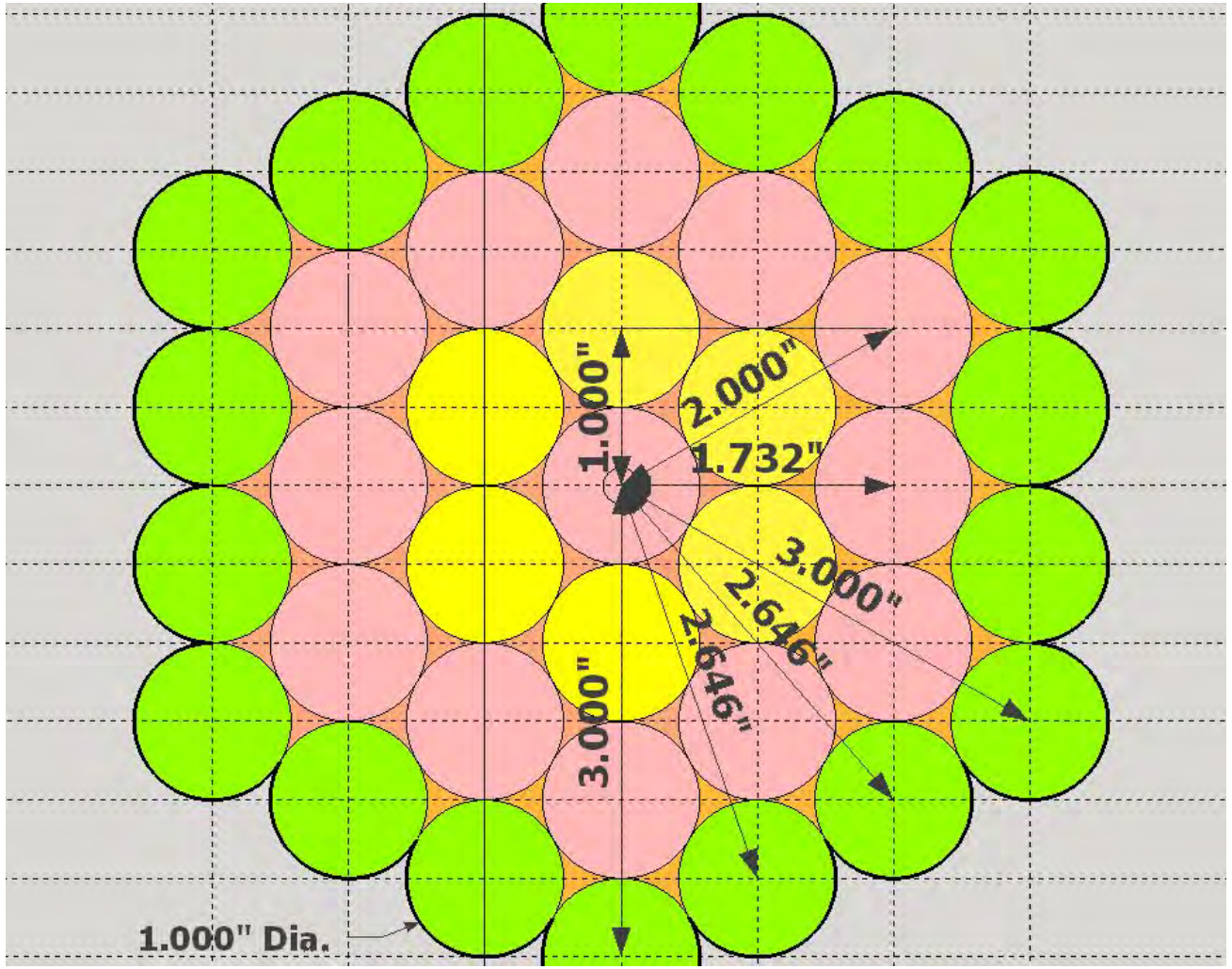


Just for fun!

Our pattern expanded to three rows on a circular work piece

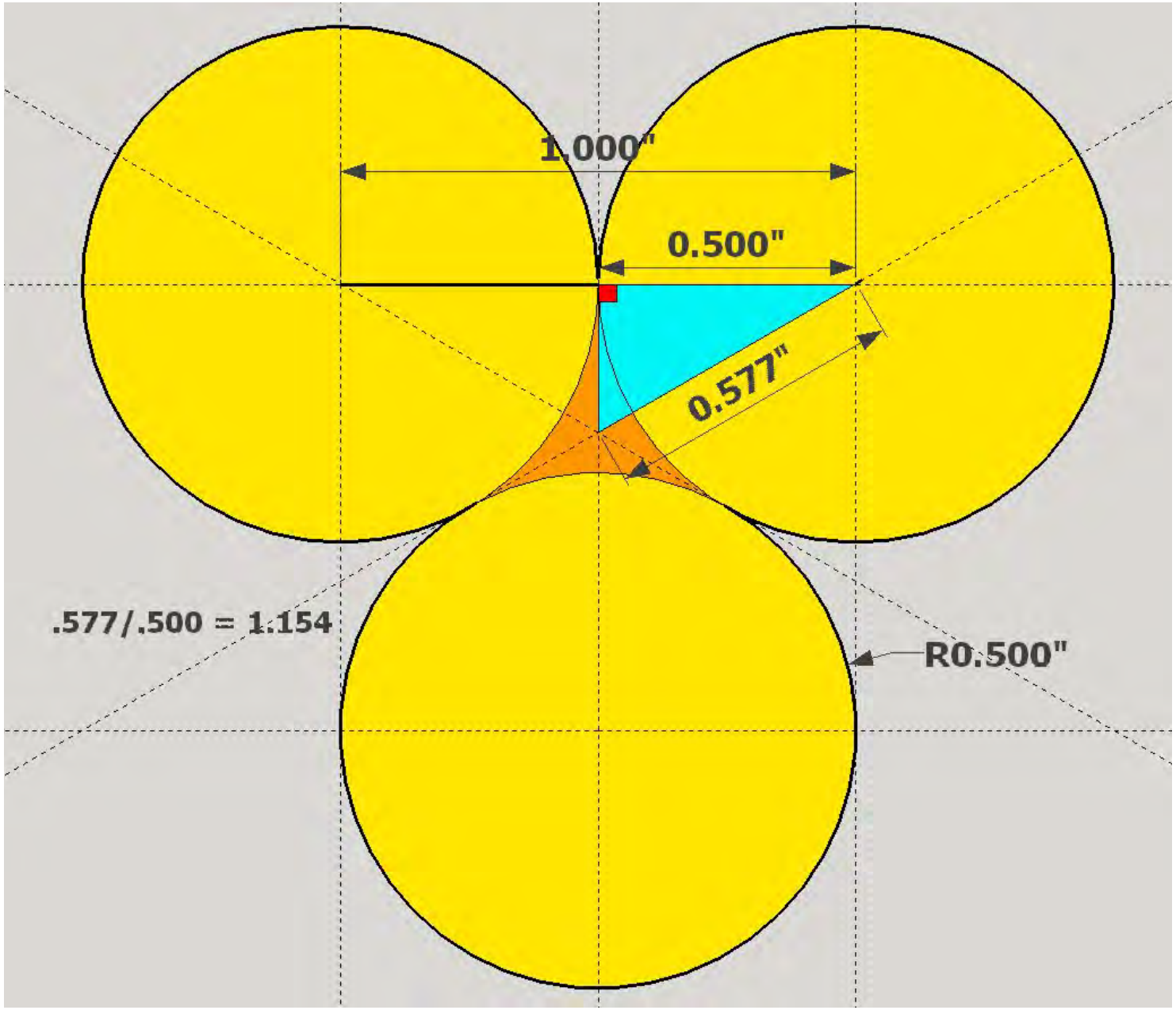


Eccentric Chuck Settings for a Hexagonal Matrix with 1.000” Diameter Base Circles



Calculation of Tool Slide Setting for Hexagonal array

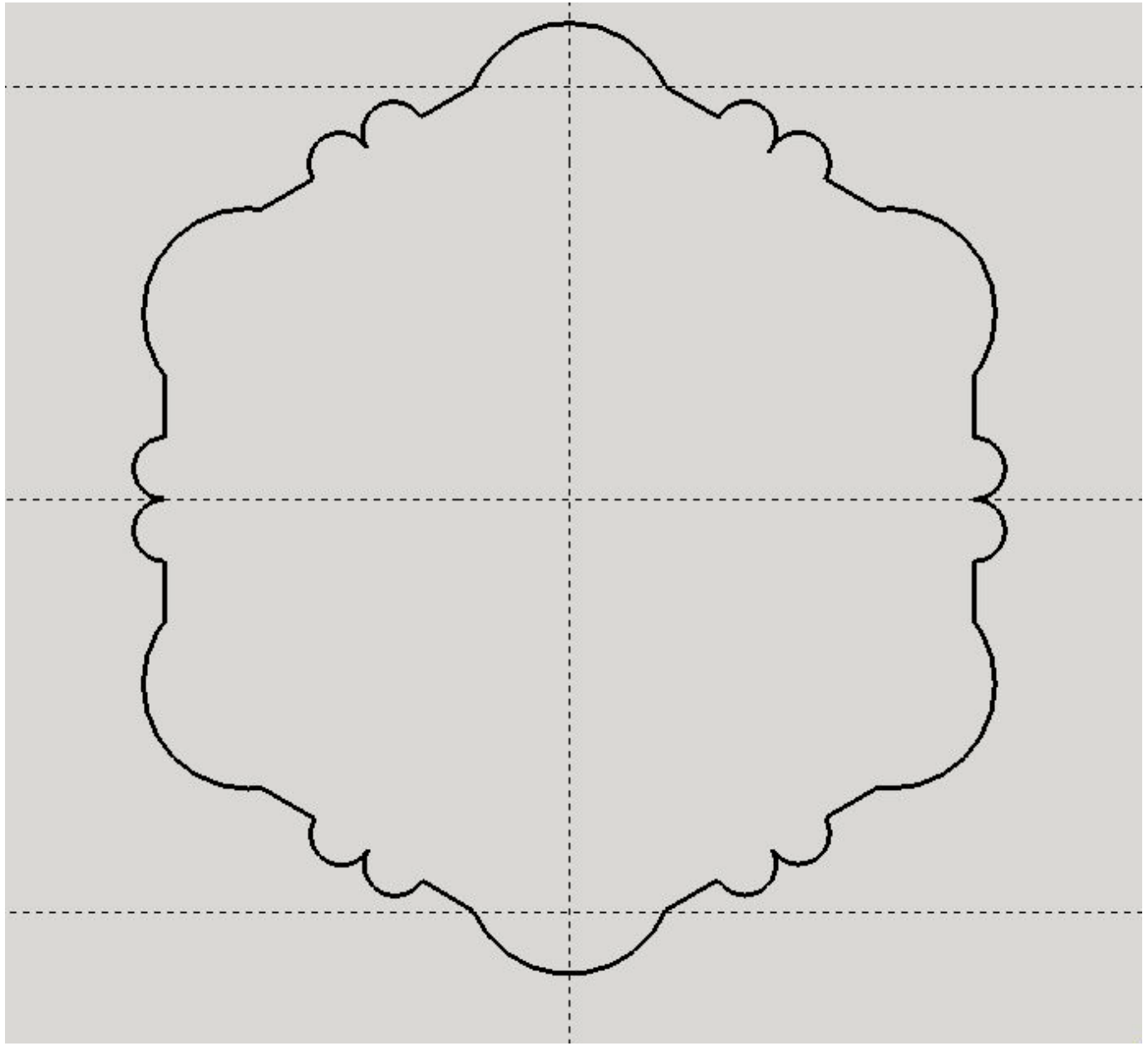
To have rosette profiles intersect at center of the void, the tool slide setting is .577” for a 1.000” diameter base circle



Let's look at a hexagonal array

- We’ll use this 18 lobe rosette. With its lobe count divisible by 6, it should work

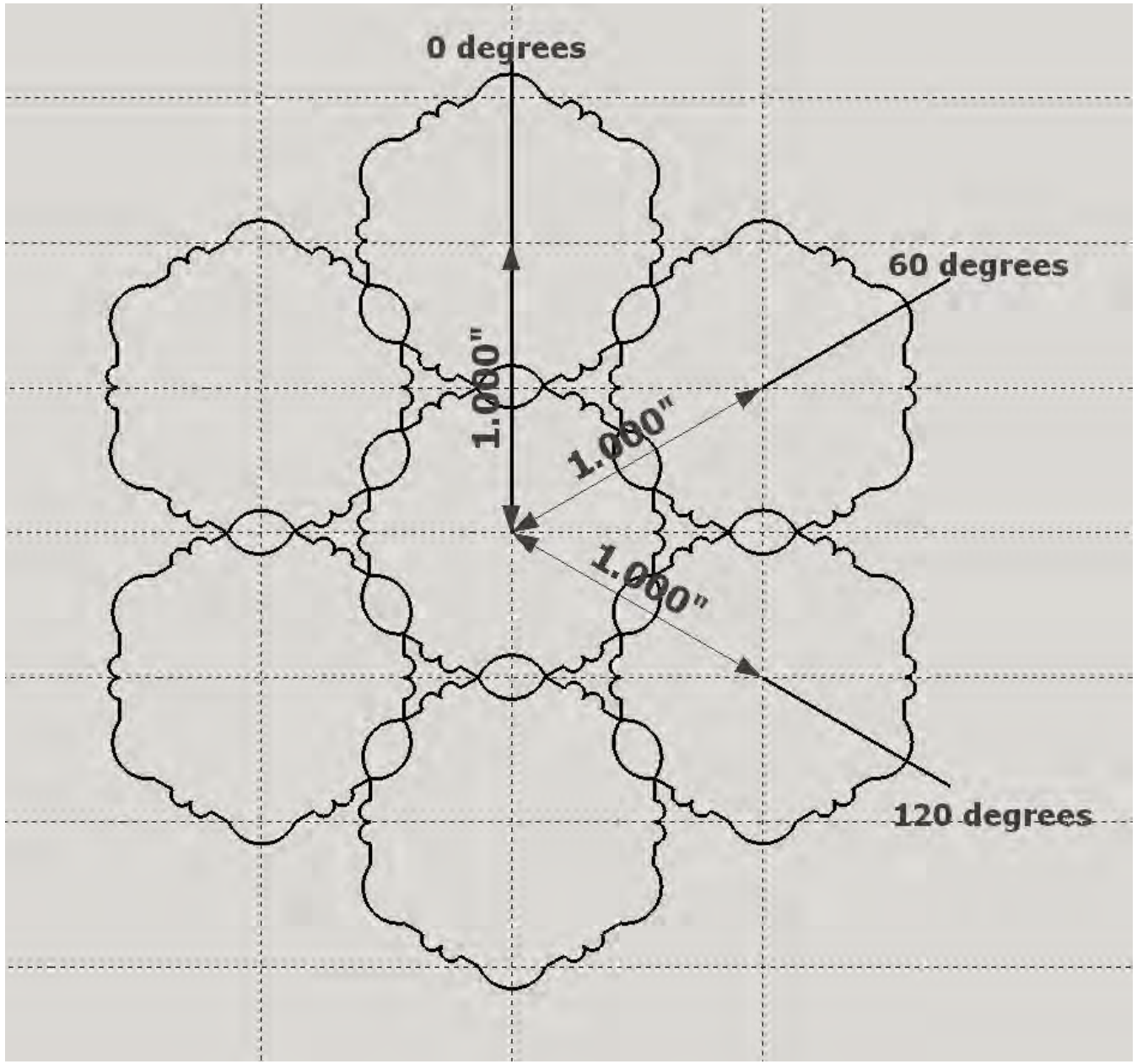
- Set tool slide to .577” and cut rosette profile on center of work piece



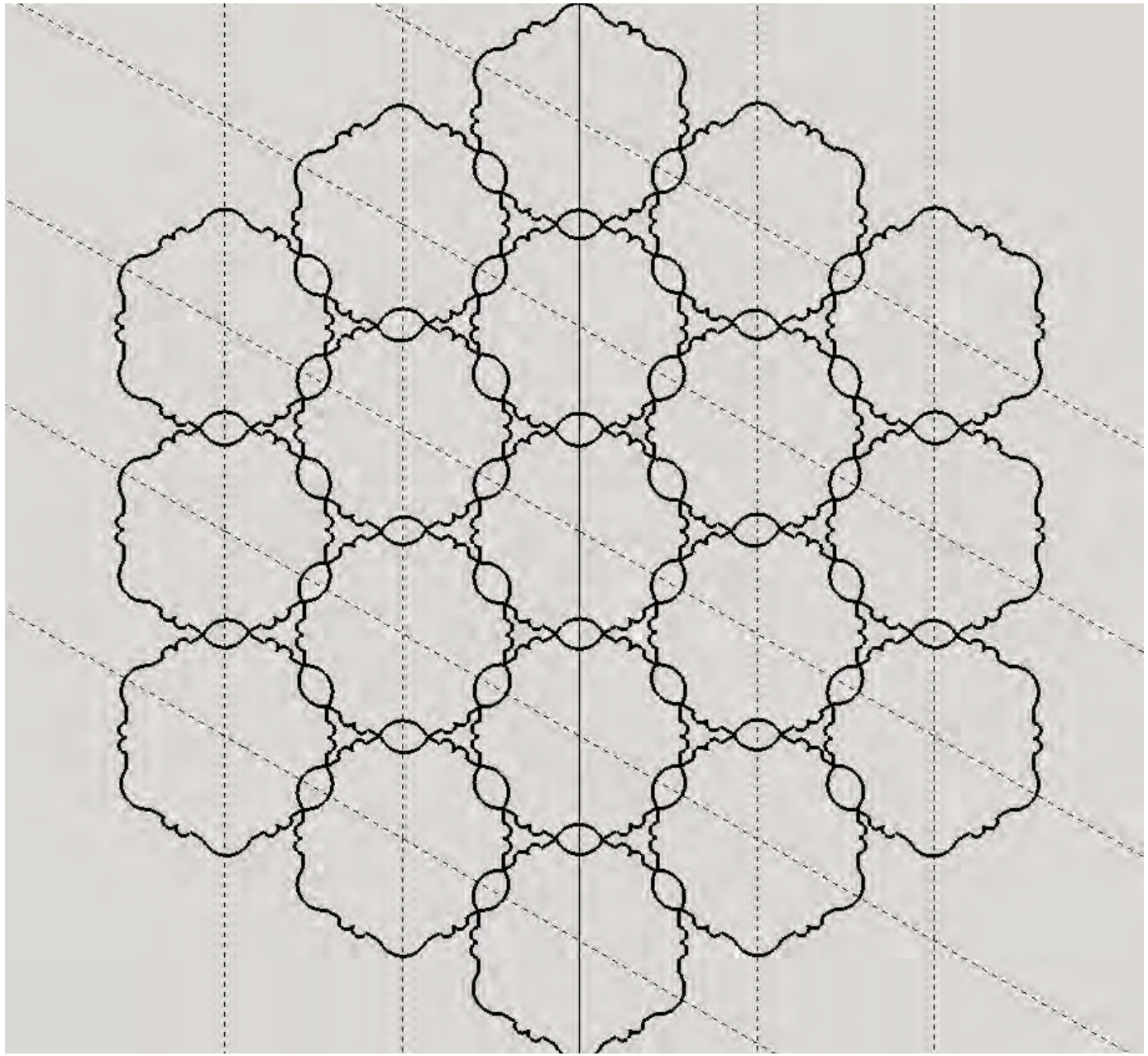
Row 1: For hexagonal array

Eccentric Chuck Slide	Eccentric Chuck Worm Wheel	Worm Wheel On Barrel
1.000	0	0
1.000	60	-60
1.000	120	-120
1.000	180	-180
1.000	240	-240
1.000	300	-300

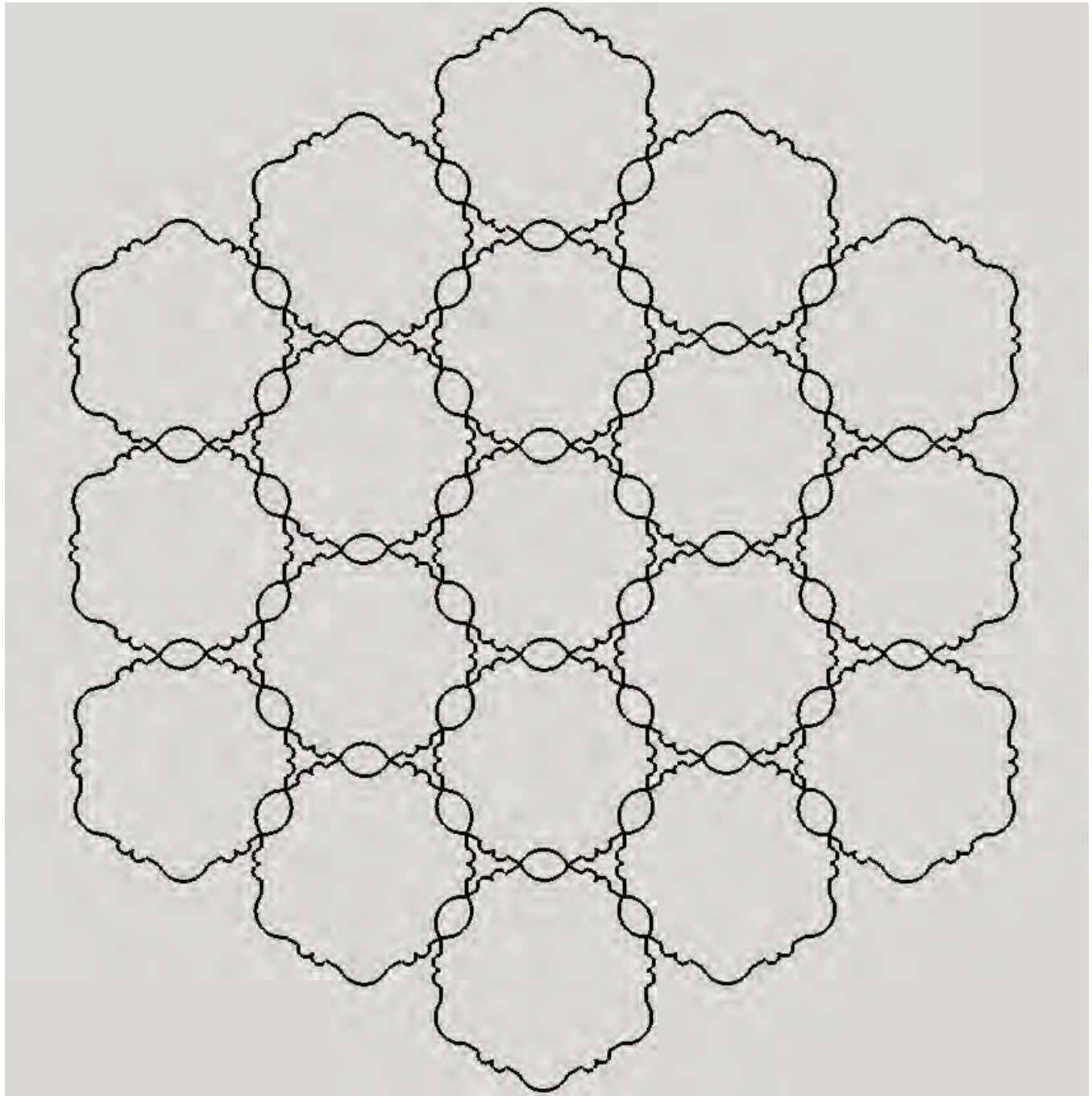
First row completed



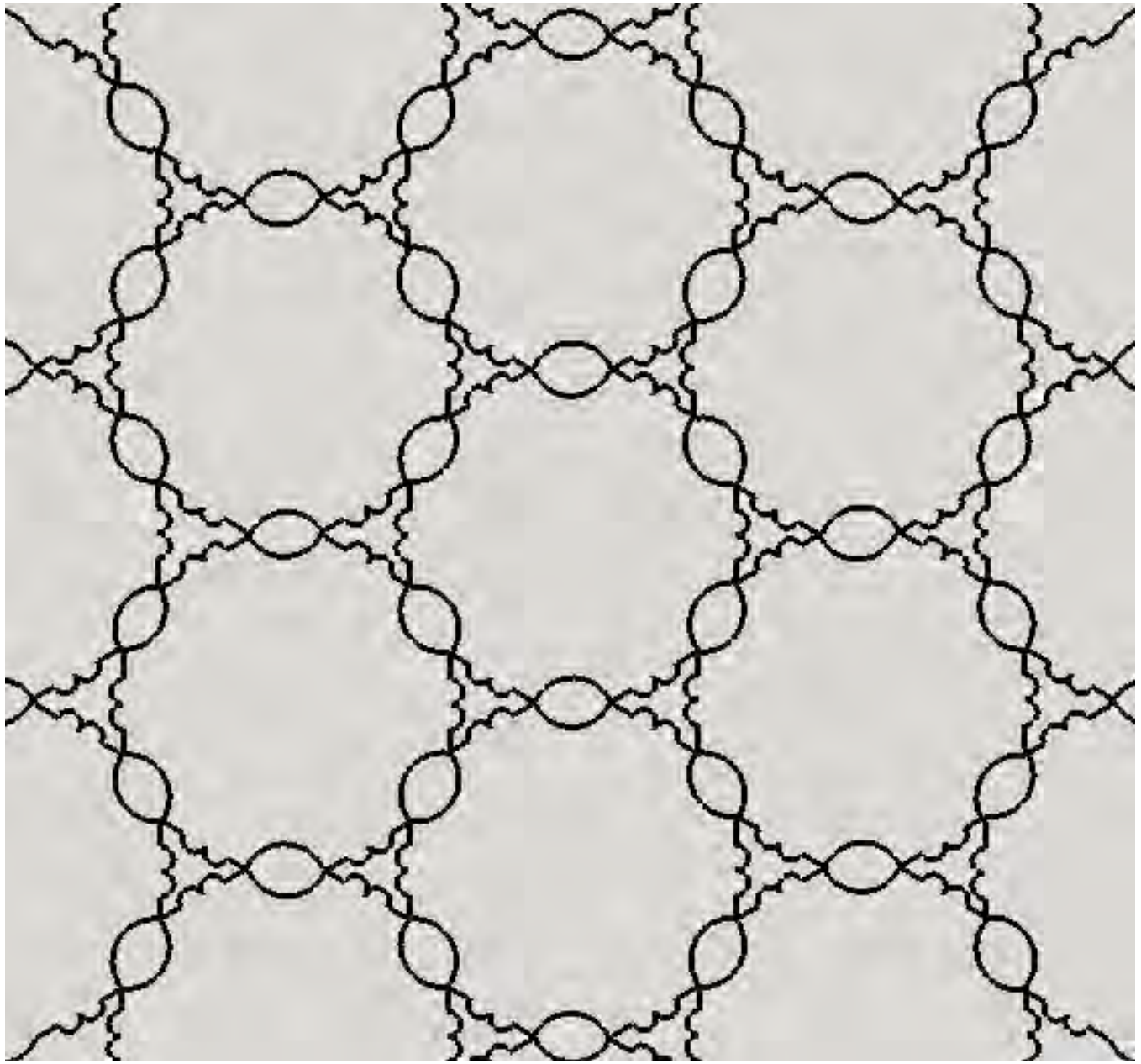
Second row complete



Two rows completed with base circle grid removed



Hexagonal pattern trimmed



Good News!

- The angles for rectangular and hexagonal arrays remain the same, regardless of the base circle size you choose.

More Good News!

- Tool slide and eccentric chuck slide settings are directly proportional to the size of the base circle chosen. Settings for a 1” base circle can be multiplied by any chosen base circle size to get the new slide settings.

- For example, to get the settings for a .400” base circle array, multiply the 1.00” tool slide and eccentric chuck slide settings by .400.

The Best News Yet!

- We have provided you with tables of both the angles and the eccentric slide settings for 1.00” base circle rectangular and hexagonal arrays of up to 3 rows.

- These are constants that can be multiplied by any factor you choose for the size of the base circles in your array.

- The tool slide settings, .707 for a rectangular array and .577 for a hexagonal array, are also a constant that can be multiplied by your chosen factor

Eccentric Chuck Angular Settings For Rectangular Array				Eccentric Chuck Slide Settings For Rectangular Array		
Row 1	Row 2	Row 3		Row 1	Row 2	Row 3
0	0	0		1	2	3
45	26.6	18.4		1.414	2.236	3.162
90	45	33.7		1	2.828	3.606
135	63.4	45		1.414	2.236	4.243
180	90	56.3		1	2	3.606
225	116.6	71.6		1.414	2.236	3.162
270	135	90		1	2.828	3
315	153.4	108.4		1.414	2.236	3.162
	180	123.7			2	3.606
	206.6	135			2.236	4.243
	225	146.3			2.828	3.606
	243.4	161.6			2.236	3.162
	270	180			2	3
	296.7	198.4			2.236	3.162
	315	213.7			2.828	3.606
	333.4	225			2.236	4.243
		236.3				3.606
		251.6				3.162
		270				3
		288.4				3.162
		303.7				3.606
		315				4.243
		326.3				3.606
		341.6				3.162

Eccentric Chuck Angular Settings for Hexagonal Array				Eccentric Chuck Slide Settings for Hexagonal Array		
Row 1	Row 2	Row 3		Row 1	Row 2	Row 3
0	0	0		1.000	2	3
60	30.0	19.1		1.000	1.732	2.646
120	60.0	40.9		1.000	2	2.646
180	90.0	60.0		1.000	1.732	3
240	120.0	79.1		1.000	2	2.646
300	150.0	100.9		1.000	1.732	2.646
	180.0	120.0			2	3
	210.0	139.1			1.732	2.646
	240.0	160.9			2	2.646
	270.0	180.0			1.732	3
	300.0	199.1			2	2.646
	330.0	220.9			1.732	2.646
		240.0				3
		259.1				2.646
		280.9				2.646
		300.0				3
		319.1				2.646
		340.9				2.646

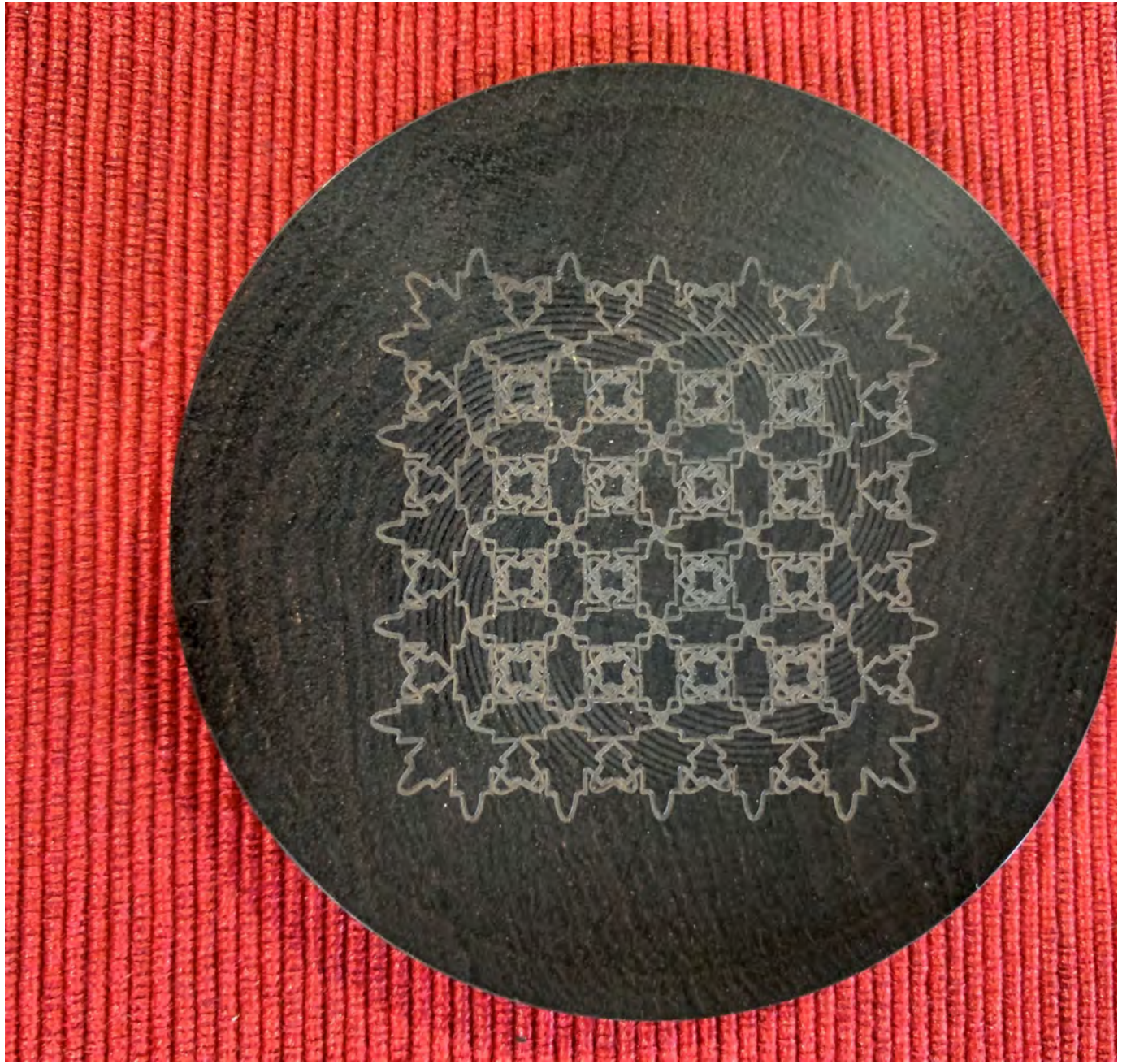
Variations On A Theme

Some Examples of Lattice Patterns

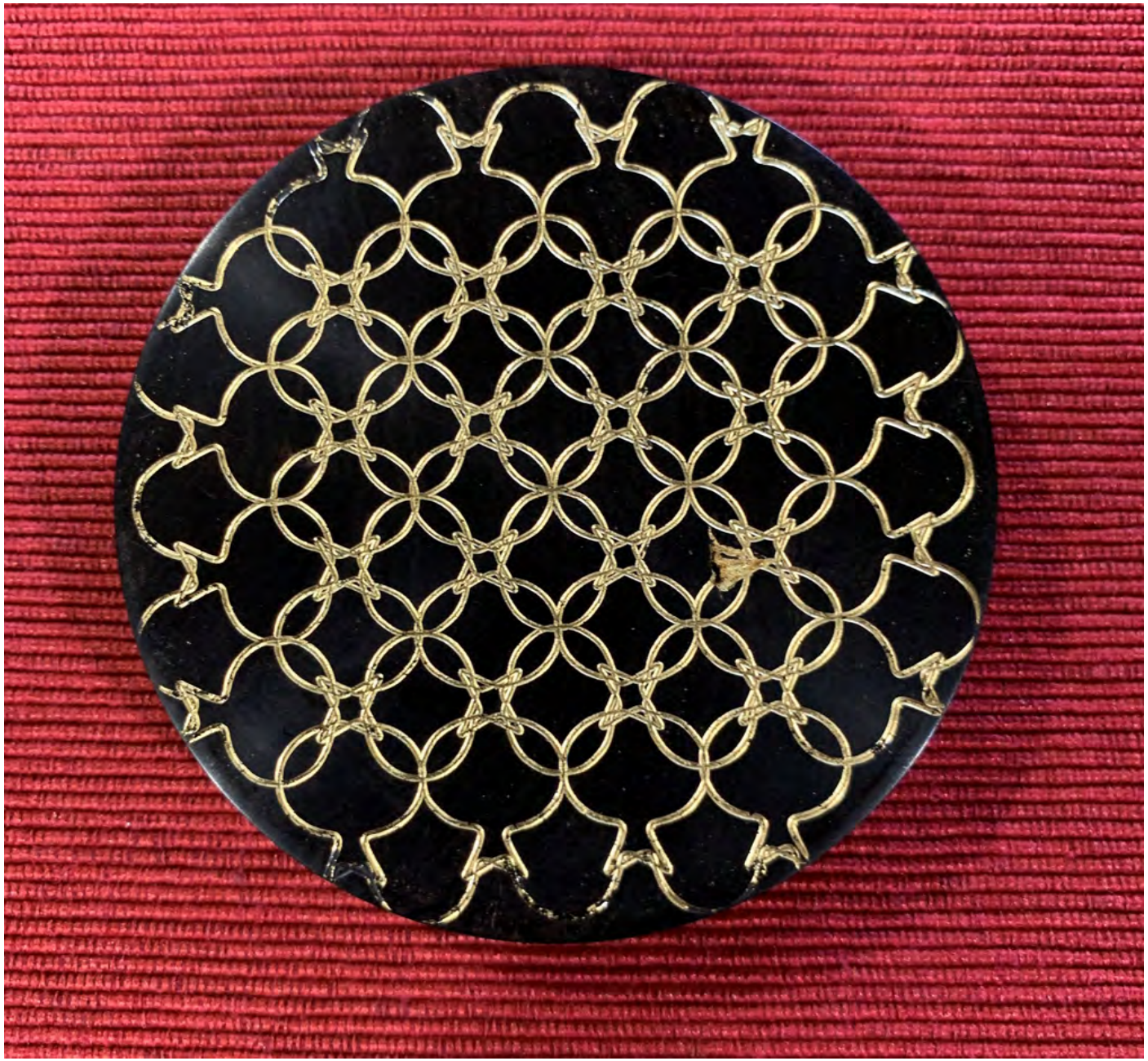
Simple line

Deep Cut

Fine Detail



Gold Filled



Colored background

Stepped Cutter