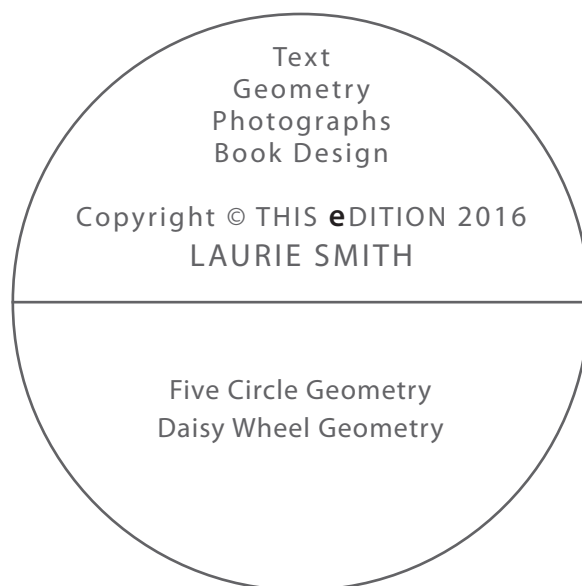


Lewannick
Cresset Stone
Let there be Light



Laurie SMITH
HISTORIC **BUILDING** GEOMETRY



Laurie Smith is an independent early-building design researcher, specialising in geometrical design systems. Because geometry was part of the medieval educational curriculum he uses geometrical analysis to excavate and recover the design methodologies of the past, a process he thinks of as design archaeology. He lectures, writes and runs practical workshops on geometrical design and publishes his work through his website HISTORIC BUILDING GEOMETRY.

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Lewannick Cressett Stone

Five Circle Geometry

Daisy Wheel Geometry



HISTORIC
BUILDING
GEOMETRY

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Saint Martins Church, Lewannick, Cornwall 1

The Church of Saint Martins at Lewannick was burnt out in January 1890 and rapidly rebuilt soon after. There were two remarkable survivals from the fire, a spectacular octagonal Norman font with its facets carved with precision geometrical symbols and a circular cresset stone with seven recesses for holding tallow and wicks for giving light, above. This text is about the cresset stone and the geometry of its layout.

The cresset stone is 18 inches in diameter and 7 inches deep and stands on a slightly tapered octagonal base 21½ inches tall. The tallow recesses are 2½ inches in diameter, the same dimension as the spaces between them, and 3 inches deep.

There are several different geometrical ways to design the layout of the cresset stone and consequently some difficulty knowing which method was actually used. The two methods described here both use compass geometry and both embody the assumption that the stone's 18 inch diameter was intentional from the start. The tools used would have been dividers, rule and scribe (a compass with pin on both arms for scribing circles, a straight edge for making alignments and a mason's scratch awl for scribing lines along them).

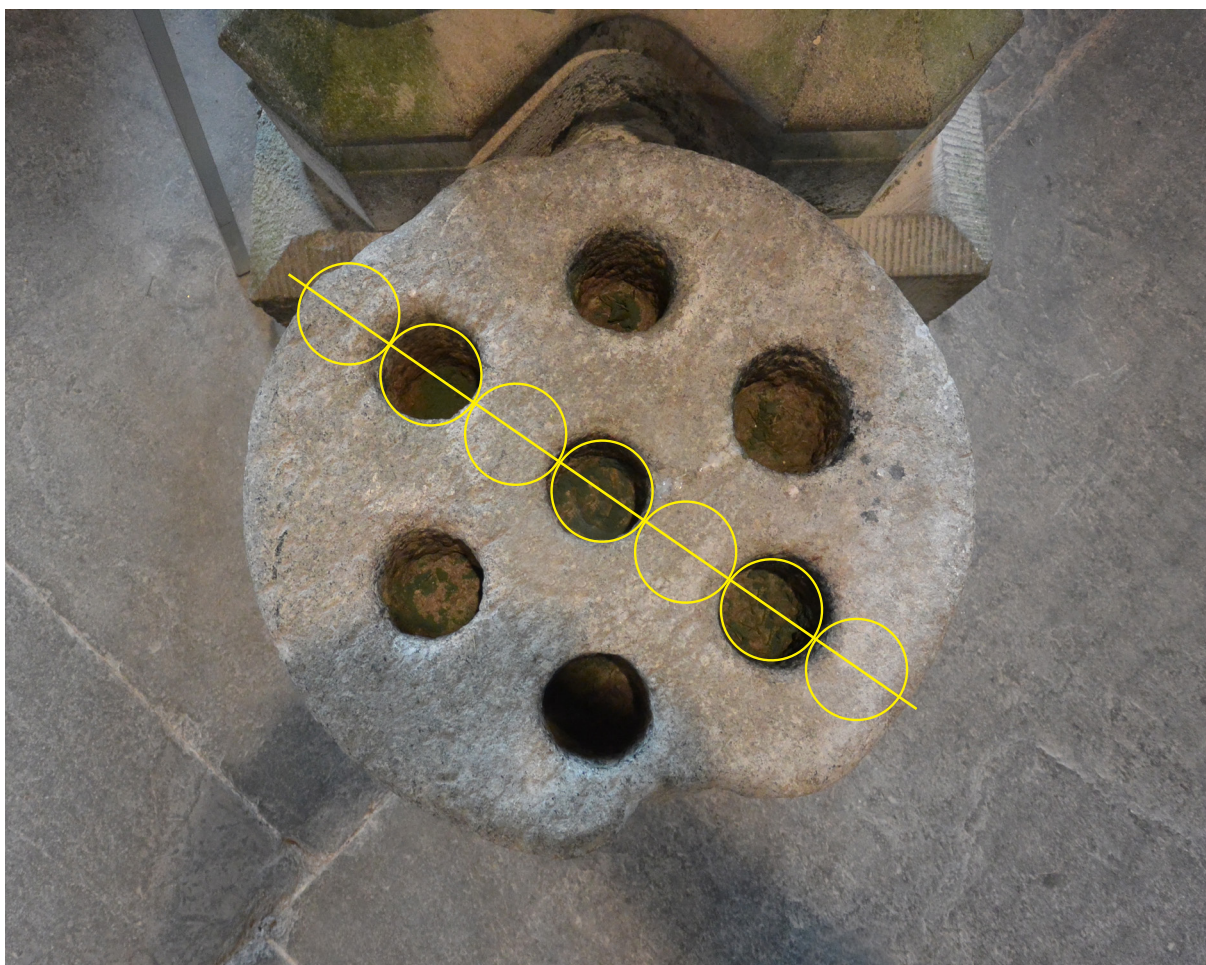


Saint Martins Church, Lewannick, Cornwall 2

The design of the cresset stone depends on the proportional relationship between the diameter of the central tallow recess, from which the other six are copied, and the diameter of the stone's full circumference. The design arises from five circle geometry (a central circle with four identical circles drawn at its north, east, south and west poles).

- 1 The first step is to construct horizontal and vertical perpendiculars, shown in dashed yellow line. For clarity here the method is shown on page 9.
- 2 From the intersection of the perpendiculars, the dividers are set to a radius of $4\frac{1}{2}$ inches for scribing a 9 inch diameter circle, shown in black line.
- 3 Four further 9 inch diameter circles can be drawn from axes at the four small arrows where the black circle cuts the perpendiculars. These circles are in fine yellow line.
- 4 Two final large circles are drawn, through the intersections of the four 9 inch diameter yellow circles and, lastly, to encompass them all as the stone's circumference.
- 5 A small circle drawn between the two outer circles generates the circumference of the central tallow recess. With the central recess defined geometrically the remainder of the cresset stone's layout can be drawn.

In my view the stages shown above commence from the central 9 inch diameter circle which as $3 \times 3 = 9$ is a reference to the Trinity or triple Trinity, a suitably theological starting point for the evolution of an ecclesiastical design.



Saint Martins Church, Lewannick, Cornwall 3

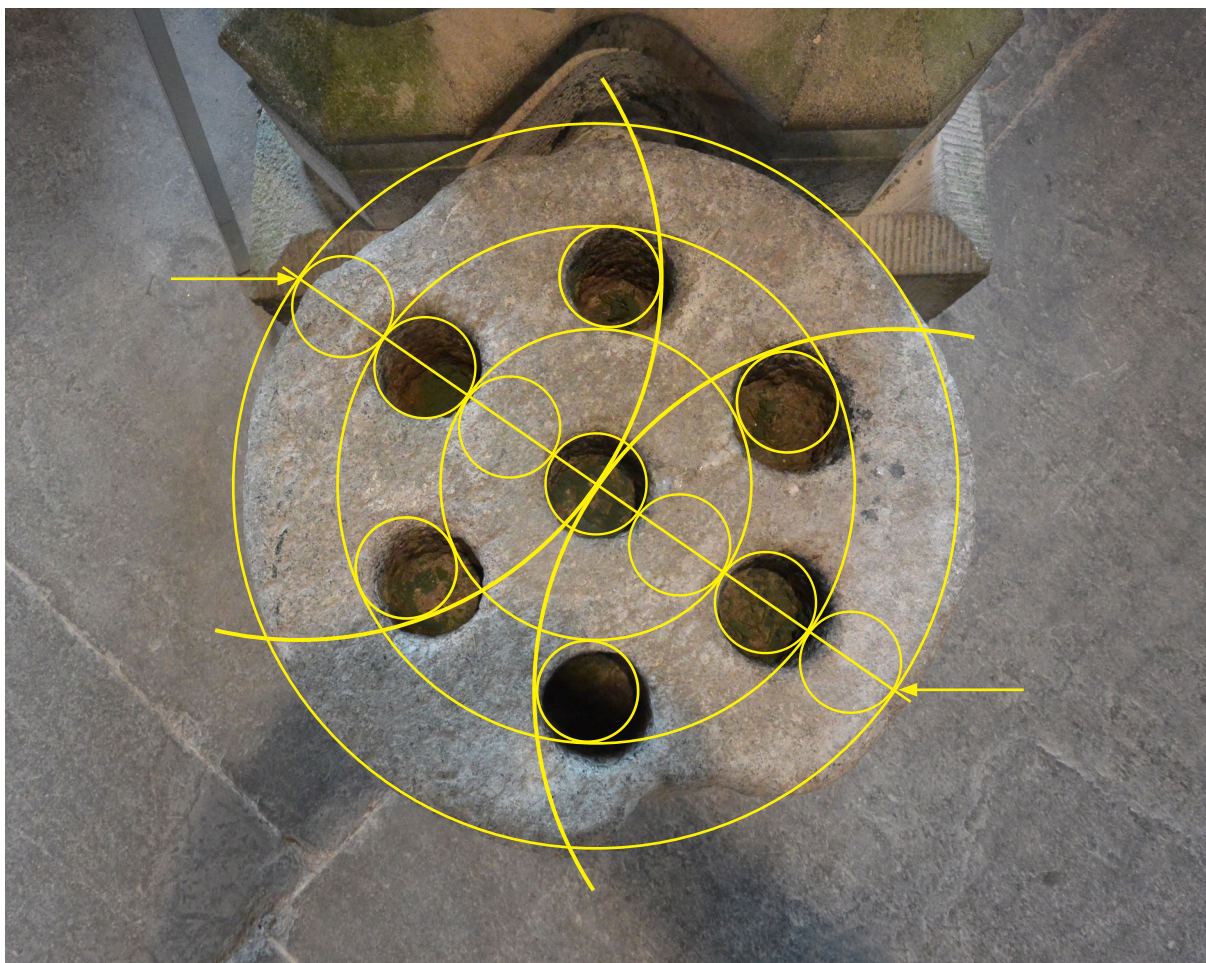
The cressett stone has a configuration of seven tallow recesses, one at the stone's centre and six arranged in a circle around it. Taking the circumference of the central recess and drawing further identical circles along a diameter it can be seen that there are also seven circles across the stone's full diameter, spaced alternately so that four remain as solid stone and three are cut as recesses. The three recesses can also be considered as a reference to the Trinity, especially as their function is to provide light.

It was a characteristic of medieval design thought that every element within a structure should relate to every other element and that all elements should relate to the whole. Drawing 3 confirms the proportional relationship between the central tallow recess, the spaces between the recesses and the full diameter of the cressett stone.



Saint Martins Church, Lewannick, Cornwall 4

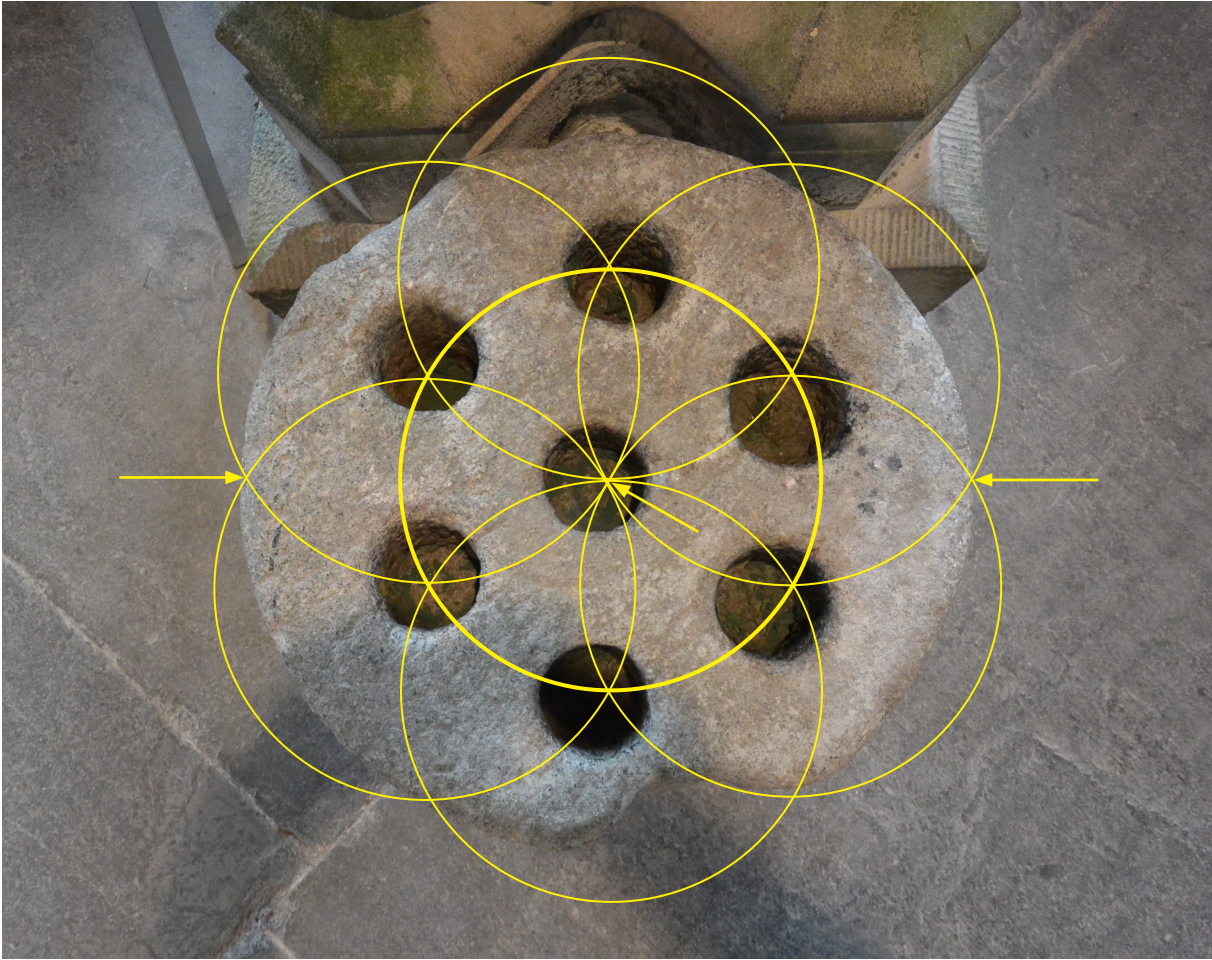
With the seven circles in place on their centre line it is possible to draw three circles from the centre of the stone so that they are tangential to the three small outer circles. It can be seen that the largest outer circle defines the circumference of the stone while the two smaller circles define a band occupied by the recesses. It can also be seen that the lower two recesses have been cut slightly out of sync with the band's outer circle. The three large concentric defining circles can also be considered as an expression of the Trinity and it is noticeable that the central of these contains a linear group of three small circles.



Saint Martins Church, Lewannick, Cornwall 5

Two further arcs of circle, with the same radius as the large outer circumference, can be drawn from either end of the small circle's centre line, at the points indicated by the arrows. The arcs, which are drawn in heavy yellow line, cut the two inner circles to give locations for the remaining four recesses.

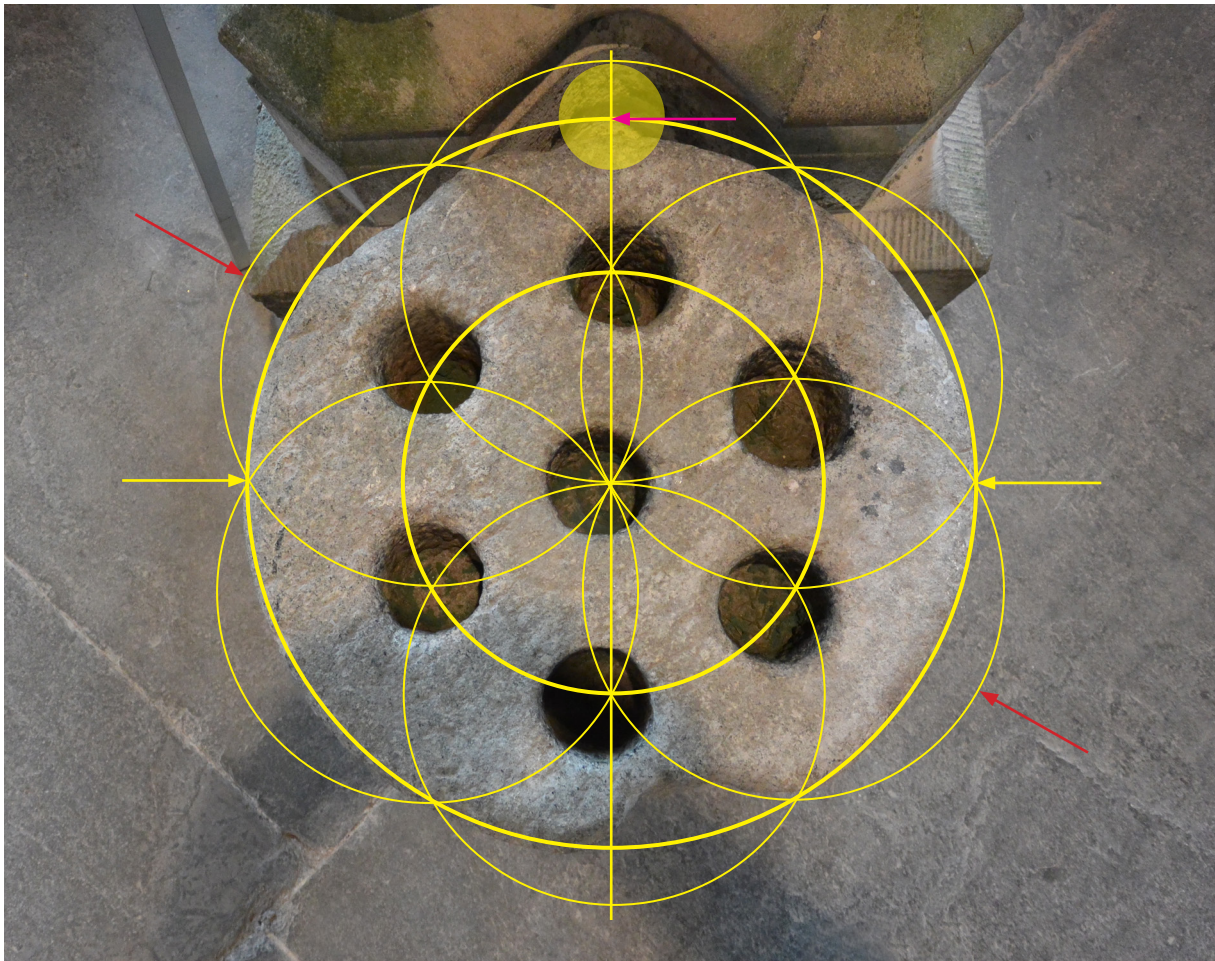
The geometry would have been scribed into the stone's upper surface using dividers, a theoretically precision technique but not so easy to attain in the unforgiving surface of granite. Similarly, once scribed, the manual cutting of the tallow recesses would be prone to a small degree of drift as evidenced by the stone.



Saint Martins Church, Lewannick, Cornwall 6

The second method of designing the proportions of the stone is by compass geometry using the well known daisy wheel, a configuration of seven circles in total, six of which are drawn equidistantly around the circumference of a central circle as shown above. For clarity the central circle is drawn in heavy line. Its axis is indicated by the central arrow. The wheel is scaled here so that the intersections of the six outer circles coincide with the stone's circumference, as indicated by the two outer arrows.

All seven circles are drawn to the same radius. Once the central circle is drawn the dividers are placed on the circumference and circle 2 is drawn. Where circle 2 cuts the central circle (it does so in two places but only one is needed) it gives the axis for circle 3. Circle 3 cuts the central circle at the axis for circle 4 and so on. Because the circles are all drawn to identical radius it follows automatically that the six outer circles are equally spaced around the circumference of the central circle and, because of this symmetry, they form the daisy pattern within the central circle. It can be seen that the wheel's six petal tips and central axis form a group of six equidistant points around a central point that matches the tallow recesses in the stone.

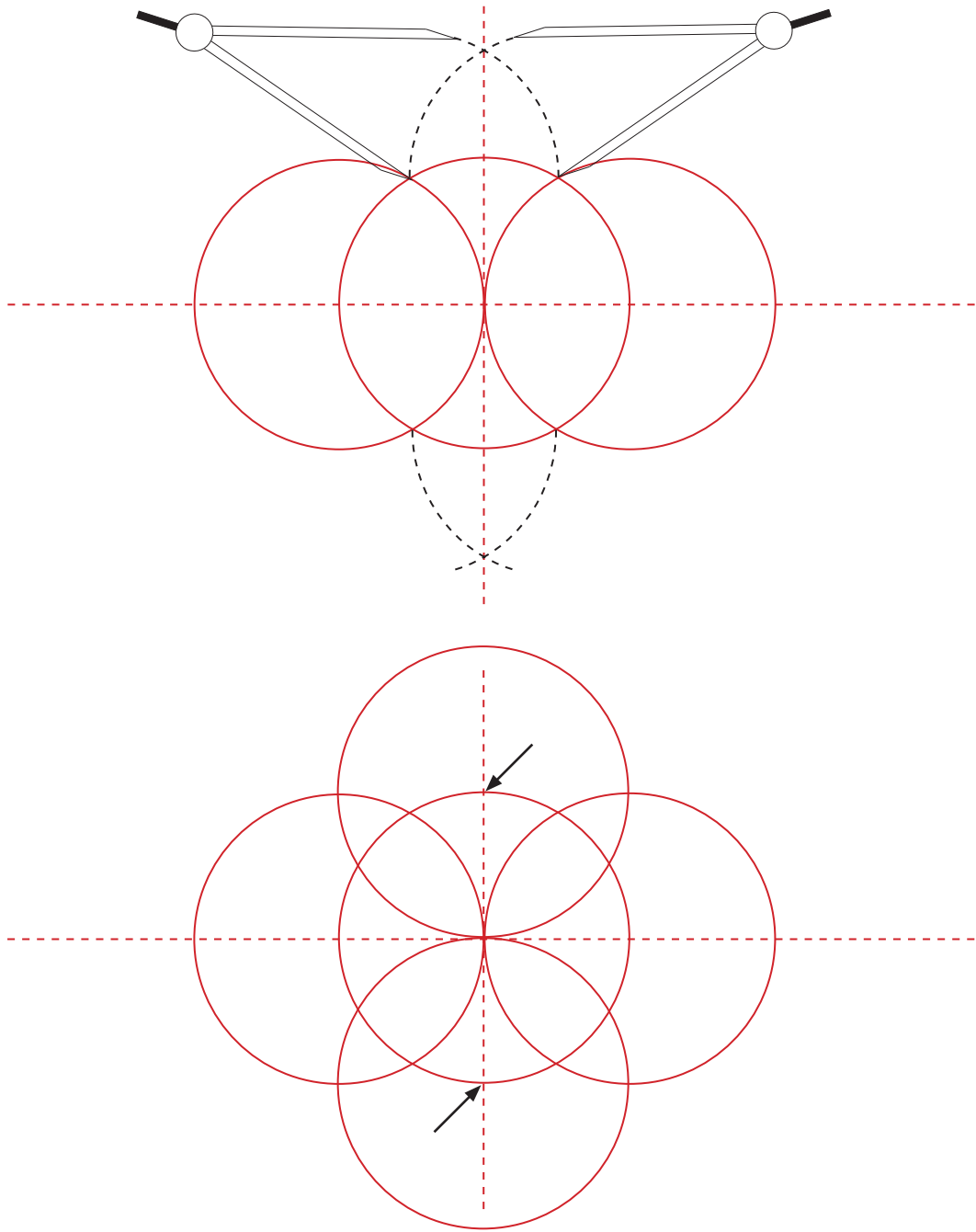


Saint Martins Church, Lewannick, Cornwall 7

The daisy wheel geometry can be developed further. A large circle, shown as a heavy yellow line, can be drawn through the intersections of the daisy wheel's six outer circles, two of which are marked by yellow arrows. It can be seen that this circle is the same as the stone's circumference.

A line drawn through the daisy wheel's vertical petals cuts the heavy outer circle at the axis of a small circle, marked by the magenta arrow, that has its radius between the heavy circle and the top circumference of the wheel's upper circle. The small circle is shown as yellow tone and it can be seen that it is identical in circumference to the tallow recesses.

This is the simplest and quickest way to draw the stone's geometry but it requires knowing the radius of the central circle ahead of the act of drawing. To attain an 18 inch diameter for the stone it is necessary to draw the central circle with a $10\frac{1}{2}$ inch diameter and, therefore, a $5\frac{1}{4}$ inch radius. The diametric distance across the daisy wheel's full seven circles, between the red arrows, is 21 inches. So drawing the correct central circle for the stone's 18 inch diameter suggests either advance knowledge of the dimensional values of the geometry or trial and error leading to the correct starting radius, a process that would only take a few minutes.



Saint Martins Church, Lewannick, Cornwall 8 Drawing perpendiculars

Upper drawing. Three circles are drawn along a horizontal centre line so that the axis of each is on the circumference of its neighbour. The circles intersect at two points above and two points below the line. Arcs of the same radius are drawn from the points so that they intersect and the vertical perpendicular is drawn through the intersections.

Lower drawing. Two additional circles are drawn from where the vertical perpendicular cuts the central circle, at the points indicated by black arrows.

*The resulting five circle geometry is the basis of the first geometrical analysis
The seven circle daisy wheel is the basis of the second.*

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