"Historic Ornament: Something About Curves," by Glanville Smith, in *Design Hints For Memorial Craftsman* Magazine, Vol. 2, No. 7, January 1926, pp. 18-20, 22-23, 26. (parabola, ellipse, hypocycloid, Witch of Agnesi, limaçon, spiral, and entasis)

HISTORIC ORNAMENT

By Glanville Smith.

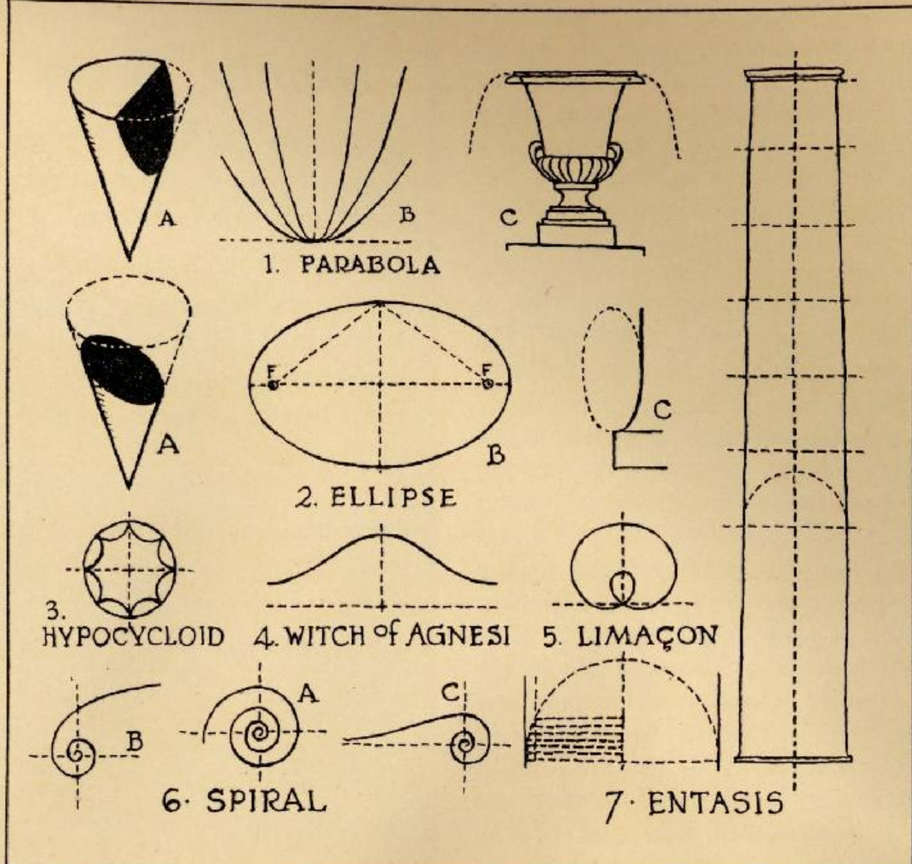
SOMETHING ABOUT CURVES

Frequently we hear, and frequently too we use the expression —"Greek curves". In most peoples' minds the belief has taken root that a curve that is Greek is superior to all other curves. Few can say why a Greek curve is so superior, but this does not prevent those that cannot from being favorably impressed when a dealer in noting the special desirability of one of his monuments remarks: "And the curves, you'll notice, are distincly Greek———."

Of course not every curve drawn by the ancient Greeks was beautiful; and it is equally true that not all non-Greek curves are inferior. But the *typical* Greek curve has this about it, that it is based on the parabola or the ellipse which are subtler curves to begin with than is the circle, on which the general run of curves (notably the Roman) are based. The circle is a convenient curve to draw: its center stays in one place, and its radius stays the same all around: hence we use the compass which is built to suit these conditions. Or perhaps we have a curve made up of arcs of circles—for instance the Tudor arch which is composed of the arcs of 2 large circles and 2 small, hence known as a "4-center arch." But here is the fault that can be noticed in these: a simple circle or circular arc has an obviousness about it: we can look at it and say, *here* is the center, *this* is the radius. With the parabola or ellipse the conditions are different: the centers move, the radius is elastic. Thus these curves have a subtlety and a smoothness about them that is not to be found in curves made of arcs of circles. For this reason it may be interesting to examine these basic curves a little to see what they are like and how they "behave."

The parabola (par-ab-o-la) and the ellipse are pure mathematical curves. In geometry they are classed among the "conic sections", because they can be obtained by cutting a cone. (See Figures 1-A and 2-A). The cones shown in the illustration are of the most familiar proportions—somewhat the shape of ice-cream cones in fact—but it must be remembered that a cone can just as well be long and spindling, or broad and squat.

But now suppose we have such a cone, say a well-shaped carrot, and cut down thru it in a direction *parallel to the slant of one of its sides*—what shape will that cut expose? The answer is, a parabola. If we take a deep cut and so slice away almost all of the cone (or carrot) we shall make a long slender parabola; if we take a cut farther up, where the cone has bellied out, we shall produce a broad parabola. A "family" of such parabolas is shown in Figue 1-B, the inmost one resulting from a deep cut, the next one from a cut not so deep, etc. A curious fact about the parabola is, that no matter how long it is drawn out it continues to curve, and yet the two lines



never come to be parallel with one another, and never meet. It is easy to visualize why this is true: for the longer the cone itself is drawn out the bigger it grows. In Figure 1-C the parabola has been used as the basic curve in the profile of a classic vase.

From our cone (or carrot) we can obtain the ellipse in a similar manner, only this time we will take our slice *across and thru* the cone. (Figure 2-A). Such a slice at a steep angle will produce a long narrow ellipse, or one at only a slight tilt will give a short broad one; and if the cut is made straight across, we shall obtain that particular kind of an ellipse known as a "circle". Thus the circle is one of the conic sections, and also actually an ellipse, altho it is practically never called by this name, being a special and important study in itself apart from all other ellipses. An ellipse mathematically correct is shown in Figure 2-B. In Figure 2-C an application of the ellipse is illustrated: here a quarter of the curve has determined the contour of a moulding. Imagine a quarter of a circle used in the same place and at once the superiority of the elliptical arc will be apparent.

In the matter of usefulness the ellipse is far more important than the parabola. To begin with it is a complete figure in itself, not running off out of bounds like the other does. Then, it can be drawn with a fair degree of mechanical accuracy, whereas the parabola must be plotted point by point from a mathematical expression to be a pure parabola: this is altogether too irksome a task for any but the most finicky and long suffering designers. Hence the parabola is usually drawn by eye, and as there are an infinite number of parabolas the draftsman with a knack at drawing smooth-flowing curves is likely to hit one of them.

There are a number of methods of approximating and plotting the ellipse. A mathematically perfect method useful in full-size detailing is as follows:

We shall assume that the length and breath of our ellipse are known. Lay out this long axis then, with the short axis crossing it at its mid point. Now with a compass take half of the length of the long axis—that is, from the mid point to one end—and with this distance as a radius, and one end of the short axis as a center, strike arcs so as to locate points F and F on the long axis. These are the "focal points" or "foci" of the ellipse. Once they are located, proceed as follows: Set a pin at each of the 2 focal points, and a third pin at one end of the short axis. Tie around these 3 pins a tight loop of cord, which loop will be in the form of a triangle extending from one focal point to the other, and up (or down) to the end of the short axis. Remove the third pin (at the end of the short axis) and put the point of your pencil in its place, and, keeping the loop of cord tight, draw your ellipse. To those who have never tried this method it will come as a surprise to see what a beautiful smooth-

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flects the newer ideas in design.

He has had two children, a son and a daughter; the son is an expert granite cutter, and the daughter died of influenza while engaged as a nurse in the World War. Mrs. Horne looks after "Jamie" as well as their substantial home adjoining the shop.

Mr Horne is active in civic affairs in Luverne having been a councilman for several terms .

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flowing curve is produced. But cord will stretch, and likewise it must have a knot in it, which makes this method not altogether desirable for small-scale or fine drawing. mathematically it is perfect, creating a true pure ellipse; and for large scale work it is a practical method. A little experimenting will show that the farther apart the focal points are, the slenderer the ellipse; whereas the closer together they are set the fatter the ellipse. When the two foci merge into one at the mid point your ellipse will be a circle.

Such is the story of "Greek curves" in a narrow sense. In reality, the Greeks probably drew their beautiful curves by eye.

The science of mathematics makes a very extensive use of pure curves, some of which are notable for their beauty, and an inspiration to the designer-craftsmen. Some of these are shown in Figures 3, 4, 5, and 6.

When the path of a single point on the circumference of a small circle being rolled around inside a larger circle is plotted, we find it to be in the form of scallops. This path is known as the hypocycloid (pronounced hip-o-si-kloid). The Brothers Adam, Renaissance designers, made extensive use of this curve: an example of its use in a fan-like motif can be examined in the Historic Oranment article in the October 1925 issue of *Design Hints*. Likewise, another fan motif inspired by a curve called the Witch of Agnes: (Figure 4) can be found in this same article. Figure 5 illustrates the Limacon. "Limacon" is the French word for "snail"—it would seem more appropriate to have chosen the word for "lima-bean." But as one examines this bean-like curve one grows to respect it as a basis for design. Does it not suggest almost at once the peacock, body erect ınd tail wide spread? Three spirals are shown in Figure 6. 6-A is the usual spiral—it suggests the snail much more than the limacon does. 6-B is another: it reminds us of the cushion and volute of the Greek Ionic column-cap. 6-C, a scroll-like spiral, is ksown as the Lituus. Napolean's sarcophagus in the Invalides, Paris is a very familiar example of the use of this curve in memorial art. Spirals are, in fact, extremely useful in decorative art of any kind.

Very gradual curves are often difficult to detail. The laying out of the entasis or tapering on a column is a familiar problem of this sort. There are various methods of determining this subtle curve, one practical method, especially suited to columns of a size generally employed in mausoleum design is as follows:

First let it be understood that as a general rule a column-shaft is straight one-third of the way up. Thus the radius of a shaft is the same at a point one-third of the way up as it is at the bottom. But from this one-third point the column tapers, until at the top of the shaft the radius is five-sixths as great as it was at the bottom. These are standard conditions, from which actual design never deviates very greatly.

We lay out our column height then, with sides parallel to the center-line up to the one-third point. From here on the radius will gradually shrink, we know, and it is our purpose now to locate and lay out a series of radii throughout the upper two-thirds of the shaft. (See Figure 7).

To this end we divide the upper two-thirds into several parts—six is a good number—thus locating several levels at which we can lay out our radii.

Now at the one-third point, using the bottom radius, strike a half-circle as shown. The larger-scale sketch in Figure 7 is an enlargement of this part of the process. The top radius will, we know, be five-sixths as great as the bottom radius: five-sixths of the way out from the center line, then. we draw a line parallel to the center-line. Where this new line cuts the semicircle draw a horizontal line—this represents the radius at the top of the shaft as we already know. Now we divide the space between this line and the base-line of the semicircle into as many parts as we divided the upper two-thirds of the shaft. In the illustration the number of parts chosen has been 6.

And now, mopping our brows

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and lighting a fresh cigarette, we come to the climax: for each of the lines just drawn in the semicircle will determine a radius on the shaft. For instance, the base line of the semicircle is the radius of the shaft at the one-third point, where it is already located. The next line up, measuring from center-line to semicircle gives us our radius at the first section above; the second-line, measured the same way, gives us the second, etc.; until, when we reach the top line and the top section, we have the top radius chosen before hand, five-sixths (or thereabouts) of the bottom radius. By this means we have located a number of points along our curve or entasis. The curve itself can, if convenient, be drawn along a flexible steel straight-edge bent so as to conform to the points located. Or if this is difficult or impossible, and the number of points located be 5 or 6 or more, join them with straight lines: the curve is so slight that the angles between line and line will be practically invisible. In fact, the process of cutting the actual stone will efface these angles altogether.

If you have trouble with your furnace, give it one of your cigars and it will probably stop smoking.

A "bonanza" is a hole in the ground owned by a liar.

A flirtation is attention without intention.