MORE FORGING MATH
or
HOW I FOUND HAPPINESS IN AN ELLIPTICAL RELATIONSHIP

by Bob Rummage

From time to time people have asked me how to do something pertaining to their blacksmithing project. Often their question has to do with the math involved in sketching or lay out of their project. In this article I will try to explain some of the basic math used to answer these questions.

One of the most frequently asked questions concerns the ellipse. "I want to make an elliptical coffee table (or mirror), but I don't know how to lay it out. Can you explain now to make an ellipse with given dimensions?" Well, let's examine this problem from the start with a definition:

> Def: An ellipse is a locus of points (a curved line) that is a constant sum of the distances from two fixed points(foci, f) in a plane (flat surface).

Now an ellipse has two diameters - a major diameter(the longer) and a minor diameter(the shorter). The greater the difference between these two diameters, the flatter the ellipse. Note: Conversely, if it were a locus of points from one fixed point the major diameter and minor diameter would be equal and you would have a circle.

The usual problem is to draw an ellipse whose dimensions are given as a length and width. In the case of our coffee table, we want one that is 2 feet by 3 feet. Let's now look at Fig. 1 to visualize what we've just read.

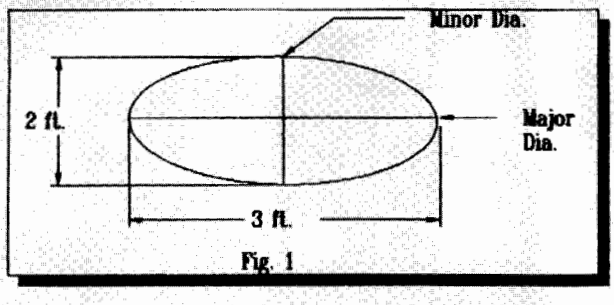

Fig. 1

One of the ways to draw an ellipse is to use the string method. To use the string method you have to know the focal points (f) and half of the major diameter (a) and half the minor diameter (b). See Fig. 2. Perhaps you are now wondering how do you find the focal points (f)? They must be computed algebraically or geometrically. It is not necessary, however, to compute the focal points since the string method is not the way to draw an ellipse in the blacksmith shop. It is too difficult to keep the pencil exactly perpendicular at all times and maintain even string tension (the string will stretch), not to mention it's hard to nail a tack in a metal table top for the focal points! So, how do you do it? It's really simple and accurate if you use the beam trammel method. For a 2 ft. by 3 ft. ellipse take a piece of 1/8 in. by 1/2 in. by 2 ft. flat stock. From one end measure half the major diameter (a) or 18 in. Center punch this measurement and mark it with an (a). From the same end measure half the minor diameter (b) or 12 in., and center punch the measurement and label it (b). Label the edge that you measure from with an (x). Drill 3/16 in. holes where the center punched marks are. These holes are peep sights for the layout that follows. See Fig. 3.

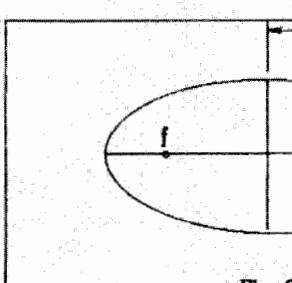

Fig. 2

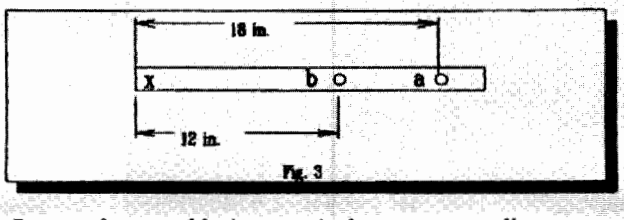

Fig. 3

On your layout table (or paper), draw your two diameters (major - 3 ft. and minor - 2 ft.). Be sure that they are perpendicular! Now place the trammel so hole (a) is on any part of the vertical axis and hole (b) is on the horizontal axis. The end of the trammel marked with (x) is a point on the curved line of the ellipse. So, whenever hole (a) is on any part of the vertical axis and hole (b) is aligned on the horizontal axis, the edge marked (x) will be on the curve of the ellipse.

Move the trammel along the two axes, marking as many points as necessary and connect the points with a smooth line. See Fig. 4.

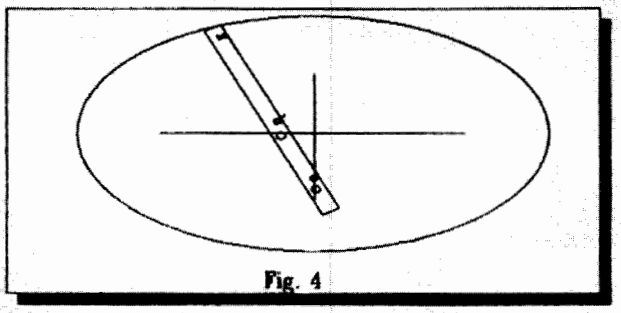
Fig. 4

Since an ellipse should be symmetrical, I only do half the layout and duplicate when making the piece. I also join the two pieces at the ends of the vertical axis since the curve transition is curved less.

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