BarleyCorn Math

by Bill Ooms

This is for barleycorns on the top of a flat surface such as the lid of a box. The math details are on the next page for those who are interested. It's easiest to just use a spreadsheet.

A typical situation is that you know how far from the center of the lid you want a band of barleycorns, you know the approximate width of the band (i.e. the diameter circle cut by the ECF), and want a certain visual appearance based on the number of barleycorns within each cut circle. You can get an approximate number of circles that have to be cut by using the first set of equations. The reason it's approximate is that you'll typically won't end up with a exact integer (or you'll want to use something close to it depending on what numbers you have on your index wheels).

For example, suppose you want a band of barleycorns with the center of the band 1" from the center of a box lid (D=1.0), the width of the band about 0.6" (which is the diameter of each cut circle, so R=0.3), and have 4 barleycorns within each cut circle (M=4). Then you end up with N=41.2. Of course, you must have an integer number.

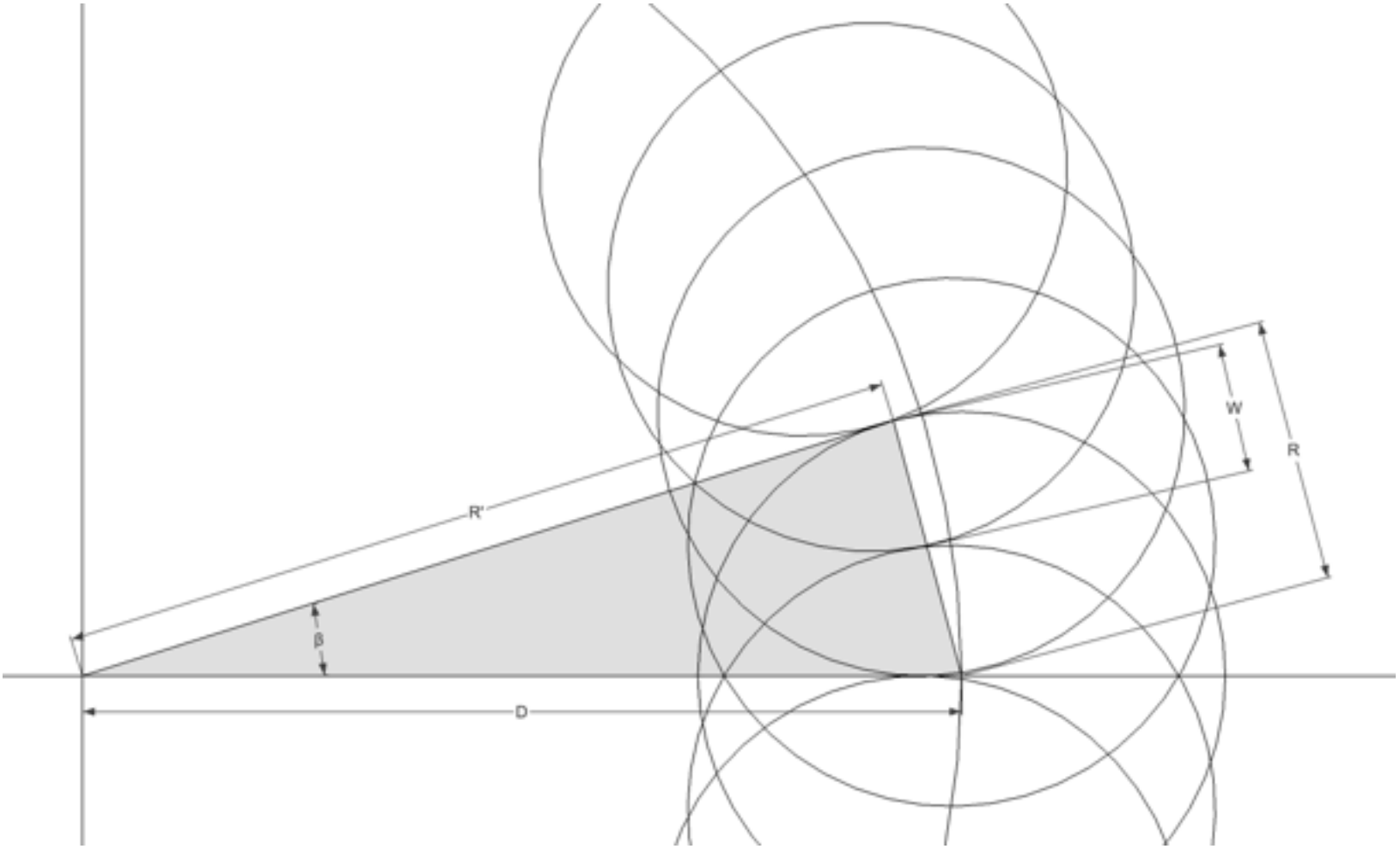
Perhaps you have an index wheel with 48 positions on it. Then you can adjust the radius of the cutter using the second set of formulas and calculate a cutter radius of 0.259". I've found it's best to use just a few thousandths smaller or the cutter may touch the adjacent barleycorn leaving an undesired extra facet.

The last thing you might want to know is how deep to make the cuts. You can do this by trial-and-error or you can calculate the depth of cut. For example, a cutter with a 120 degree angle will require a cut depth of 0.036".

D = Distance from center to midpoint of band
R = Radius of eccentric cutter (half the diameter of the cut circle)
M = number of barleycorns within each circle
N = total number of barleycorns (number of cuts, positions on index wheel)

Given D, R, M --> calculate approximate N:
angle $\beta = \sin^{-1}(R / D)$
$N = 180 * M / \beta$

Given D, N, M --> calculate R:
angle $\beta = 180 * M / N$
$R = D * \sin(\beta)$



Given the angle of the cutter --> calculate cut depth:
angle α = angle of cutter tip
R' = Distance to barleycorn midpoint = $D * \cos(\beta)$
W = width of barleycorn = $2 * \pi * R' / N$
d = depth of cut = $(W / 2) / \tan(\alpha / 2)$