Spheres

This method of making a sphere uses the property that a circle fits nicely in an octagon. It is relatively easy to turn an octagon profile and there is a consistent relationship between the length of the side of an octagon and the diameter of a circle as shown in a separate PDF file (Diagram and Templates). Once you have an octagon profile there is very little wood that needs to be removed to make a sphere. In the Diagram and Templates file I have included a set of templates of various sizes which can be used to layout the critical dimensions, or one can use the formulas a sphere of any diameter.

I will describe making a 3 inch sphere. To practice, it is convenient to start with a piece of 4X4 fir.

Between centers rough a 5 inch length of 4x4 into a 3 inch cylinder. Using the 3 inch sphere template, mark the sphere center and ends and the width of the octagon side on the cylinder as shown in Figure 1. Now part down at each end of the sphere so that the resulting cylinder is just the diameter (This diameter is just the distance between the two blue lines) of the side of the octagon, see Figure 2. Now cut at a 45 degree angle from the blue line to the base of the cylinders at each end, see Figure 3.

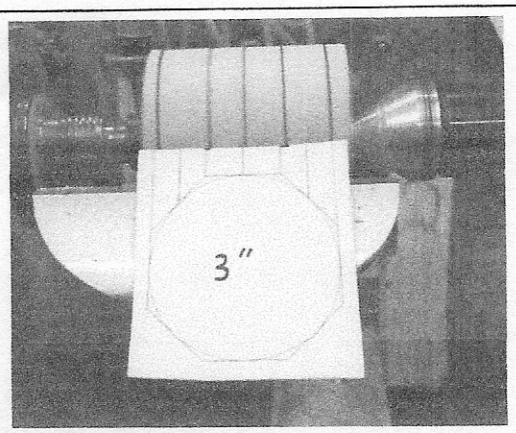


Figure 1

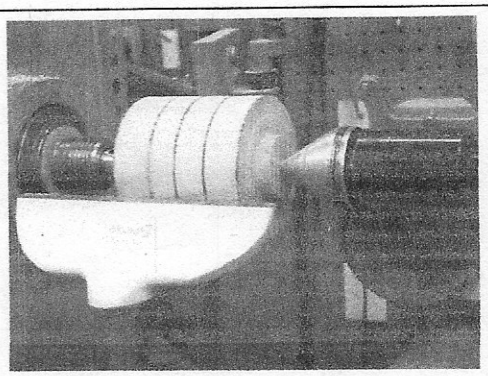


Figure 2

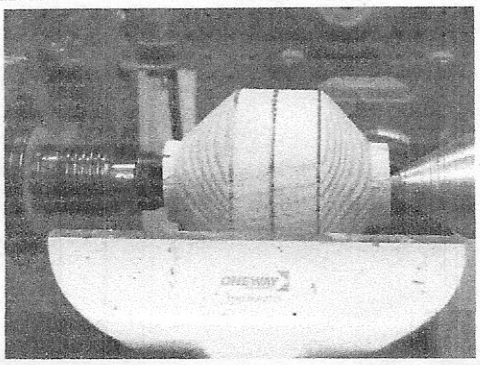


Figure 3

You now have the outline of the octagon. Now use the template to make the center line of the two 45 degree sides, see Figure 4. These two lines and the center line (shown in black) lie on the surface of the sphere. Now make small cuts between the two black lines to shape the upper left and right sides of the sphere, see Figure 5. Do not remove the black lines, they lie on the surface of the sphere. You can now reduce the diameter of the tenons on each end and make small cuts to shape the lower portion of each end of the sphere, see Figure 6. Remove the sphere and trim off the ends, see Figure 7.

If you do a good job here this will be a reasonable sphere and may suit your purposes, e.g. a decorative garden sphere. I did not do a great job with this one so we will proceed to refine the shape.

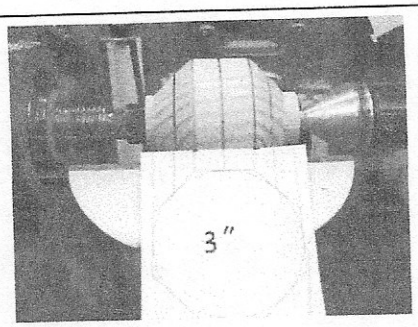


Figure 4

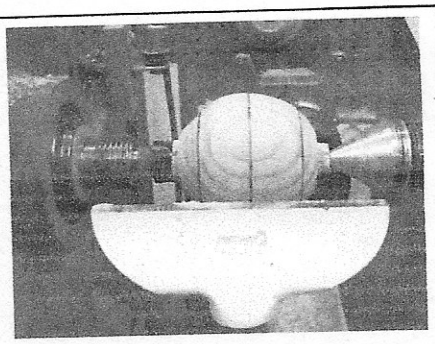


Figure 5

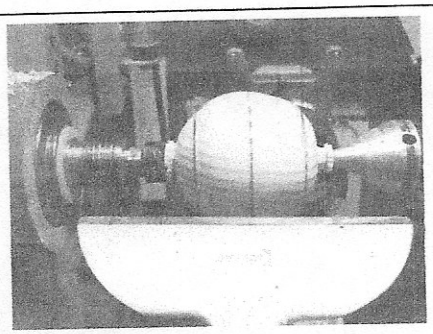


Figure 6

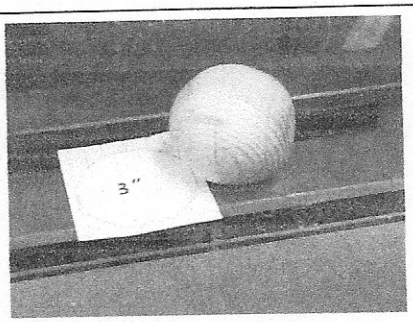


Figure 7

Refine the Sphere Shape

You will need to make two wooden cup centers so the sphere can be held between centers while being rotated on various axis. These are shown in Figures 8A & 8B. Use a relatively hard wood, I used dry madrone. For the drive center, I cut a #2 mores taper on one end and make a shallow cup about 1 inch in diameter on the other. I glued a piece of rubber mat in the cup to prevent marring the sphere. For the tail stock, I made an adapter that fits over the tail stock cup center.

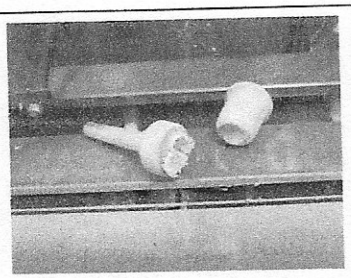


Figure 8A

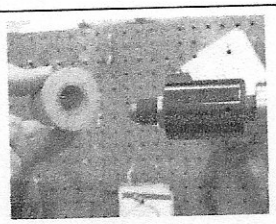


Figure 8B

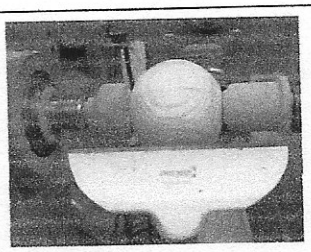


Figure 9

Mount the sphere with the center line parallel with the bed and passing through the centers of the two cup centers as shown in Figure 9. The ends that were formally parallel with the lathe bed should now be perpendicular to the lathe bed. When you turn the lathe on you will see a ghost image just outside a solid sphere image, see Figure 10. A white background enhances the ghost image.

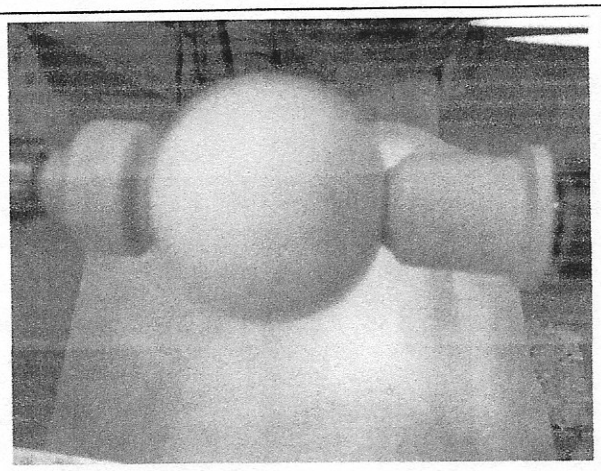


Figure 10

The objective is to make small cuts and cut away the ghost image. I find it works best to concentrate primarily on the center half of the sphere. When this is relatively smooth draw a center line on the sphere, remove it and now align this center line parallel with the bed and proceed to again remove the ghost image. It usually takes 3 to 4 rotations to get the sphere relatively smooth. It's critical to keep the axis through the sphere center going through the center of the drive centers, if the sphere is way off center after a rotation try to realign it to make it run truer. After each rotation the sphere ghost should be smaller and the sphere truer. Once the sphere is relatively smooth, it does not need to be exact, start sanding with 120 grit. Rotate the sphere on 3-4 random axis while sanding. Then switch to finer grits and continue rotating the sphere. Figure 11 shows the finished sphere. I started with a 3 inch sphere and final diameter was between 2.82 and 2.85 inches. The better job one does in making the original sphere; the less wood is lost from the final sphere.

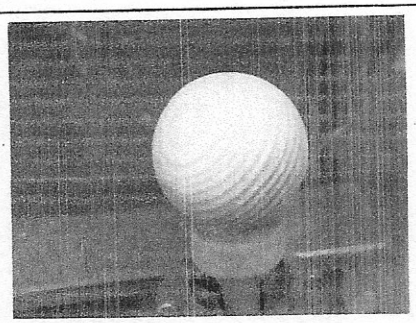


Figure 11

Decorating a Sphere

In order to hold the sphere for decorating, a jam chuck must be made. The one that I made is shown in Figure 12. I used a green piece of fir log mounted end grain. You must have a hole through the chuck so you can use a knockout bar to remove the sphere from the chuck, without the hole you might end up with a sphere stuck into the end of a chuck. Note the plunger I built into the chuck because my knockout bar was too short to reach the sphere. The plunger also provides a soft surface which will not mar the sphere surface. The chuck diameter should be slightly less than the sphere diameter. Sneak up on the diameter until the sphere fits snuggly in the chuck. When I mount the sphere in the chuck I use the tail support cup center to as a backup support, Figure 13.

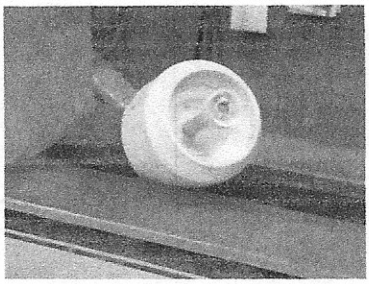


Figure 12

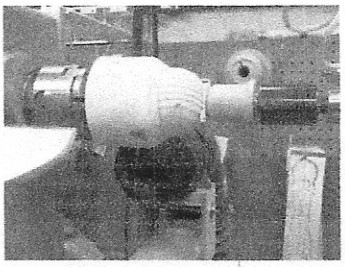


Figure 13

I used a point tool to place two v-groves on either side of the sphere center line, then rounded the edges over to make a bead, Figure 14. Now rotate the sphere and repeat the procedure along a different center line, Figures 15 and 16.

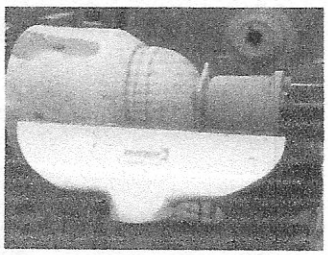


Figure 14

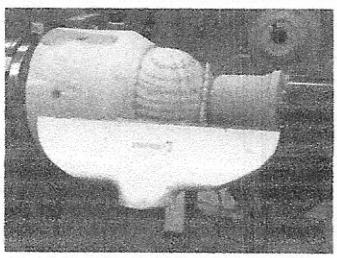


Figure 15

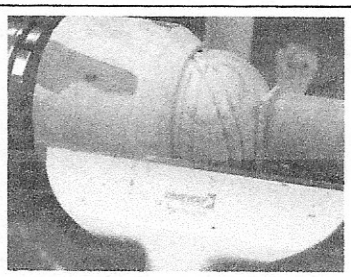


Figure 16

Reorient the sphere to center a hole for the a votive candle and use a 1 ½ forstner bit to drill the hole. Figure 17. Now reverse the sphere to flatten the bottom. It is tricky getting the sphere oriented so the bottom is parallel with the top. I find that if I make four light pencil marks on the sphere where it is held in the chuck before I reverse it I can use these marks to keep the base parallel with the top. Two of these marks have been highlighted in Figure 18 which shows the flattened bottom.

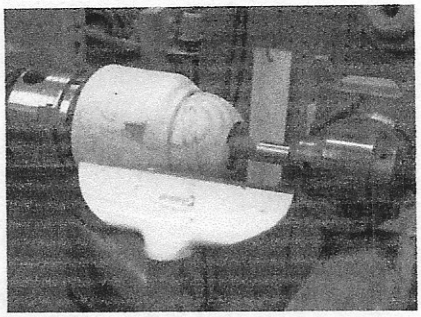


Figure 17

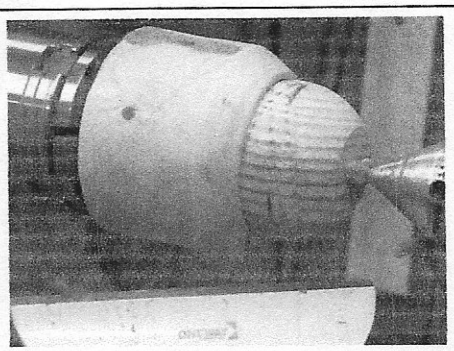
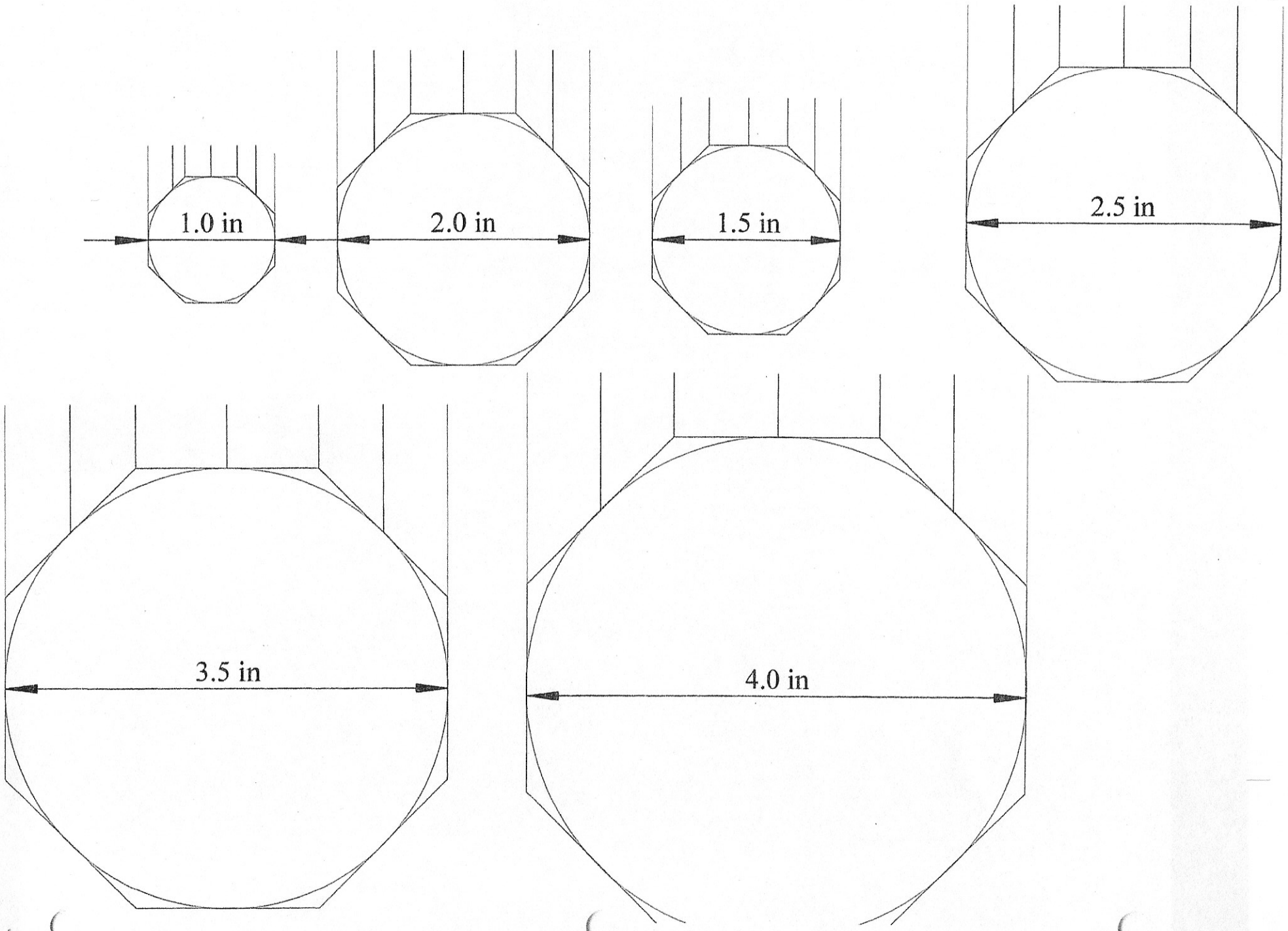
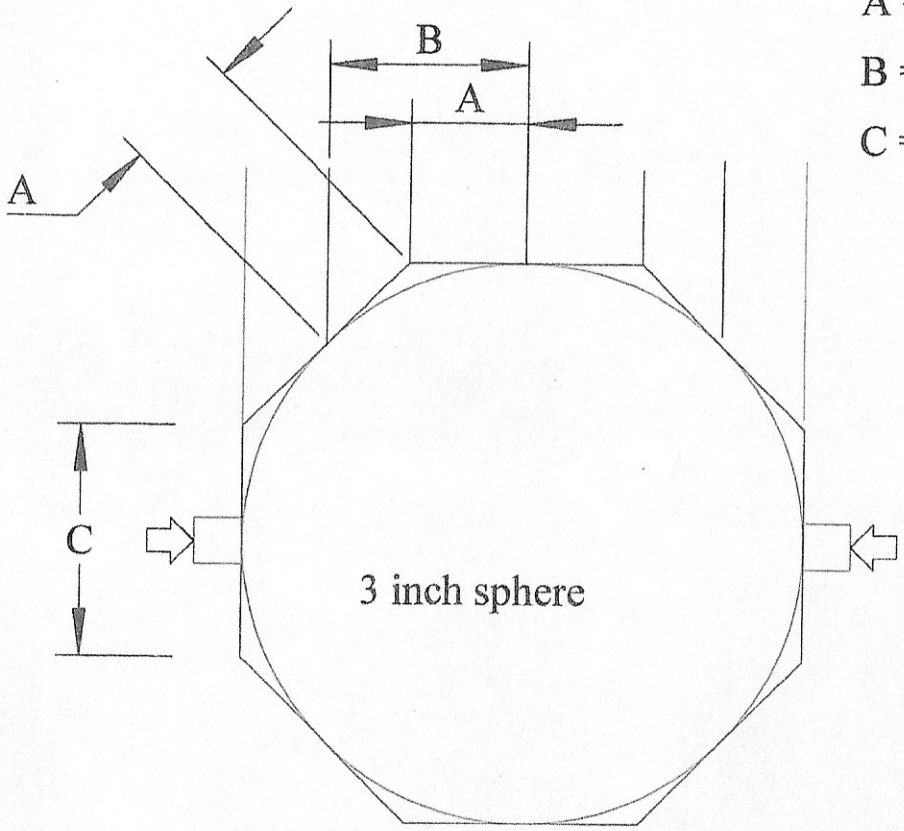


Figure 18

Sand each decoration as it is finished. Then finish (I used wipe-on poly) and enjoy your creation.


1.0 in
2.0 in
1.5 in
2.5 in
3.5 in
4.0 in

For 3 inch sphere



A = D x 0.207 = 0.621 in

B = D x 0.353 = 1.059 in

C = D x 0.414 = 1.242 in

Other Sphere Diameters			
Dia.	A	B	C
1	.207	.353	.414
1.5	.310	.530	.621
2	.414	.706	.828
2.5	.518	.882	1.035
3.5	.725	1.225	1.449
4	.828	1.412	1.656
4.5	.931	1.59	1.863