# Super Dome Chuck

## by Bill Ooms

After meeting Cynthia Gibson at the Utah Symposium last May, I started thinking about how I could cut flower patterns anywhere on the surface of a vase or other shape. I would have to be able to position the work in any position which meant offsetting from the axis of the lathe, tilting to a point tangental to the surface, and rotating the work on its own axis.

The other major design consideration was that it had to be really light weight. The spindle of my ornamental lathe is driven by a relatively low torque stepper motor, so I can't have several pounds of heavy chuck swinging around.

**Holding the work:**

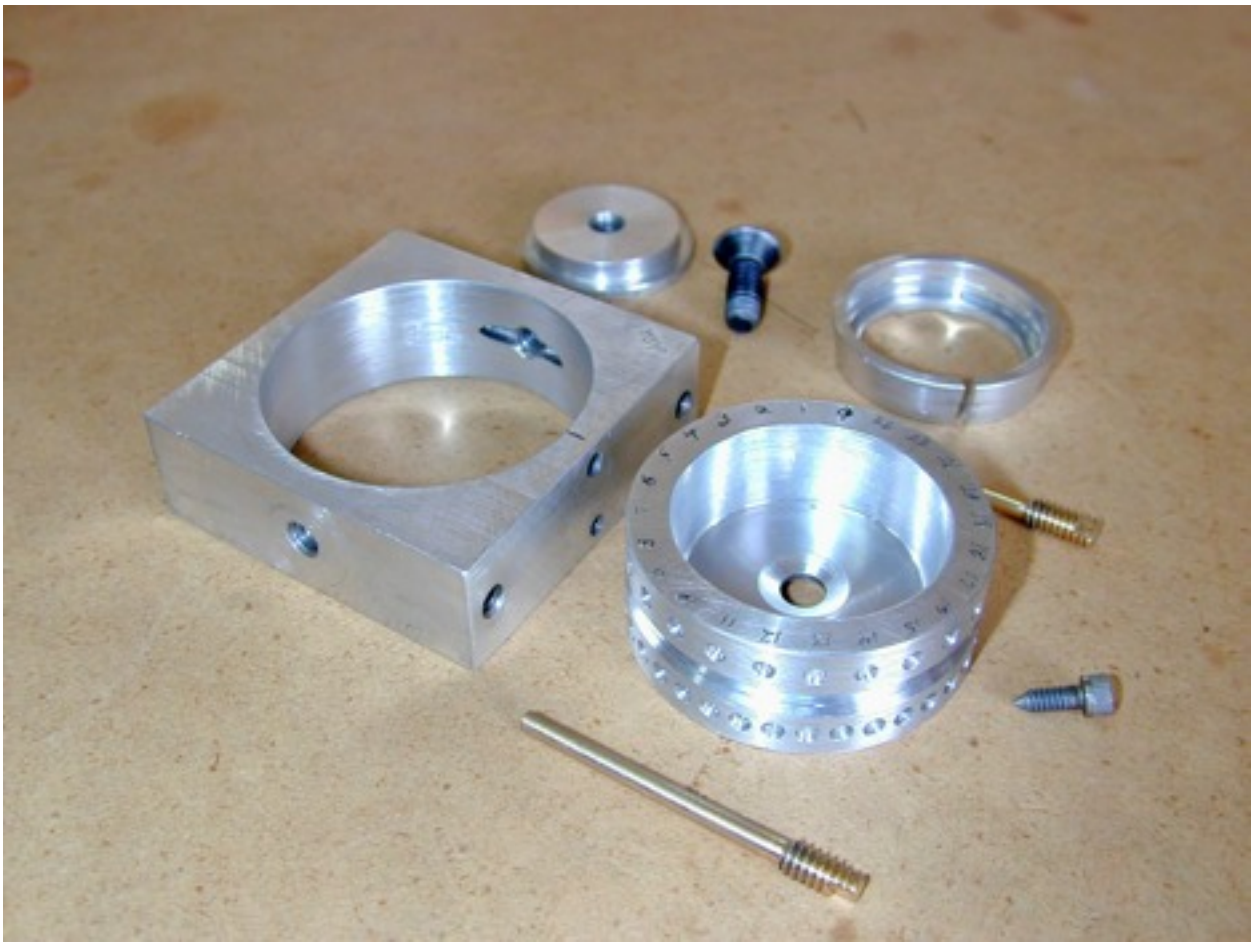
I really needed a very small and light weight method of holding the work piece. I like the accuracy of 5C collets, but they are really quite long. So I went with what I'll call a "split ring collet". The interior of the ring is tapered like the jaws of a regular dovetail chuck. The exterior of the ring is tapered at 8 degrees like other collets. The split in the ring allows it to be compressed as it's drawn into the holder by a disk having a screw hole in the center (see photo 1).

I made the interior of the ring 1.3” diameter which is the smallest tenon that my Vicmarc VM100 chuck can grab. This size also works well on my metal lathes (which I use for wood). I tested the split collet concept by attaching it to a MT2 taper. It seems to hold the work well enough (although for roughing out and hollowing I would still use my Vicmarc chuck).

**Tilt and Rotation:**

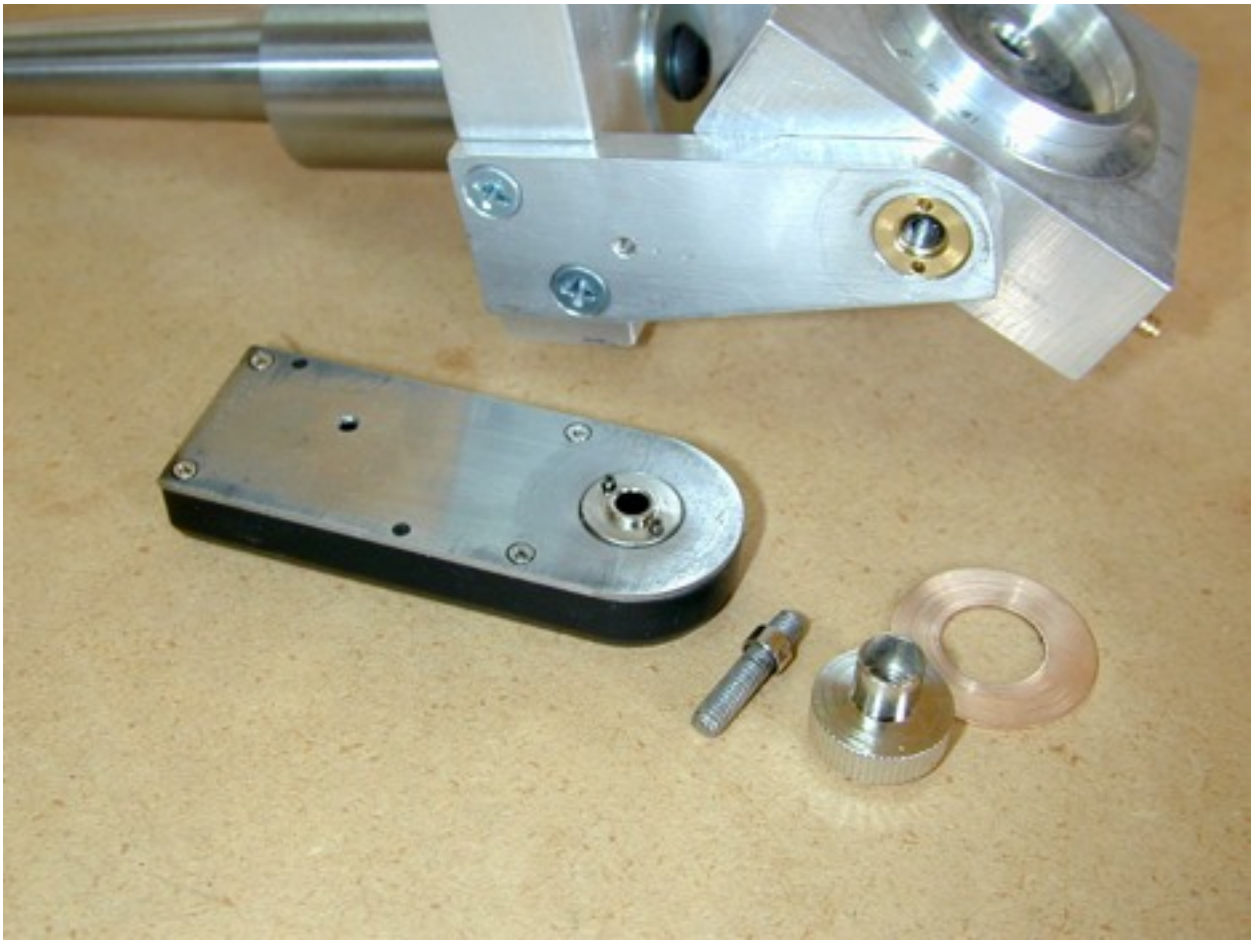
I visited John Lea and saw one of Al Collin’s dome chucks (featured on the cover of the last OTI newsletter). I liked some of Al’s design concepts and evolved them further to meet my own needs over the next several months.

Rather than use a worm gear for rotation, I decided to use indexing. The collet holder has two different rings of tapered holes -- one ring with 24 holes and another with 35 holes. This gives me the ability to have 2, 3, 4, 5, 6, 7, 8, 12, 24, 35 positions. The collet holder also has a V groove around the exterior which keeps it held in the tilting block with two small brass rods -- one on either side. (see photo 2)



The tilting block pivots on the two side arms. In use, I quickly discovered that setting the angle accurately was the most important factor in cutting a well balanced pattern. To solve this problem, I bought a digital protractor on eBay (iGauging 7” for $15.95) and

took the guts out of it. It attaches to the shaft from the tilting block by means of two small roll pins and the body/display is attached onto the side arm. (see photo 3)



**Offset:**

I used a 20tpi lead screw with the nut attached to the end of a blank MT2 taper (LittleMachineShop #2394 $12.95). I find that fixtures with MT2 tapers are the best way to move work from one machine to the other with minimal error. (see photo 4)

**Using the chuck:**

When making boxes I like using a threaded joint. This provides a great way to hold work. I take a piece of scrap hard maple and put a 1.3” diameter tenon on one end and thread the other end to match the threads on the work piece.

For any piece of work, I always digitize the curve of the piece so that I can accurately plan where to make cuts and view the simulated cuts with my Rose Engine Surface simulator software (RESurface software available on my web site). The modified version that I use in the shop also generates the g-code which drives my computerized ornamental lathe.

I made some major modifications to the software to be able to visualize offset cuts made around the perimeter of a piece. The software gives me the tilt angle as well as the offset from top dead center of the piece. I measure the distance from top dead center with a calipers and make a small mark. Then I set the tilt angle with the digital protractor and lock it tight. Finally, I adjust the offset so that the tip of my UCF cutter lines up with the mark.

After cutting the pattern, rotate the piece in the chuck to the next index detent. I always touch off the tip of my cutter and reset the Z-axis zero before making the next cut. (see photo 5)

The bubble on the side of the frame is to let me accurately set the zero for the spindle rotation. Go to the Dollar Store and pick up a $1 plastic level. Take it apart and you'll have 3 of these little bubbles that you can attach to any fixture with hot melt glue (thanks to Dewey Garrett for that tip).

**Next Time:**

Although I planned the size to clear the bed of my OT lathe, the addition of the crank handle was an after thought. I have to remove it when there is zero offset or it hits the bed of the lathe.

Other than that, I'm pretty happy with the rigidity of the chuck. The weight is very light and poses no problem for my spindle stepper motor.