more WOODTURNING
the newspaper for turners

Volume X, Number 3 March-April 2005 Price — $3.00

Making a Longworth Chuck

Photo 1. A Chuck with mounted Cole Jaws.

by Garrett Lambert

A few years ago, I came across an article describing something called the Longworth chuck, a self-contained device that enables a turner to reverse an otherwise-finished bowl and hold it on the lathe to cut off the foot or tenon that holds it in a scroll chuck. The process leaves a professionally finished bowl with no visible evidence of how the turner had mounted it.

There are, of course, other methods including age-old jam chucks - pieces of scrap wood held in the scroll chuck and turned with a recess to tightly fit around the mouth of a bowl, or vacuum chucks that, as the name suggests, use a pump to hold the bowl by suction. However, the most common modern approach was, and probably still is, a set of Cole Jaws as shown in the photo above. They are popular because they can be not only be purchased, but are easy to make in the shop. Unfortunately, all three methods require time that could be spent more fruitfully, and setting up Cole jaws is undoubtedly the most costly. To mount the jaws to the chuck, 8 screws have to be withdrawn to remove whatever jaws are already installed, and then replaced to attach the Cole jaws. Because the scroll chucks have a relatively limited amount of travel, the 8 buttons on the jaws then have to be unscrewed and re-installed to fit them to whatever bowl is to be cut. Of course, they then have to be dismounted and the original scroll chuck jaws re-installed to move on to the next turning. That totals 64 separate operations, and doesn't take into account time spent scrabbling in the shavings for dropped screws.

Needless to say, the idea of a self-contained scrolling set of Cole jaws was really appealing.

However the instructions for fabricating the Longworth Chuck were incomplete and seemed quite complicated. After setting the article aside, I soon forgot about it. After coming across it again a few weeks ago and deciding to "just do it", I was surprised at how simple it proved to be. The cost was a couple of pieces of scrap and $5 for four 5/8" cane tips and four 3/4" chair tips (buy rubber not vinyl) plus four machine screws (1/4" x 21/2") and a couple of hours in the shop.

Photo 2. This photo shows the Author's new Longworth chuck holding a bowl for turning the foot.

Photo 3. This photo shows the Author's Longworth Chuck holding a small bowl. The chuck is very versatile.

The chuck has only two major parts, a pair of disks that rotate against each other. Their maximum size is twice the distance between the centre of the headstock and the bed. If you turn outboard, the theoretical maximum size then becomes the distance from the spindle to the floor. That's a very big bowl and, in my view, safety would require many more jaws and extremely low rotation speeds.

Note: *For an outboard rig of any size, the curves should be routed in the opposite direction from those described here.*

Some preliminary comments:

Mr. Leslie Longworth of Australia invented this chuck in the late 1980s and died soon after publishing only the first of what had been intended to be a two part article on it. More info is available at http://www.fholder.com/Woodturning/chuck.htm, including that from which I made the version above.

Caution: *Be very, very careful of the spinning jaws on the front and the wing nuts on the back. They can hurt. A lot.*

With only four jaws, this first chuck I made isn't designed for heavy side pressure, so take easy cuts or add more jaws. I intend to do this by interspersing 4 shorter arcs between the existing 4 long ones.

For smaller work, 4 jaws are adequate, but as the above photo shows, in this case a better choice than the cane tips suggested in the original article are white rubber chair tips. They are flat conical sections that are almost identical to the buttons on commercial Cole Jaws. Just remove the wood screws that

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come already inserted and use an awl to pierce through the existing holes to accept the 1/4" machine screws. (They'll stretch over the screw threads so don't enlarge the holes.) However, just as with Cole Jaws buttons, it is absolutely essential to place a flat steel washer between each button and its screw head. Otherwise, the tips can flex enough to release the workpiece under cutting pressure. The washers provide essential compression strength and rigidity.

Since it would be so easy to make a pair of chucks at the same time, one large with 8 jaws and one small with 4 is probably a better choice than a single one-size-fits-all.

Time to Build.

(Note: It's important to do the following steps in order presented. Believe me.)

My lathe has an 8" swing, so I maximized my chuck at just under 16" in diameter, and recycled some scraps of 3/4" MDF for the back disk and 1/4" Baltic Birch for the front disk.

The bandsaw circle jig shown in Photo 5 was made from an article in Canadian Woodworking. It quickly turned them into disks.

Photo 4. Recycled scraps of 3/4" MDF and 1/4" Birch Plywood to use in making the disks.

Photo 5. Circle cutting jig makes cutting the disks easy.

Photo 5a. The circles cut to size.

First, attach a faceplate to the back disk (3/4" PDF disk), tack the front disk to the back disk, mount them on the lathe, and true up the edge. With a chuck in the tailstock, drill a small hole through the exact centre of both disks. Draw a registration line across the edges in case you have to re-align them later if necessary.

You will notice two things in Photo 6. First, that it shows the routed arcs because I mounted my "faceplate" after routing. That mis-step was a major mistake, and I wasted a lot of time to subsequently get it centred exactly. Second, it's obviously a nut rather than a faceplate. Some time ago, I found a source for some 1-1/4" x 8 TPI nuts and bought a bunch. Although this is a standard headstock thread, it's an unusual size in fasteners because pipe thread is 1-1/4" x 7. I've been using nuts in various ways to make faceplates and vacuum chucks, and one works very nicely in this application, too.

Photo 6. This photo shows the routed arcs on the reverse side of the chuck base plate and the nut that was used instead of a faceplate.

Choose the poorer face of the front disk, and find or make a compass equal to the task of drawing the largest of three circles. The smallest is the diameter of your faceplate plus a bit if you're making the small chuck, or plus about 5"-6" if you're making the large chuck, too. (To add arcs/jaws, divide the centre ring into either six or eight equal segments depending on how many you want.) The biggest circle is about 1" in from the outer edge of the disk, and the middle is, in fact, centered between the other two. Draw perpendicular lines through the disk's centre.

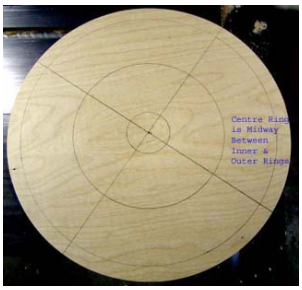

Photo 7. This shot shows the three circles drawn on the disk and the horizontal and vertical lines.

Carefully dimple the intersections of the perpendiculars with the middle ring...

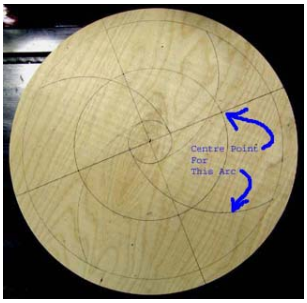

Photo 8. This photo shows where to make an indent to locate the compass point to mark the arcs.

... and use the dimples to centre your compass to draw arcs from the outer ring to the tangent of the inner ring. (These arcs will ensure you make no mistakes while routing.) Make sure the tacks holding the two disks together are well away from the arcs, and mount the disk sandwich horizontally in a vise clamped on the faceplate nut.

If you don't already have one, make a circle cutting base for your router. (See Photo 9.) I made mine

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More Woodturning is published monthly except April and October for $30.00 per year by Fred and Mildred Holder at 19805 Fales Road, Snohomish, WA 98296. Mailing Address is P. O. Box 2168, Snohomish WA 98291-2168. Telephone: (360) 668-0976, E-Mail: woodturner@fholder.com, WEB Page URL: http://www.fholder.com/ . Periodicals Postage paid at Snohomish, Washington and at additional mailing office. *More Woodturning* is sold by subscription at $30.00 for one year and at a single copy price of $3.00 plus 0.75 postage and handling. Editorial material submitted for publication must be accompanied by a stamped, self-addressed envelope to ensure return if it is not accepted for use. *More Woodtunring* uses materials from many sources and many authors, the views expressed herein are, therefore, those of the authors and not necessarily those of the Publishers. *More Woodturning* receives a number of products each year for evaluation, but accepts no responsibility for return of those products unless specifically requested to do so, in advance!

POSTMASTER: Send address changes to *More Woodturning,* P. O. Box 2168, Snohomish WA 98291-2168.

USPS No. 015387
ISSN 10939490

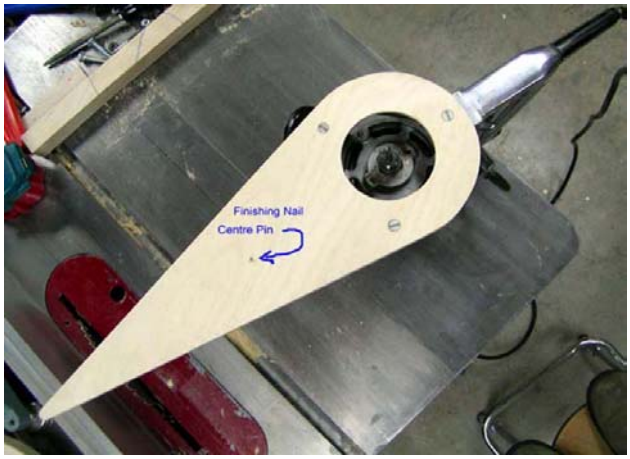

Photo 9. The Author's Circle Cutting base for his router.

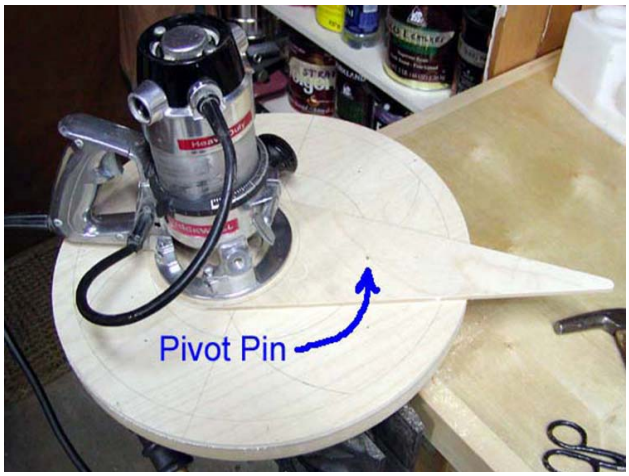

Photo 10. This photo shows the router mounted on the circle cutting base being used to route the arcs in the two disks at the same time.

Photo 11. The arcs have been routed.

out of another scrap of 1/4" Baltic Birch, and made the interior hole 3" in diameter to ensure good vision since all start and stop points are done by eye. Drill the dimpled centre points to accept whatever you use as a pin-mine is just a small finishing nail-and carefully rout the arcs through both disks. (Routing MDF makes a lot of dust so be prepared!) Photo 10 shows the router being used to cut an arc.

The best way to start a cut is to be an inch or so away from an end point, plunge the bit into the work, back up to the start point and then move forward to the end point. With a solid carbide spiral bit, only two passes were required to go through both disks (1") but any 1/4" straight bit should do.

The result will look something like Photo 11, varying according to the diameter of the smallest ring and the number of arcs.

Now drill some 3/4" finger holes around the perimeter of the disk sandwich, as shown in Photo 12. These make

Photo 12. Drilling the Finger Holes near the rim of the disks.

it much easier to counter-rotate the disks to set the jaws, and just as with the jaws, experience shows that six or eight would be more convenient than just four.

After separating the disks, mount the back disk on the lathe, true up the face, and use some sandpaper to ease the sharp rear edge.

Find a #10 1" round head screw, preferably with an unthreaded shoulder. This screw serves mainly as an axle, so enlarge the centre hole in the front disk just enough so that the disk can rotate snugly on the shoulder of the screw. Enlarge the centre hole in the back disk to the inside diameter of the screw's thread.

Now, reverse the front disk and place it against the back disk so that the routed arcs cross each other. Drive the screw into the centre holes. Back off just enough to allow the front disk to rotate.

Make the jaws. I turned a piece of dowel to 5/8" diameter, cut it to length to fit inside each cane tip, and drilled 1/4" holes lengthwise through the top of the tip and the dowel. With the machine screws passing through the arcs, wing nuts and washers on the rear of the back disk make for quick and easy adjustment.

In Photo 13, I've inserted just the machine screws. When the nuts are loose, the front disk rotates very easily and synchronizes the movement of the four jaws from the innermost position to the outermost with no effort at all, and can be snugged up at any point to make the whole unit very secure.

In use, as shown in Photo 2 and 3, it's quite flexible for big (12" bowl) and small (3.5" hollow form) pieces. It's also a good chuck for truing the glued-up rings used in segmented turning.

And best of all, no more having to manage 32 screwing operations to mount and dismount the jaws on my Super Nova 2, and adjust the eight buttons on the Cole Jaws every time I want to reverse a bowl that I cannot vacuum chuck.

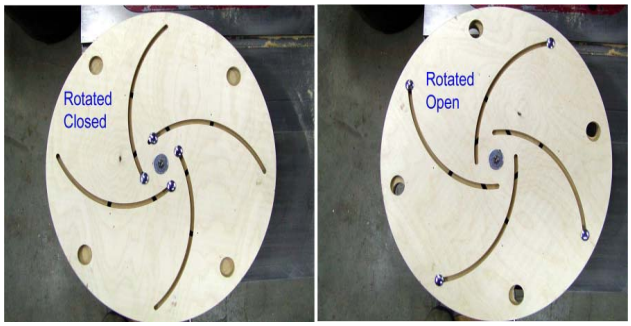

Photo 13. Shows how the routed channels move the bolts in and out as the disks are rotated.