

Turning Bowls?

Make a Longworth Chuck

by **Garrett Lambert**
Victoria, BC, Canada

Several years ago I came across an article describing something called the Longworth Chuck. It purported to reverse an otherwise-finished bowl and hold it on the lathe to turn off the foot or tenon, thus leaving a professionally finished bowl with no visible evidence of how the turner had mounted it.

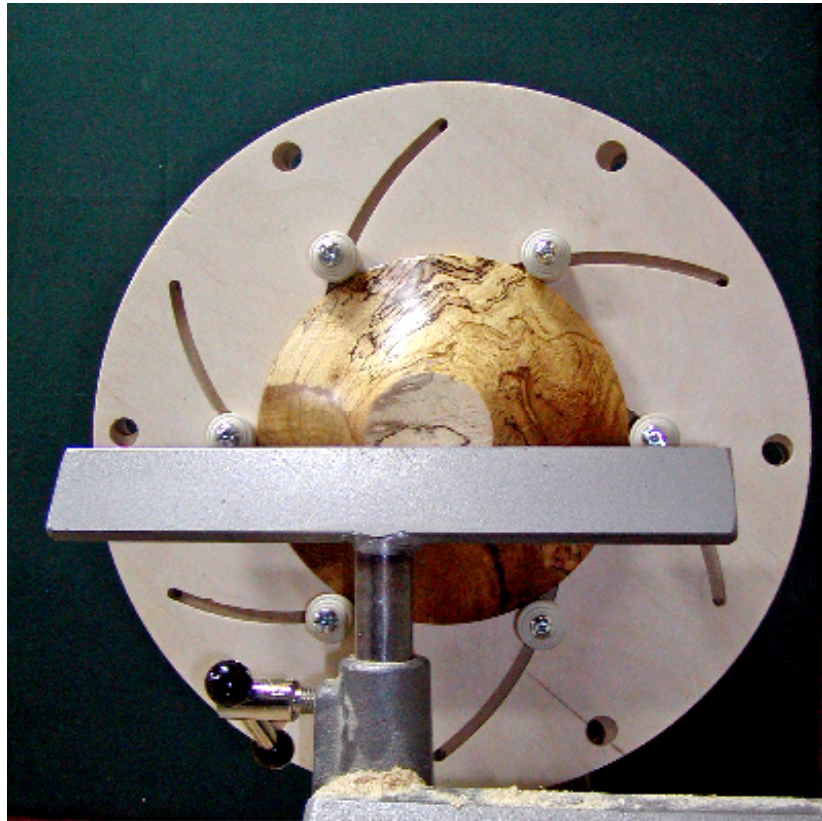
There are, of course, other methods including age-old jam chucks (a piece of scrap wood on a face plate turned with a recess to tightly fit around the mouth of a bowl), or vacuum chucks that, as the name suggests, use a pump to hold the bowl by suction. However, the most common modern approach was, and probably still is, a set of Cole Jaws as per the photo below.

They are popular because they can be not only be purchased, but are easy to make in the shop. Unfortunately, all three methods require set-up time that could be spent more fruitfully. Setting up Cole jaws is undoubtedly the most time-consuming. 8 screws have to be withdrawn to remove the jaws already in the scroll chuck, and then replaced to mount the Cole jaws' plates. Because 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 the bowl. Of course, the plates then have to be dismantled and the original scroll chuck jaws re-installed to move on to the next turning. That totals 48 separate operations, and doesn't take into account time spent scrabbling in the shavings for dropped screws.



Although the idea of a set of self-contained scrolling Cole jaws was appealing, the instructions for fabricating this new chuck were incomplete and seemed complicated. Leslie Longworth, the Australian inventor, wrote only the first of what was to be two descriptive articles sometime in the late 1980's, and sadly passed away before writing the second. I soon forgot about it.

After coming across it again after another session with the Cole jaws, I decided to “just do it”, and after a couple of hours in the shop, was pleasantly surprised at how simple it proved to be. The cost was negligible.

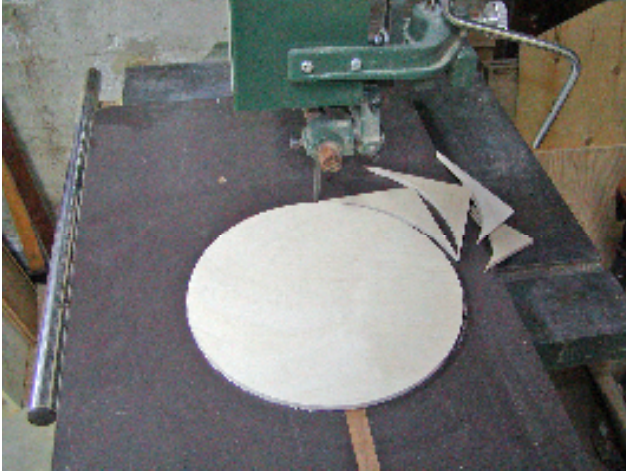


The chuck is just a pair of counter-rotating disks. Their maximum radius is a smidgeon less than the distance between the lathe’s headstock and bed. Outboard turners could size chucks to accommodate still larger work, but should consider increasing the thickness of the materials. One further *outboard* consideration is that the routed arcs should be cut in the *opposite* direction from those described below.

Some preliminary comments before starting to build:

1. Longworth’s design shows only 4 jaws that are not well suited to handle side pressure. I discovered that it’s just as easy to make a far safer 6 jaw chuck.
2. It's crucial to do the following steps in precise order. Trust me on this.
3. The spinning jaws and wing nuts can hurt. A lot.

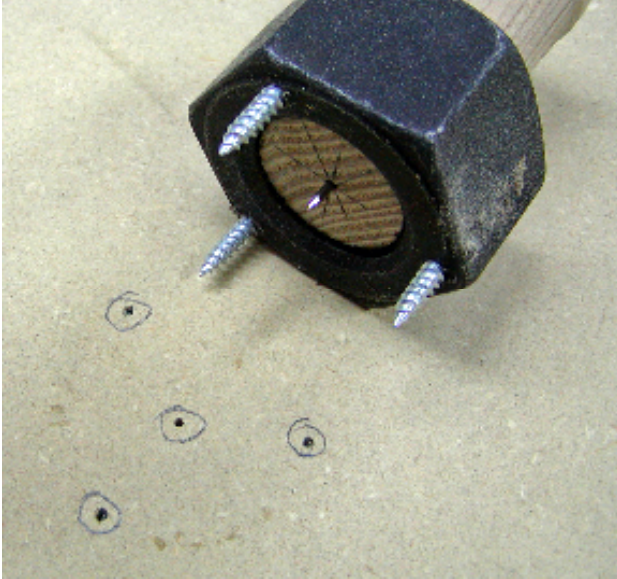
Start by cutting matching disks of $\frac{3}{4}$ " MDF for the back and $\frac{1}{4}$ " Baltic Birch for the front. Other materials might work, but I know these stay flat.



The next step is to choose how to mount the chuck on the lathe. You could turn a hardwood flange to fit your scroll chuck's jaws, and glue and screw it to the MDF disk. However, a self-mounting chuck is a real convenience, so adding a small faceplate works well. If, like me, you prefer to find thrifty alternatives when possible, a nut with the same thread as the lathe's headstock works well. (I've also made a "nut" out of a piece of hardwood using a tap the size of my headstock.)

Headstocks on smaller lathes generally use standard pipe thread, and nuts are readily available. Unfortunately, for those with $1\frac{1}{4}$ " headstocks, the standard $1\frac{1}{4}$ " pipe thread is 7 TPI, so you'll have to go to a specialty supplier for $1\frac{1}{4}$ " x 8 TPI nuts. I bought several and have been using them to make a variety of faceplates. To mount them, I drill and countersink 3 holes through the face of the nut – the metal is soft - and use wood screws to fasten it. (Size the holes so the screws fit snugly.) A small nut has a further advantage in that the diameter of the nut/faceplate establishes the limit of inward travel for the buttons.

However, nut manufacturers have no need to ensure the faces are perfectly coplanar. All of mine have been off just a little, inducing wobble in the chuck. The fix is not difficult. You can put the nut on the headstock, and use a sanding disk in the tailstock to face it. Alternatively, mount the nut on the MDF disk centered as well as possible. Although this positioning is not critical, I turned a plug that will just squeeze through the nut, and drove a small finishing nail into its center. By dimpling the center of the disk, the nail will ensure the nut is centered. Tapping the 3 screws with a hammer marks the pilot holes.



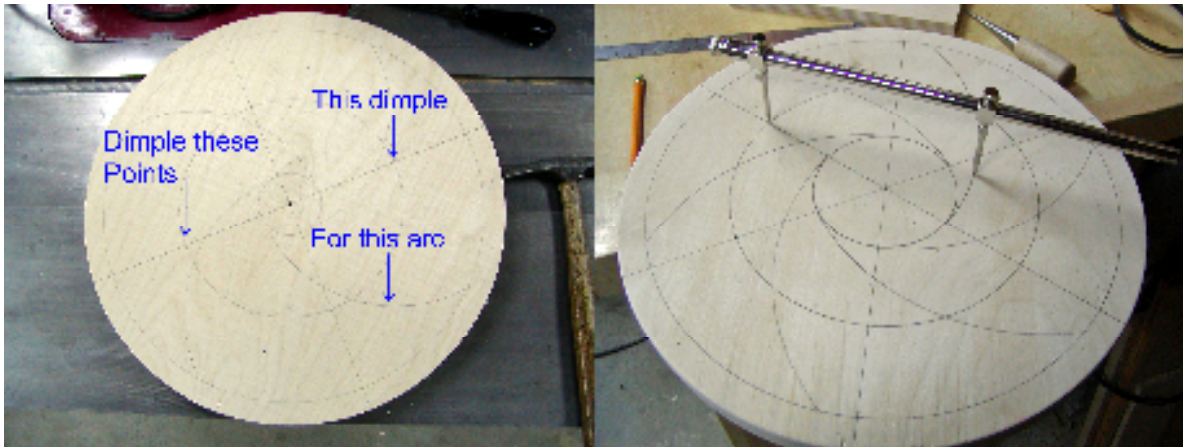
If your nut still induces wobble, you can reduce it to almost nothing by shimming one side of the nut with a single business card. Eliminate the rest by facing the *rear* disk.

Whichever mounting method you choose, tack the front disk to the back disk with 4 small finishing nails set about $\frac{1}{2}$ " in from the rim. Mount the assembly on the lathe, true up the rim, and round the edges.

Now for ***the most crucial step***: use a chuck in the tailstock to drill a $\frac{1}{16}$ " hole through the exact centre of both disks. This hole will ensure the chuck runs true after final assembly.

Remove the chuck from the lathe, and clamp it in a vise. Draw three circles: the smallest is the diameter of your faceplate/nut plus about an inch; the largest is the diameter of the disk less about an inch; and the middle circle is centered exactly between the other two.

At this point, if you're making a chuck larger than about 14", you have to decide how many jaws you want. I've made both, and while 4 are adequate, I recommend 6. The photo below shows the layouts for a 4 jaw and a 6 jaw chuck. For 4 jaws, draw 2 perpendicular lines through the centre of the $\frac{1}{16}$ " hole you drilled earlier. For 6 jaws, draw 3 lines at 60° angles. I used drafting triangles.



Small 4 jaw chuck.

Large 6 jaw chuck

Dimple the intersections of the diameter lines with the middle ring, and then use the dimples to draw arcs from the outer ring to the tangent of the inner ring. (Drawing these arcs helps avoid mistakes while routing.) Keep the compass setting to use in making the router jig.

I made a circle cutting base - photo below - for my router out of $\frac{1}{4}$ " Baltic Birch. The hole is 3" in diameter for good vision, since all start and stop points are by eye. With a $\frac{1}{4}$ " bit in a router, set the compass pin against the edge of the bit closest to the wing extension of the router base, and draw a short arc on the wing. Drill a $\frac{1}{16}$ " hole through that arc and insert a finishing nail as a pivot pin. Push the nail through so that about $\frac{1}{2}$ " protrudes and set it in a dimple. Push the jig flat and hammer the nail in at least $\frac{1}{8}$ " to ensure the jig can't slip out of position.

Routing the arcs is so easy that one can become a tad complacent and make a ruinous mistake... Begin a cut by plunging the bit partially into the work about an inch away from an outside start point, back it up to that point -cautiously, for this is a climbing cut - and then pull forward to the end point. A solid carbide bit required only two gentle passes to go through both disks. Repeat until all arcs are cut.



The result will look like this.

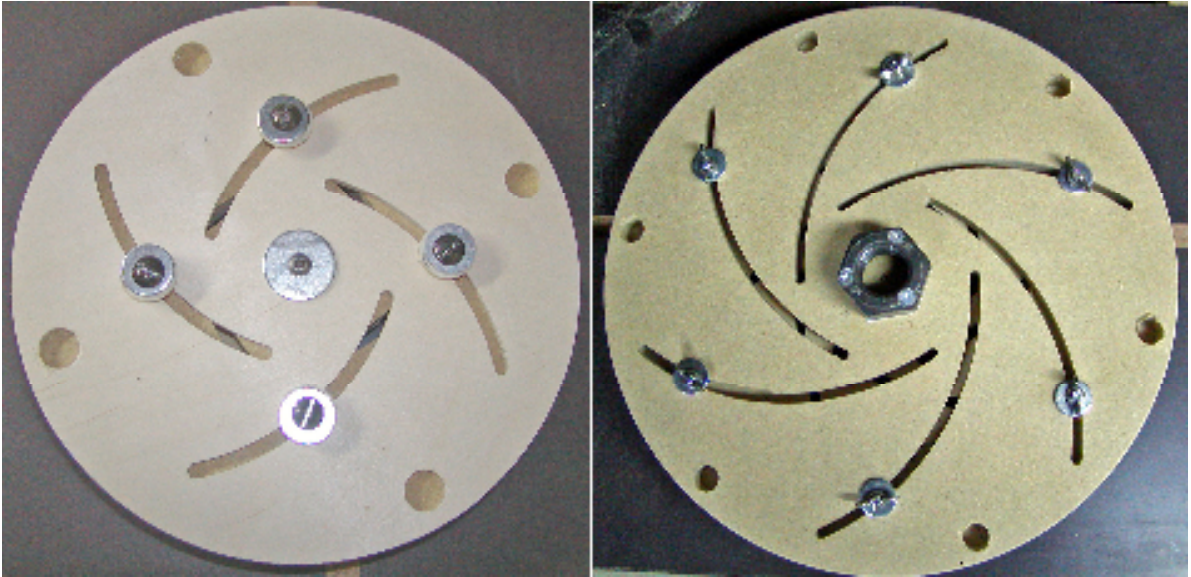


Now drill finger holes (about 1" d) around the perimeter of the disk sandwich. Four for a small chuck, and six for a large one. These provide the means to counter-rotate the disks to set the jaws.

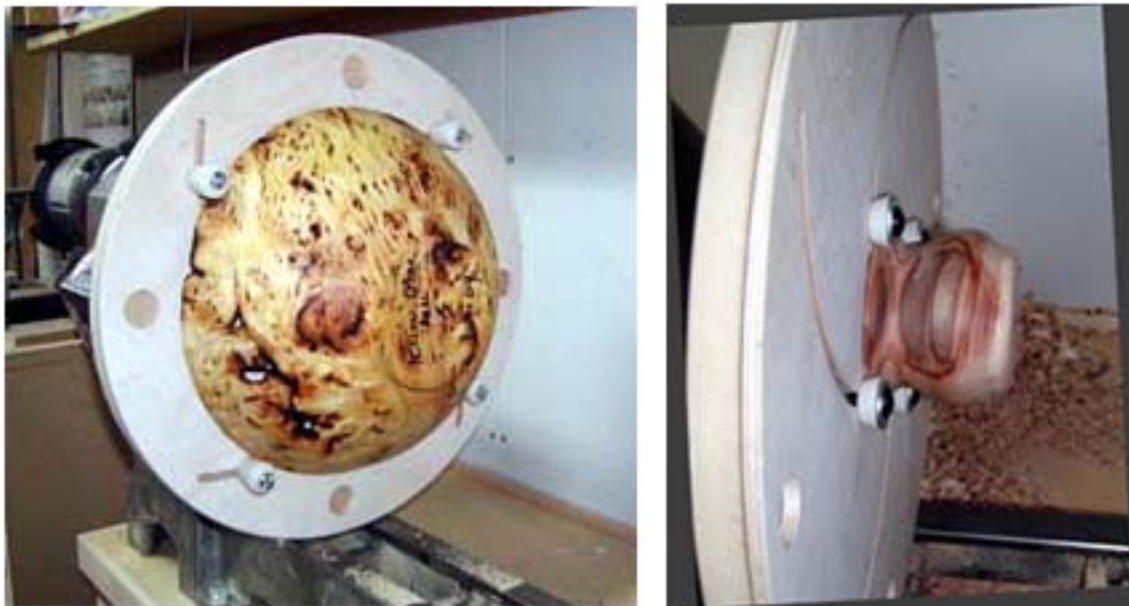
A #10 1" round head wood screw with an unthreaded shoulder serves as an axle, so enlarge the centre hole in the front disk just enough for it to fit snugly on the shoulder of the screw. Enlarge the centre hole in the back disk to the inside diameter of the screw's thread.

Sand both faces of both disks smooth, taking particular care to get rid of any fuzz on the edges of the routed arcs. Apply a couple of well-buffed coats of paste wax to the face of the MDF disk, and to the face of the Baltic Birch disk that has the drawing on it. This will ease rotation. Now, **reverse** the front disk and place it against the back disk so that the routed arcs cross. Drive in the axle screw, and back it off just enough to permit the front disk to rotate. This completes the chuck body.

Now for the jaws. This photo shows the buttons on the front of a 10" 4 jaw chuck and the wing nuts on the rear of a 15" 6 jaw chuck.



These photos show the two styles of “jaw” with the smaller ones being quite similar to those on Cole Jaws.



The jaws are made from “rubber leg tips” available from hardware and housewares stores. (Do not buy the vinyl versions. They do not grip.) The 5/8” sleeve type is best for large chucks, and also provides more reach. However, the screw-on button type is the choice for smaller models.

The sleeve tips require wooden inserts, so turn a dowel to 5/8" diameter, and cut lengths to fit inside each sleeve. Drill 1/4" holes lengthwise through the top of the rubber tip and the dowel. With 2 1/2 "x 1/4" machine screws inserted through the dowels and the arcs, wing nuts and washers on the rear of the back disk make for quick and easy adjustment.

This photo provides detail for the construction of the larger jaws.



The buttons require washers (smaller in diameter than the buttons) under the screw heads to compress the buttons against the workpiece.

Rotate the disks until the outer ends of the arcs overlap. Insert the jaws and place the washers and wing nuts loosely on the back side. Rotate the front disk again, and watch how it perfectly synchronizes all 4 or 6 jaws as they move in and out. Place a reversed bowl against the disk face, rotate the jaws until they press against the outer – or inner – edge of the bowl, tighten the wing nuts, and the whole unit is secure.

Retire your Cole Jaws and jam chucks.