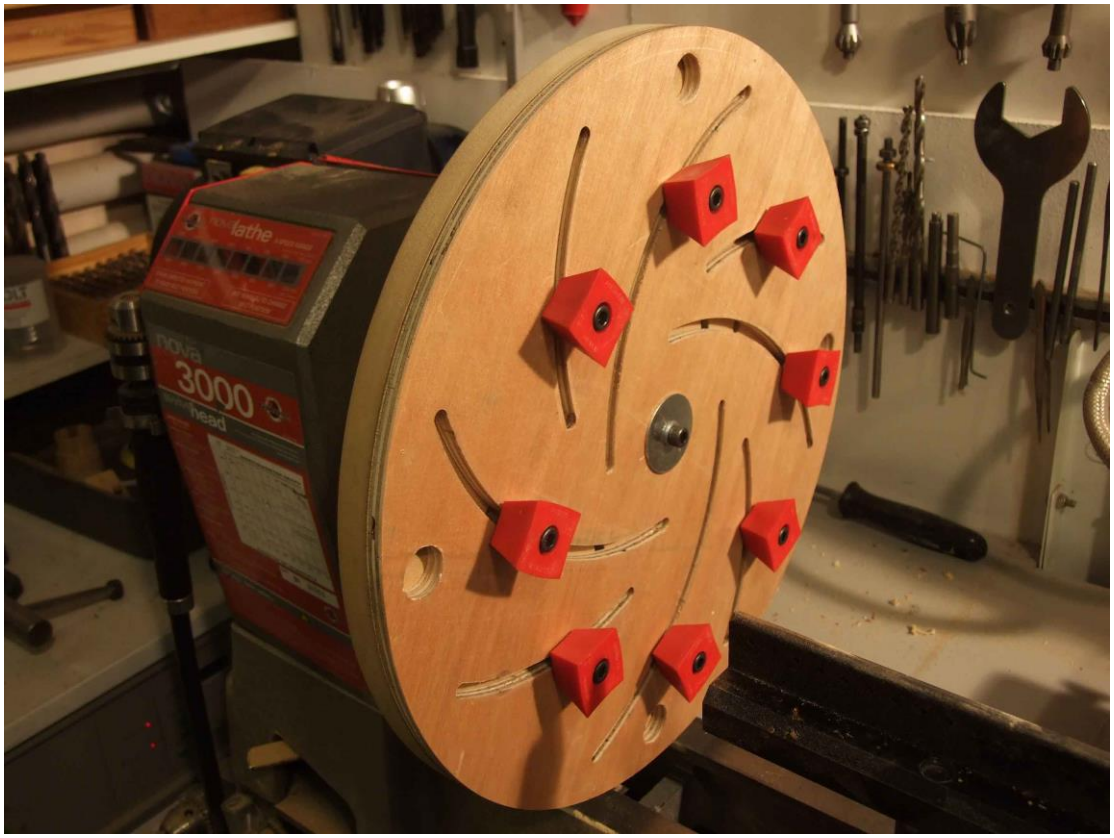
An Improved Longworth Chuck
(And a cheap one made from odds and ends)

Walter Hall 02 December 2009



What is a Longworth chuck and why do I want to make one?

I first became aware of the “Longworth” chuck designed by the late Mr Longworth of the Hunter Valley Woodturning Club, New South Wales, Australia, when I was looking for an inexpensive way of reversing bowls on the lathe without the inconvenience of removing the dovetail jaws from my chuck and replacing them with Cole jaws, then adjusting the buttons on the Cole jaws to fit the bowl, an operation that involves a minimum of sixteen fastening or unfastening operations using an Allen key, thirty two if you need to move the buttons. Of course I could just make up jam chucks in the time honoured way, but having to make an individual jam chuck for every bowl soon becomes a bit of a chore if, like me, you never make the same size of bowl twice.

Research on the internet threw up a couple of articles describing the making of Longworth chucks including one from Woodturning Magazine Issue No3 in 1991 and another from More Woodturning in 2005. Whilst both of these articles provided instructions that would enable the manufacture of a chuck, I felt that the chucks produced fell some way short of what I wanted in a number of areas.

Although reference was made to chucks with eight slots, both of the articles resulted in four slot chucks, insufficient in my opinion to provide a secure hold on a large bowl.

Various options were suggested for the rubber buttons including walking stick rubbers, wine corks and doorstops, all of them intended to reduce cost, but none in my opinion affording a grip equivalent to well designed commercially made buttons.

The buttons were invariably held in place by bolts and wing nuts, exposing the user to revolving metal parts which I felt could all too easily cause injury.

The hub or axle of the chucks relied upon the use of a woodscrew upon which the outer part of the chuck revolved. Even with my limited knowledge of engineering I could see that this was not an ideal solution as any later adjustment would rely upon the grip of the woodscrew in the body of the chuck.

Designing the improved Chuck

Armed with the two articles and determined to produce an improved version of the chuck I set about the making of a prototype to the original design as a means of ascertaining whether the improvements I planned would be feasible. This simple version cost me next to nothing, being made from materials I had available in the workshop or was able to obtain very cheaply. I have included a few photographs of this version at the end of the article for those who simple wish to build a version that will do the job for minimum outlay. The making process is not described as it is in essence the same as that for the improved chuck, but without the addition of the extra slots.

It immediately became clear from the prototype that building a chuck with eight full length slots would result in a structure that was significantly weakened near the hub of the chuck and that the smallest size of bowl to be held would be restricted by the need to accommodate eight buttons at the smallest setting, so I decided to incorporate four full length slots and four shorter ones so that four buttons could be used for small bowls and a further four added to the shorter slots when a larger item was to be held.

Using the prototype I tested buttons from Axminster and Vicmarc along with some of the cheaper options and decided that the Vicmarc buttons, which have a square format with a concave curve on two faces and a convex curve on the other two afforded the best grip on the bowl and determined that these would be used on my improved design. Of the cheap options, cut down demijohn bungs worked best and were used on the “cheapskate’s” prototype version.

My initial thought to resolve the safety issue of spinning wing nuts was to provide some kind of guarding, but it soon became apparent that any structure to restrict access would also add considerable inconvenience when tightening the buttons and would restrict the maximum movement of the

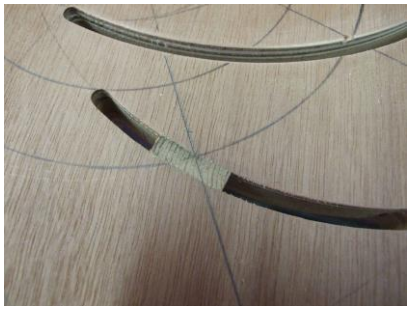
components thus limiting the maximum bowl size that could be held in the chuck. I decided instead to use small (22mm dia.) thumbscrew knobs to replace the wing nuts. These might still give your knuckles a rap if you get in the way of them but they are less likely to take a chunk out of your finger. The bolt heads on the face of the chuck were not a problem with the Vicmarc or Axminster buttons as they were recessed into the face, and I added this feature to the cheaper version by boring a suitable recess in the face of the demijohn bungs with a forstner bit.

The prototype used a No 10 round headed woodscrew for an “axle” but in the improved version this was replaced with an M6 cap head screw and locking nut with large “penny” washers beneath the heads thus allowing easier and more reliable adjustment.

Making the chuck

Making both the prototype and the improved version was a relatively simple process. The prototype was made in an afternoon and the improved version, including taking and uploading the photographs to my computer took less than a day.

The making process is described in the following step by step series of photographs. It is important that the steps are followed in order, for example attempting to fit and centre the hub after cutting the slots is not to be recommended.

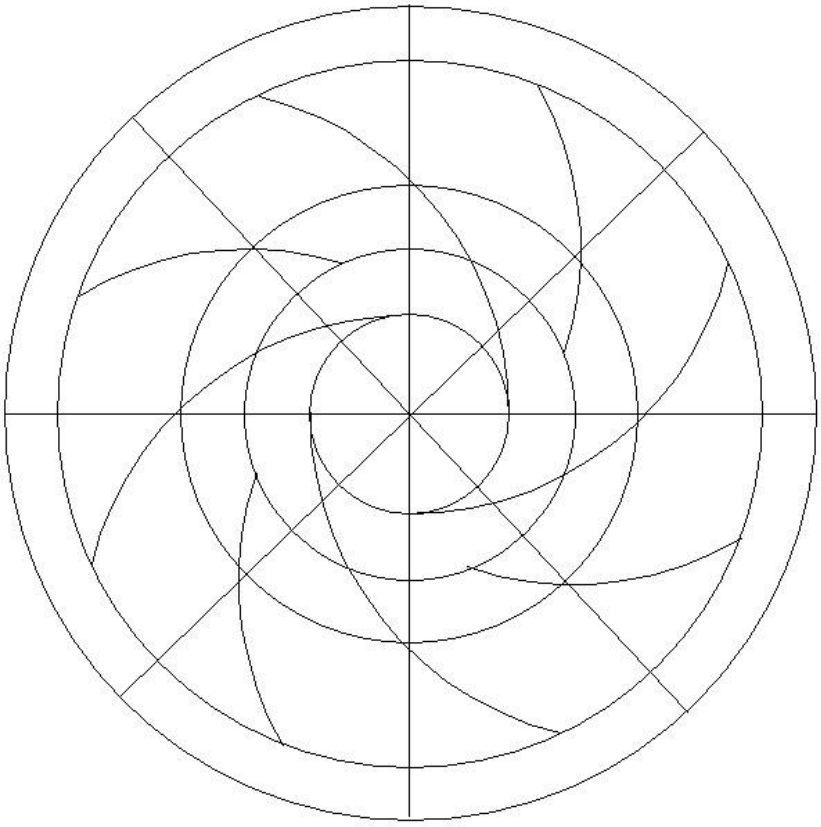


It is also important to give some thought when setting out to the location of the pivot points for the router. When I came to cut the last slot I found I had a slot where the pivot point should be and had to improvise with a softwood wedge in the slot. Cutting to the left of the scribed line rather than centring the router cutter on it would have avoided this problem.

Apart from basic tools such as screwdrivers and appropriately sized Allen keys and spanners or sockets you will need a protractor, trammel or large compass (or a set of dividers with a pencil taped to one leg as I used) and a router fitted with a 6mm cutter and a suitable circle cutting jig to cut the slots. The initial discs can either be cut on a bandsaw or using the router.

Components required are suitably sized pieces of good quality 9mm plywood and 15mm MDF large enough to cut the discs (which can be made to any size suited to the swing of your lathe), a suitable backplate to attach to the lathe spindle for which purpose an old faceplate is probably the best, a suitable set of buttons from Vicmarc, Axminster or similar, nine 6mm x 50mm cap head bolts, eighteen 6mm washers, ten 6mm penny washers, one 6mm Nyloc type locking nut, eight small thumbscrew knobs (or wing nuts if you must) and suitable woodscrews to attach the faceplate to the body of the chuck.

Layout Drawing



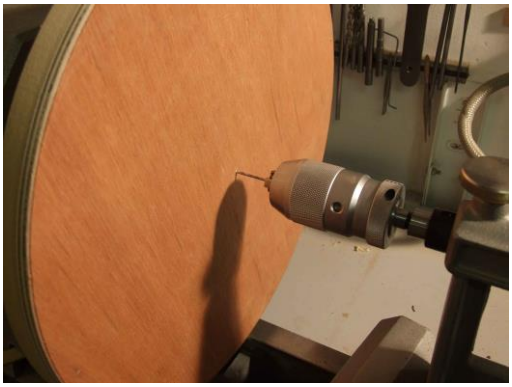
Step by step instructions

(Guards and dust extraction removed for clarity. Always wear respiratory protection when working with MDF)

1. Using a router fitted with a 6mm straight bit and a suitable circle cutting jig, cut discs from the plywood and mdf to a size appropriate to the swing of your lathe. (This can also be done on the bandsaw)

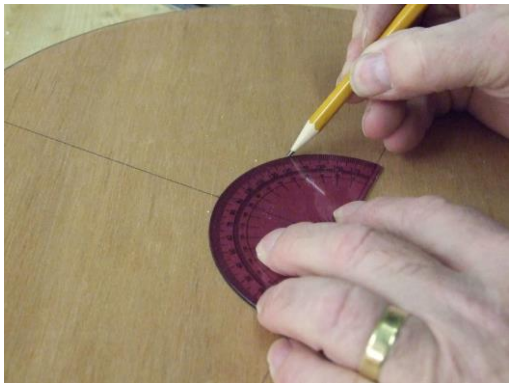
2.Pin the two discs together using panel pins (within 20mm of the edges to avoid getting in the way when cutting the slots), find the centre and mount the faceplate that will be use to attach the chuck to the lathe.

3. Mount the assembly on the lathe and true up the edge of the discs.



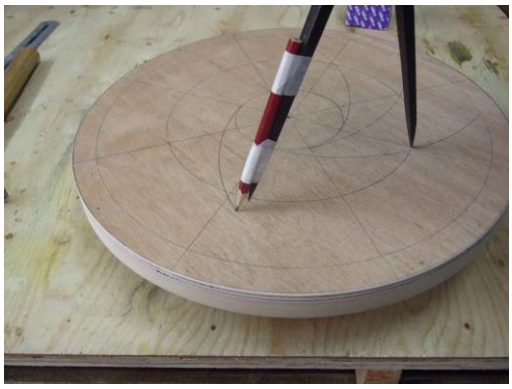
4. With a chuck mounted in the tailstock drill a small, 1.5mm – 2mm pilot hole to mark the centre

5. Mark a line across the diameter of the discs.

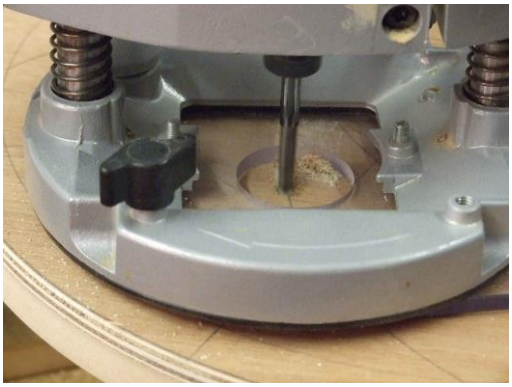


6. Mark diameters at 45°and 90° to the first.

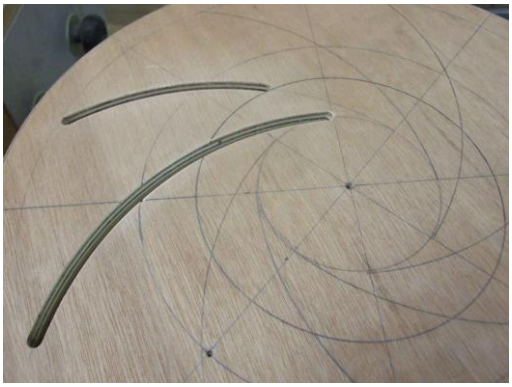
7. Draw three circles, the first slightly greater than the size of the faceplate, the second 20mm from the edge of the disc and the third half way between.



8. With the point of the compass centred at the points where the middle circle and the diameters intersect draw arcs tangent to the inner circle to a point where they reach the outer circle.

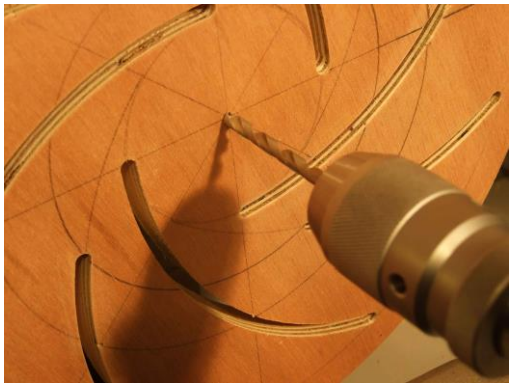


9. With the pivot point of the router centred on the same points as used to mark out, cut a slot the full length of the drawn arc. (Take shallow cuts to avoid putting excessive stress on the 6mm bit.)

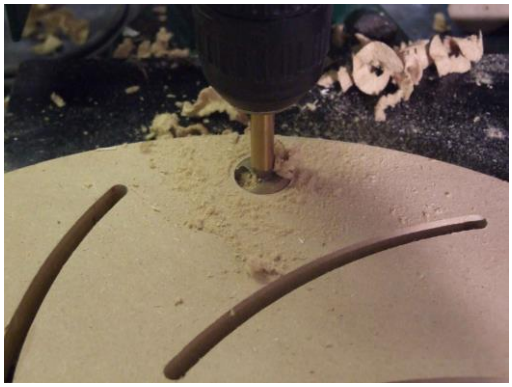


10. The next slot should stop half way between the middle and centre circles. (Marking a fourth circle will make this easier to judge)

11. Continue in this way until all the slots have been cut.



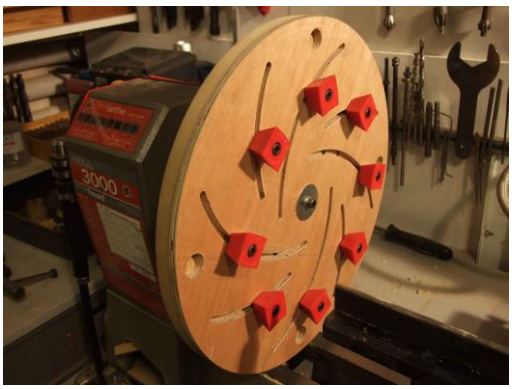
12. Remount the assembly on the lathe and drill a 6mm hole right through for the axle bolt.



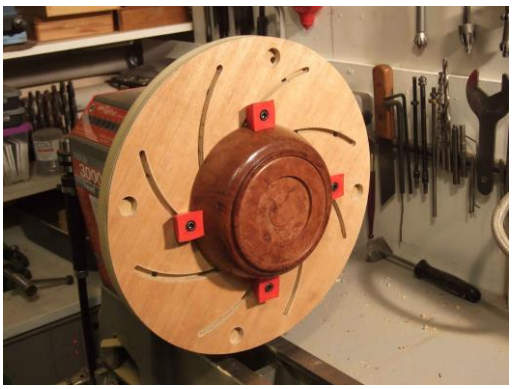
13. With a pillar drill and forstner bit drill finger holes through both discs 20 mm from the edge at four points around the perimeter.

14. Separate the two discs and remove the panel pins. Reverse the front disk and place it against the back disk so that the routed arcs cross each other. Fit the axle bolt and adjust so the discs move easily.

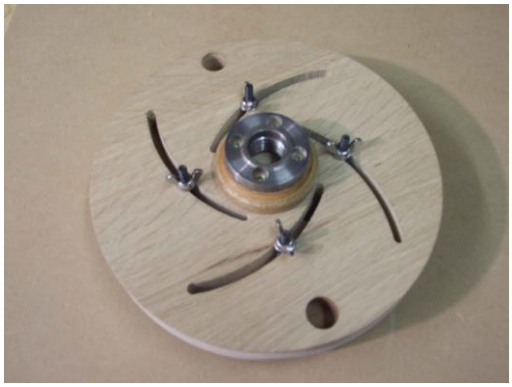
15. Fit the rubber buttons using the 6mm x 50mm cap head bolts, thumb screws and washers. Placing a washer between each rubber and the face of the chuck will enable them to slide more easily



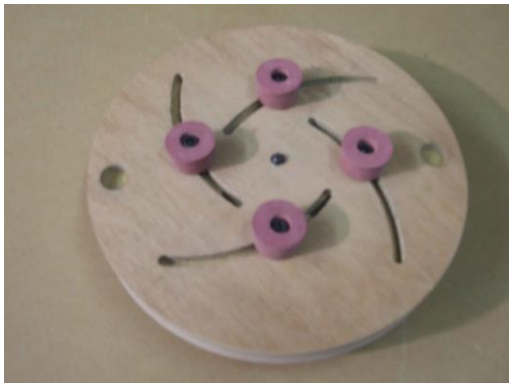
16. The completed chuck



17. Using four buttons to hold a smaller bowl. If required an Allen key can be used to hold the cap head bolts whilst the thumb screws are tightened.



The cheaper prototype version, which has been made in a smaller size to fit my Axminster M300 lathe is made using a spare Axminster chuck insert instead of a faceplate as a mounting and uses wing nuts instead of the safer thumbscrew knobs.



The buttons are made from cut down demijohn bungs recessed to house the cap head screws.