

# The Longworth Chuck

by Larry Pope

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I am a member of the Northshore Woodturners Guild in New Zealand. Like many others, we exchange our newsletter with other clubs, including some in Australia. They in turn send us copies of their newsletters to our mutual benefit.

I don't remember the date, but I think it was early in 1989, that a copy of a bulletin from the Hunter Valley Club in New South Wales, Australia, was brought to my attention by our Club Editor, Nelson Rundle. It contained part one of a two part article by a Mr. Longworth on a self centring chuck which held the rims of bowls, enabling the turner to complete work on the base of the bowl. Quite a useful tool for removing all evidence of how a bowl was originally chucked when leaving bowls with screw holes, chuck recesses, etc. in the bottom is no longer acceptable.

Unfortunately Mr. Longworth died shortly after the first article and the second part was never completed, The first article contained a rather rough drawing and I was asked if I could possibly draw up something more precise I decided to go further than that and to actually make the chuck. After one or two experiments with compasses and protractor, I eventually produced a three jaw model which created a lot of interest among our members, and several more chucks were made from the plans I had produced.

Interest was also shown by visitors to our club who went away, made a few modifications and, as I see from our National Quarterly Magazine, have almost claimed it as their own The inspiration however was that of Mr. Longworth of Hunter Valley and to him should go all the praise. It is interesting to note that Mr. Longworth's own club wrote to us to obtain plans of the chuck which we had made available to our members. I have no doubt that eventually it will be produced commercially, probably in metal with a Multitude of jaws. However make one yourself, it's not difficult.

## You will need

- a. A wood lathe.
- b. A router with a swing arm so that you can cut out an arc of a circle. Most routers have a little jig which attaches and allows this facility.
- c. An electric drill
- d. A screwdriver

## Building Material

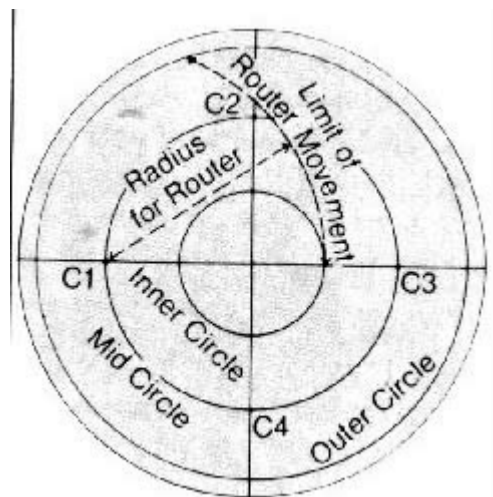
- A. A small face plate (not more than 100mm [4"]). Use a larger face plate if you wish but the jaws can come no closer than the width of the face plate. So the smaller the face plate the smaller the bowl which can be worked,
- B. A small wooden block 30mm [1-1/8"] thick and the same length and breadth as the face plate

- C. Piece of (6mm [1-1/4"]) good quality plywood,
- D. Piece of (20mm [3/4"] thick) close density particle board, plywood or wood board The size of the latter will depend on the maximum size of the bowls to be used. If the chuck is to be operated in board of the lathe its dimension will be limited to the maximum throw of the lathe. Otherwise, obviously, it will not fit on the lathe.
- E. Four gutter bolts with wing nuts 6mm [1/4"] diameter. Note that you will need the same diameter router bit for cutting the slots. The length of the screws will be the sum the thickness of the plywood plus the thickness of the particle board, plus the thickness of the rubber jaws, plus about another 20mm [3/4"].
- F. Rubber jaws. I use doorstops. Sink plugs are another good alternative. Any rubber shape with a hole through it.

**Construction**

1. Screw the wooden block B firmly to face plate and mount face plate on the lathe. Remove surplus wood until you have a disc the same size as the face plate. Check that the face of this disc is true. If it isn't, clean it up.
2. Take the piece of plywood C and the piece of particle board D and cut each into a circle. The diameter should be close to the maximum size you require the chuck to be. This doesn't have to be precise as you will true it up later on the lathe. The best method of cutting the wood is by using a bandsaw, a jig saw, a coping saw, a fret saw or any saw in that order.
3. Glue and screw the face plate and wood block to the centre of the particle board disk. Get it as accurate as possible but don't get neurotic about it.
4. Place the face plate in a vice, or between two pieces of timber, with the particle board uppermost. Now tack the piece of plywood to the particle board. Avoid tacking through the centre of the piece. Use sufficient tacks to make it secure, Don't use too long a tack as they will have to be removed later. Make sure that the heads of the tacks do not protrude or else later on they will impede the movement of the router.
5. Mount the chuck on the lathe and clean up the edges so that we have two precise disks. Using a pencil, and with the lathe rotating at slow speed, accurately locate the centre of the disk. It is very Important that you locate the exact centre, so take your time over this. Now remove the chuck and mount in the vice, or across two pieces of timber, as previously. Make sure it is in a stable and comfortable position for you to work on.

6. From here on it all gets a bit nerve wracking. We are going to make a 4 jaw chuck, It would be better if it were a 6 or more jaw chuck. The more jaws the more firmly it will grip. However a 4 jaw works well enough and is more simple to describe. One day I will make one in metal and make it a 10 jaw.



**Figure 1. Showing Router Movement.**

Through the centre draw two diameters each at right angles to the other. Now draw three circles around the centre:

1. One the same diameter as the face plate.
2. One 21 mm [13/16"] in from the outer edge,

3. One midway between the two circles just drawn.

If you don't have a compass large enough then just mark along one of the diameters the radii required, Then remount the chuck in the lathe and, resting a pencil on the tool rest at each marked spot. rotate the lathe at a very slow speed and describe the circles. Then remove the chuck and set up as before.

7. At the intersection of the mid circle with each diameter, a small indentation should be made. There are four of them (C1, C2, C3 and C4 as shown in Figure 1). These points should be very accurately marked as they are the centres about which the router will rotate. So take a lot of care here.

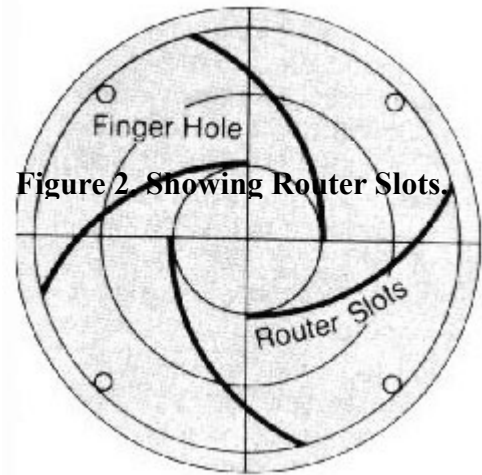
8. Now prepare the router for use. The router bit needs to be the same diameter as the gutter bolts. It will need to be deep enough to cut through both the plywood and the particle board. Set it up so it will swing about a centre. The radius of the swing is from the centre just calculated to a position just past the other side of the inner circle. The slot so made should not enter the inner circle but just graze the edge, Set the radius carefully because once you have started, you may not change it or allow it to change. Figure 2 shows the direction of cut for a chuck which is to be used inboard of the lathe. Reverse the direction if it is to be mounted outboard. (Anti-clockwise instead of clockwise.)

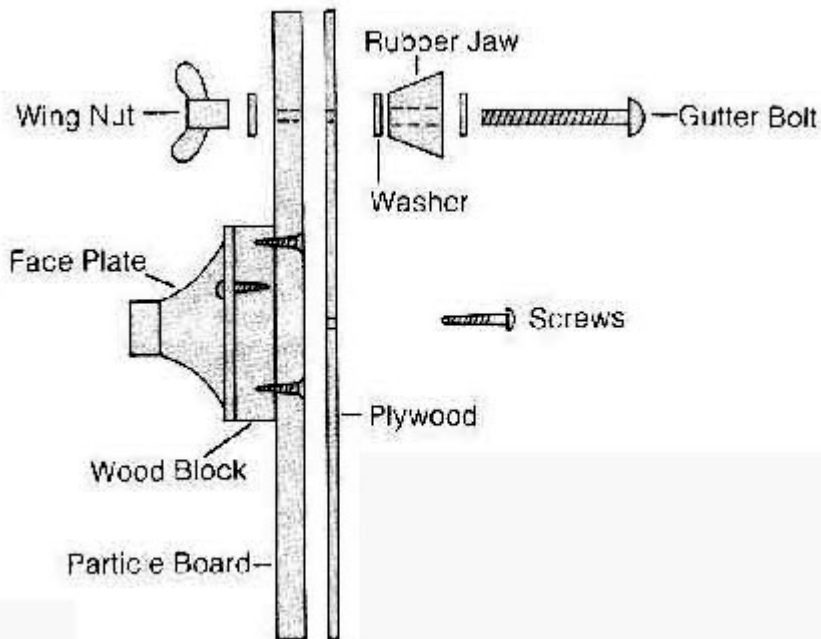
Now begin cutting the slots They begin at the outer circle and finish when the router reaches the opposite side of the inner circle. Make sure you do not exceed these positions. Make sure also that the point of radius of the router is correctly located. Increase the depth of each cut slowly. Take much time and care over this stage of the chuck's construction. Its ultimate accuracy will depend on how well you do this routing. Continue cutting each slot until eventually you come through the other side.

9. When the routing is completed, you must cut several finger holes. The purpose of these is to assist in the rotation of the chuck disks when positioning the bowl to be worked. Make four holes, about 15mm [5/8"] across, near the edges in an area well away from the slots. Lastly, drill a hole through the centre of the plywood disk through the particle board and into the wood block. Ultimately the plywood disk will be located on the particle board disk by a screw. The first drilling should be deep enough to take the length of the screw and no wider than is necessary to allow the screw to bite into it. Now use a drill bit the exact diameter as that of the screw. It is essential to have a snug fit. Drill only through the plywood disk.

10. Now remove the tacks holding the plywood disk. Rotate the plywood disk. if you have cut accurately, each set of slots will line up exactly with the next set. Lightly sandpaper the slots and ensure that the gutter bolts will move easily within them.

11. Lightly grease the surface of the particle board and place the plywood disk back onto the particle board but In reverse order to what it was before. The upper surface is now against the particle board and its other side is now uppermost. Screw the plywood disk to the particle board disk through the centre until the screw is fully home but still allows the upper disk to move freely, Now assemble the jaws as shown in Figure 3, with the wing nuts to rear. The chuck is now completed.





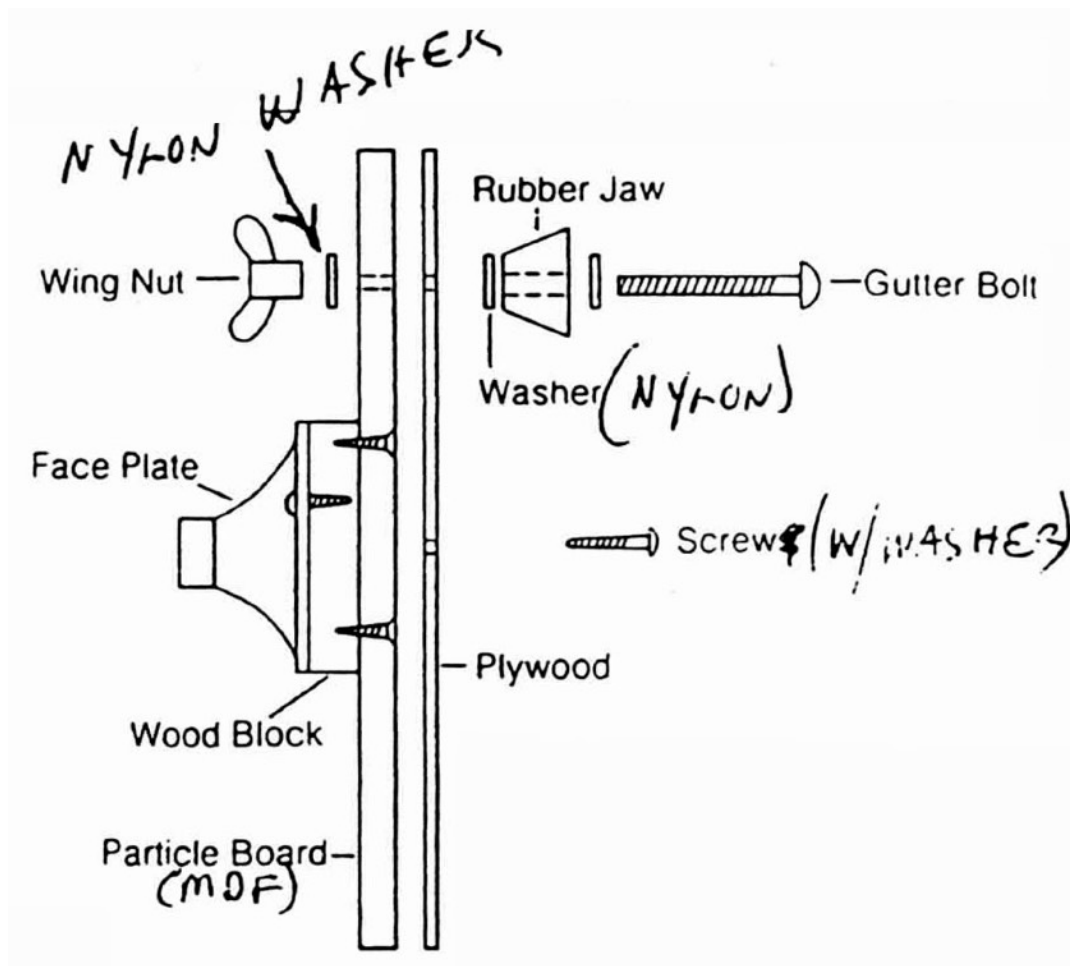
**Figure 3. Shows the assembly of the chuck.**

12. Place the chuck back on the lathe and, with the gear ratio at its lowest speed, start up the lathe. If the wing nuts have not been tightened, the jaws will move towards the centre ... a safety factor which will ensure the chuck will always have some degree of grip on your bowl. Note that the previously, oh so obvious jaws have now become a blur. I guarantee that, the first time you use the chuck, you will get a smack across a finger from one of them. For this reason always run the machine at slow speed. A bruised finger is better than a broken one.

13. Now get one of your most least liked bowls to try it out. If the edge of the bowl turns out, apply the jaws to the outer edge of the bowl. If the outer edge of the bowl turns inwards, apply the jaws to the inside of the bowl edge (Oh bliss, no bruised fingers). Place the chuck on a bench and lay the bowl on it. Bring the jaws to the edge of the bowl using the finger holes, and begin to tighten the wing nuts, a little at a time, until the bowl is firmly gripped. Now place the chuck back onto the lathe and bring the tail stock up as a safety measure. Position the tool rest and start the machine. It should run true.

### **Indispensable**

Until you get used to the chuck, use a light scraper for your initial work and keep the tail stock in position for as long as possible. Having given it a light scraping, try a gouge and see how it goes. Don't make deep cuts. you don't want to risk a dig in and the whole thing coming off the chuck, I have ruined two masterpieces on this chuck, so always have a healthy respect for it. When you have got the hang of it you will find it indispensable. Happy turning!



### Technical Comments about the Longworth Chucks by Jon Schilling & Carl Asch

My woodturning neighbour Carl Asch and I made three of these Longworth chucks and I have listed our recommendations and observations below:

1. Make the chuck as large as your lathe can turn. This chuck will easily adjust to turn the largest or the smallest diameter that you have, and I think it could take the place of the cole jaws except for the diameters under 7 or 8 inches. (Item D)
2. We used 3/4" MDF and 7/16" birch plywood as we already had it on hand.. (Items C& D)
3. Have a woodturner friend help you and make two chucks. It helped, especially when routing the arcs to have two sets of hands and eyes.
4. Use a 6 or 7" waste block if your chuck exceeds 16 or 18". I feel this gives more stability and strength to the chuck. As with any other waste block make sure you use suitable wood. you don't want this block splitting and coming apart. (Item B)
5. IF YOU ARE GOING TO USE THIS CHUCK FOR OUTBOARD TURNING, be sure to read the instructions carefully concerning construction for outboard turning. (Item 8)
6. Use nylon washers 7,16" X 7/8" against both sides of the chuck. (Figure 3)
7. We spent a great deal of time sanding the slots. We found that having these slots clean allowed for more free movement of the chuck. (Item 10)
8. We recommend cutting some finger holes in the MDF disk, too. NOTE: Be careful and don't place these holes on the same arc as the holes that you cut into the plywood disk. you don't want

these holes to coincide with holes in the other disk, because of the danger of getting a finger caught. (Might not seem apparent to you now, but when you get ready to cut them, it will make sense) (Item 9 )

9. Instead of using screws to attach my faceplate to the waste block I made it so that I could easily remove and reinstall the faceplate. I did this by countersinking 4 1/4" dia bolts to the waste block before gluing and screwing it to the ND)F circle. (You have to layout the holes to match the faceplate for easy installation) You countersink from the side that will be glued to the MDF, drill the holes, insert the bolts and attach the faceplate to the waste block before you glue up the MDF and the waste block. By using this method your face plate will always be accurately centred every time you reinstall the faceplate from some other project. (Figure 3)

10. Take your time when you actually reverse the plywood disk and insert the bolts. There are two different places where each arch intersects another arc. Place a bolt into an intersection and attempt to rotate the disks. It won't move freely in the wrong intersection, but will move freely when you have the bolt in the right place. (Item 11)

11. I have used the chuck to turn the bottom of 3 large platters and using approx 200 rpm's it worked very well. Bert Stanford turned the bottom of a 12" dia and 10" deep walnut bowl and it worked well for that size too. Here is my point:

- a. Be sure to use slow speeds.
- b. When gripping an object, loosen the bolts holding the rubber jaws about a 1/4" and tighten the chuck by using the finger holes. Then, tighten the bolts holding the rubber jaws and you will gain more pressure with the jaws.
- c. If you have concerns about tightness, take a rope or some twine and tie it around the jaws and you will also increase the holding power and insure safety of your object.

## The LONGWORTH CHUCK

### List of materials Needed

#### Secures Object

- 4 Rubber Jaws

#### Secures Rubber Jaws

- 4 1/4" x 3" Hex Cap Screws
- 8 3/8" ID x 7/8" OD Nylon Washer
- 8 1/4" Flat Washer
- 4 1/4" Wing Nuts

#### Secures Waste Block to Face Plate

- 4 1/4" x 3" Flat Head Bolt
- 4 1/4" Hex Nut

#### Centres Plywood to MDF

- 1 1/4" Brass Flat Washer

#### Attach MDF to Waste Block

- 8 No.14 x 2" Wood Screws
- 1\* 24" x 24" x 3/4" MDF
- 1\* 24 x 24" X 1/2" Hardwood Plywood
- 1 8" x 8" x 2" Hardwood Waste Block

*\* NOTE: Adjust sizes of MDF and plywood to meet maximum size for your chuck.*

