Making a Block Tumbler

First up, I wish to acknowledge that the basic design of this tumbler is not my own. I was inspired by a post made by Janos and have simply modified the construction somewhat to suit my own needs.

Materials used include:
100mm long section of a used cardboard postal tube of about 85mm diameter (PVC tubing could be used in lieu)
19mm diameter dowell rod for the central shaft
6mm dowells
3mm MDF (end caps)
6mm MDF (end caps)
Sandpaper - grit of your choice. I've made up three tumblers with 120, 400, and 600 grit
Spray-on adhesive
PVA glue

Tools required:
In putting this together, I used:
Scroll saw
Drill Press
Milling machine
Lathe

However, the entire project could just as easily be completed with only hand tools.

Design intent:

The intent for this design is to attach it to my lathe, with one end held in the 3-jaw chuck and the other in the tailstock chuck. This actually determines the maximum diameter of the main body of the tumbler, as it needs to fit over the lathe bed. The tumbler could equally be driven by a drill press, a hand held drill, or even manually turned. Any of these drive options would free the size limitation.

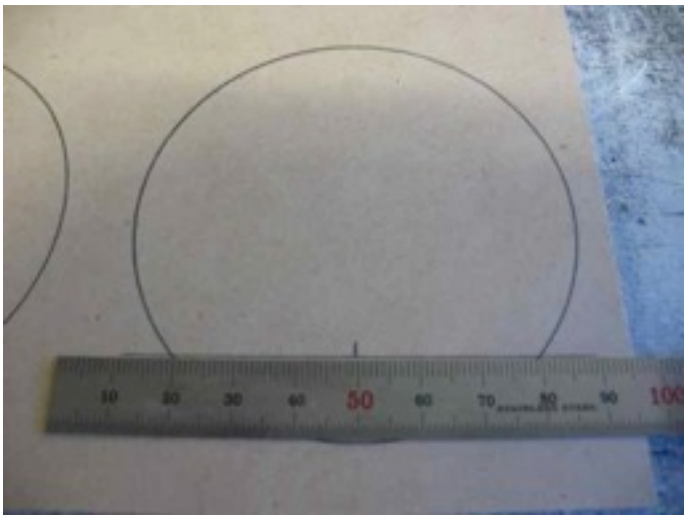
It had been my intention to use some PVC tubing for the main body, but the tubing I bought (90mm) was just a tiny bit large to fit across the lathe bed. Rather than re-visit the hardware store, I happened to have the postal tube lying around and it seemed to be just right in terms of size.

End Caps:

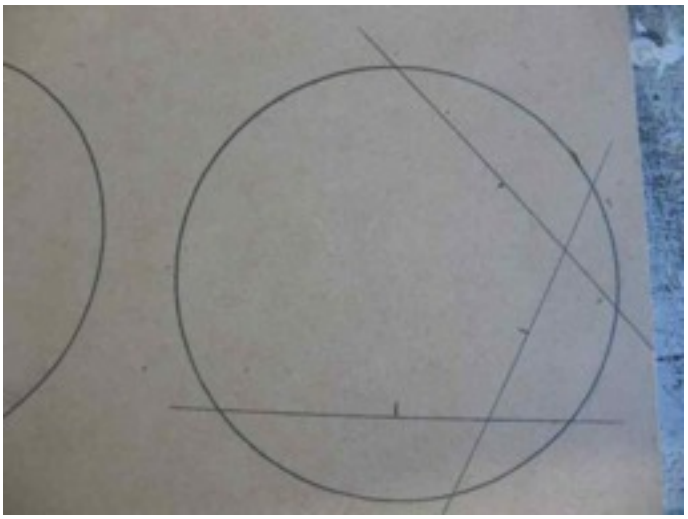
Having cut the postal tube into 100mm long sections, the next task was to make the end caps. These were made up of an outer cap of 6mm MDF and an inner cap of 3mm MDF, joined together to make a snug seal over the end of the tube. The tube section was used to trace circles of the requisite sizes for both Outer and Inner caps onto the MDF sheets.

I needed to mark the centre of each of these circles, so here is some basic high school geometry that makes this task easy:

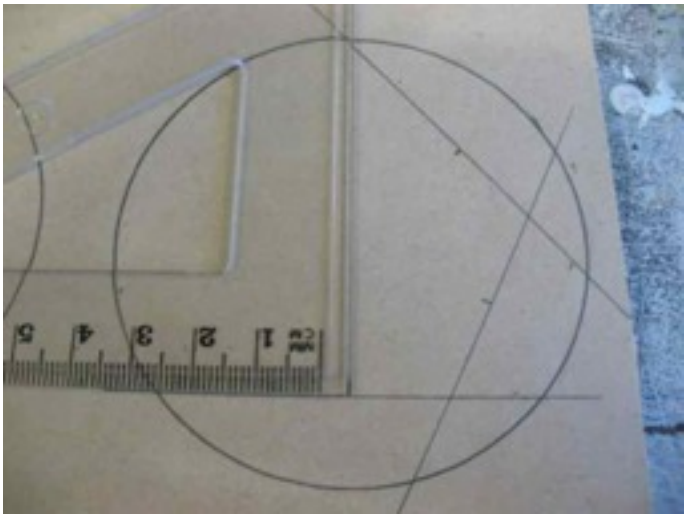
Step 1: Draw a chord of convenient length (in my case 60mm) across a section of the circle and mark its mid-point:



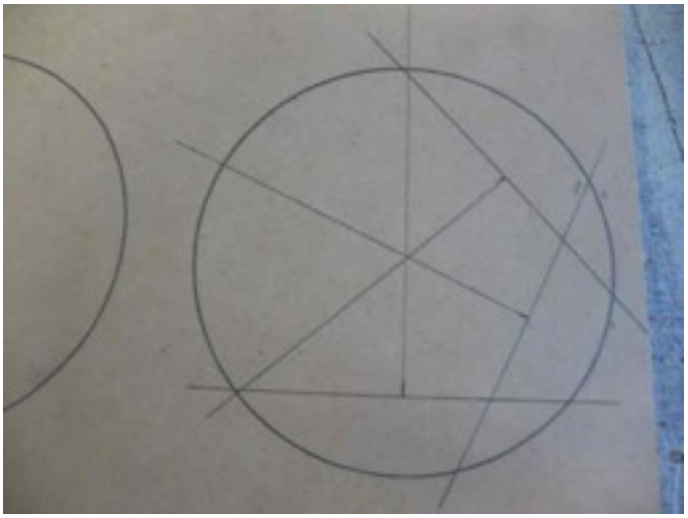
Step 2: Repeat this twice more, so that you have three chords drawn, all with centers marked. (It is only necessary to use two chords, but the third will reveal any errors in the construction). I chose to draw chords at an angle of about 120 degress to each other - the reason will become obvious shortly.



Step 3: Using a set square, draw a line perpendicular to each of the chords, passing through that chord's mid-point previously marked.

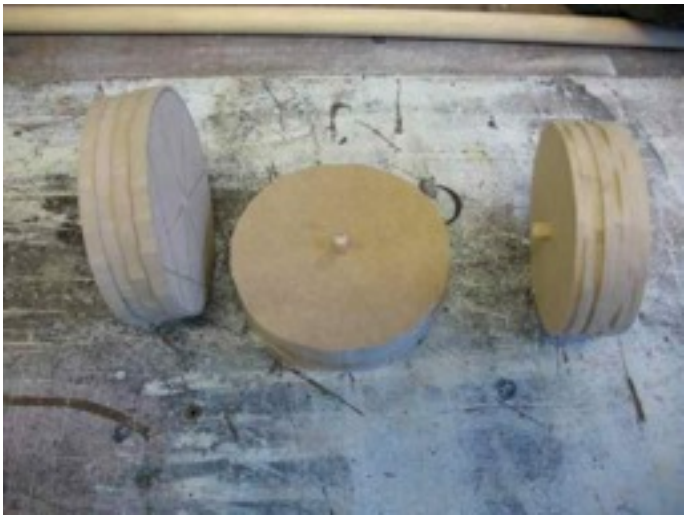


Where these three lines intersect is the centre of the circle:

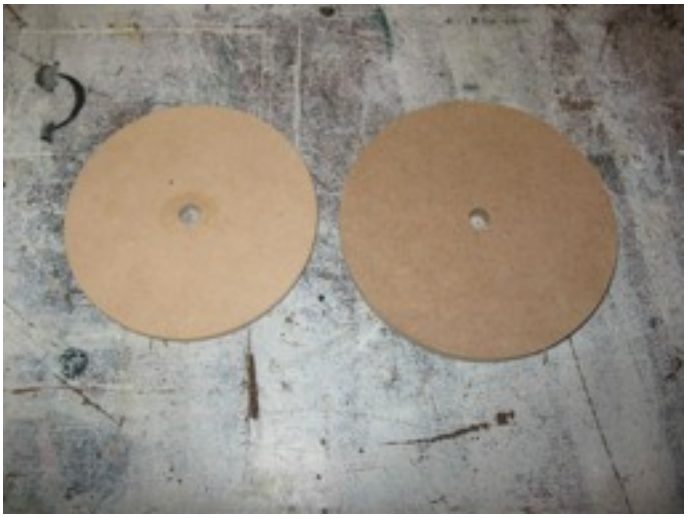


Step 4: Cut out each of the circles using a scroll saw (or hand held fret saw / jeweller's saw). Then drill a 6mm hole through the centre of the circles.

Step 5: As I was making several tumblers at once, I temporarily spot glued the rough-cut circles together in gangs of the same size, over a central dowel. This then enabled me to mount the gangs in the lathe in order to turn them down to a consistent diameter with a smooth finish. You can avoid this step if you take more care than me with the cutting out.



Here is the result of the lathe turning process, once the discs had been separated from each other:



Step 6: Join together one each of a large and small disc, using a 6mm dowel for alignment and protruding a roughly equal distance either side. This will be the base end cap. (the picture below shows two of these, but I was making a set of three tumblers).

Central Shafts:

Step 7: The central (or "drive") shaft needs to be a single piece that runs through the top end cap. The limitation for me was that the "business" end needed to be no larger in diameter than 10mm in order to fit through the headstock spindle of the lathe. So drive shafts were manufactured with the "business" end turned down to a 10 mm diameter. Note that if you are using an alternate means of propulsion, then this limitation won't exist.

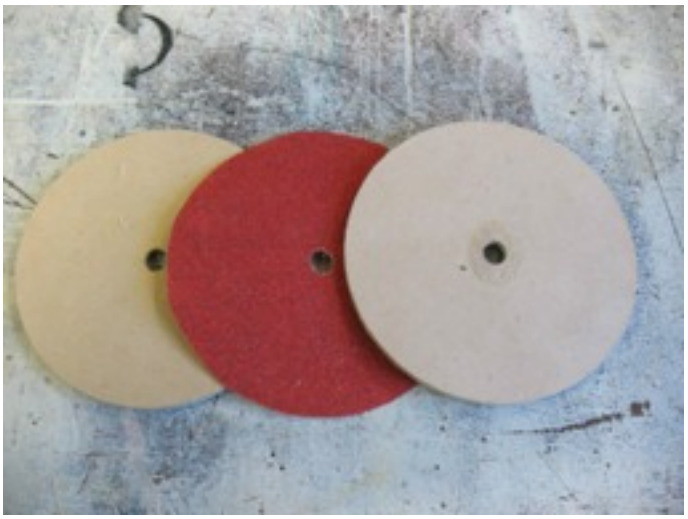
Finish preparing the central shafts by boring a 6.5mm hole in the "tail" end. The idea here is that the 6.5mm hole will provide a locator for the tail end cap but with room for the shaft to turn around it. Complete the shafts by sawing slits along the length of the shaft. This is take the sandpaper "flappers" later on.

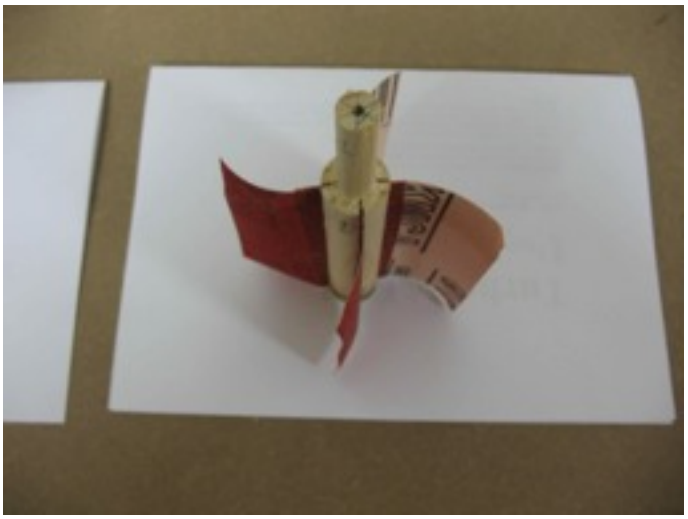
My intent had been to cut these slots with a slitting saw in the Mill. However, during the cutting of the first one, the Mill's motor died - whether as a result of this operation or some other reason I do not know. Regardless, this left me no choice but to complete this operation by hand. In fact, the slots are quite easily cut using a hacksaw - the kerf of the blade is just the right width to accommodate the sandpaper flappers.

So, here is how our overall construction looks so far. (Note that in this photo, an earlier (unsuccesful) version of the drive shaft is shown).

Sandpaper:

Step 8: Now it's time to fit the sandpaper to our machine. First up, I used a couple of spare smaller discs to trace the outline for the end caps, then sandwiched the sandpaper between them and drilled a hole through the centre. This now fits neatly over the end caps.





In the photo above, the flappers have been fitted "back to front" - a fact that became obvious once testing began (oops).

Cutting the remaining sandpaper to size is just a matter of “eye-balling” it. We need one piece to go around the inside of the central chamber, and four “flappers” which go into the slots on the central shaft. The end cap and chamber sandpaper was fixed in place with spray-on adhesive. The flappers are simply folded over and slid into the slots without glue (which makes them easily replaceable).

Here is the completed setup running on the lathe. The lathe cutting tool is lightly held against the canister body to prevent it from turning. In this picture the lathe is actually running, with the drive shaft turning within the canister.

Functional Test

The functional test worked perfectly (although this was after modifying the drive shaft to that described above). To further the testing, a selection of kit blocks was put through a short spin in each of the grades of sandpaper. To begin with, this is how the blocks look "as provided" in the kit:

It's pretty obvious from this picture why a block tumbler is needed. Up until now, I have been individually hand sanding all blocks prior to use - a very tedious process!

Here's a comparison of an untreated block (on the left) with one that has had a very short tumble.

I then proceeded to a larger test with a range of block sizes. Time spent in the tumbler was very short for these tests - no more than 2 minutes in each grade of sandpaper.

After Tumbling in 120 grit:

The same blocks after then Tumbling in 400 grit:

And after then Tumbling in 600 grit:

So just for comparison let's look at a "before" and "after" shot side by side:

I think this proves the concept. Even better results should be achievable with a longer duration in the Tumbler. Finishing with 600 grit does seem to produce quite a nice end result that is ready to use.

Finally, here's a couple of pics of a range of kit blocks after 3mins (timed) tumbling in each grit successively.

While there is still a little finishing required around the sheave holes, the block bodies are all smooth and ready for use.

Reflections / Observations

The Tumbler works well and is relatively simple to construct. If I were doing it again, I would reduce the size of the canister considerably. This canister I made is 100mm long with a diameter of about 85mm. I think a canister length of 50 mm, with a diameter of 50 mm would probably be quite larger enough for the purpose.

The drive shaft is key. It must be a single piece that runs through the top end-cap. Boring a 6.5mm hole in the tail end allows it to be located on a 6mm dowel spigot through the tail end cap. This both supports the end of the drive shaft and allows it to spin freely. The outer end of the tail end cap spigot is held in the lathe tail-stock chuck.

The whole assembly could be modified for hand held use. To do that, cut the tail stock spigot off flush with the outer end of the tail end cap. Then make and attach a “winding handle” to the drive shaft.

Happy Tumbling. May all your blocks be smooth!