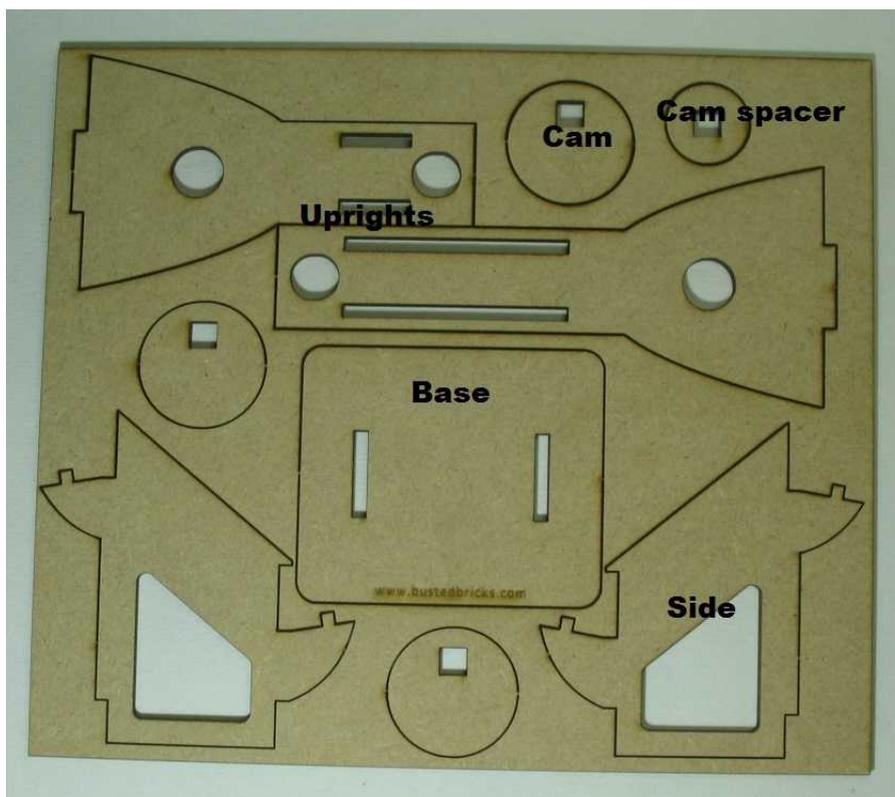
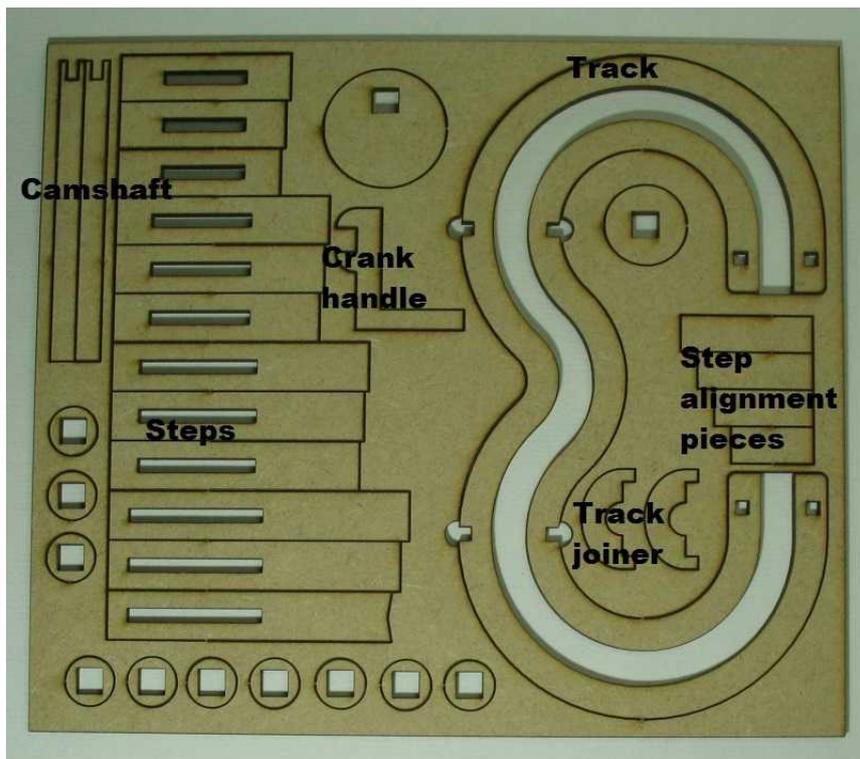


Assembly instructions for the Simple Marble Machine



Parts layout

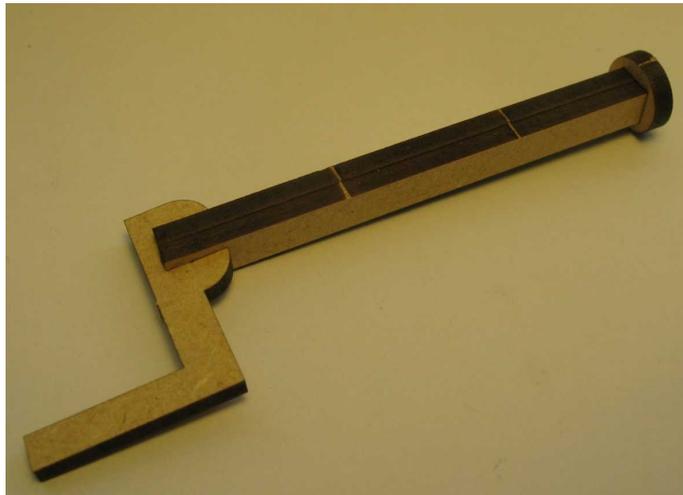


Please note: All the assembly can be done with PVA glue. Don't apply it from the bottle or tube but put a blob on a piece of plastic and apply it with a small brush. That way it is much easier to control the amount of glue you apply.

Remove all parts from the sheets except for the track. This should be left in until the joiners have been glued in place. Use a sharp modelling knife or scalpel to cut the small retaining tabs that hold the parts in the sheets.

Camshaft assembly

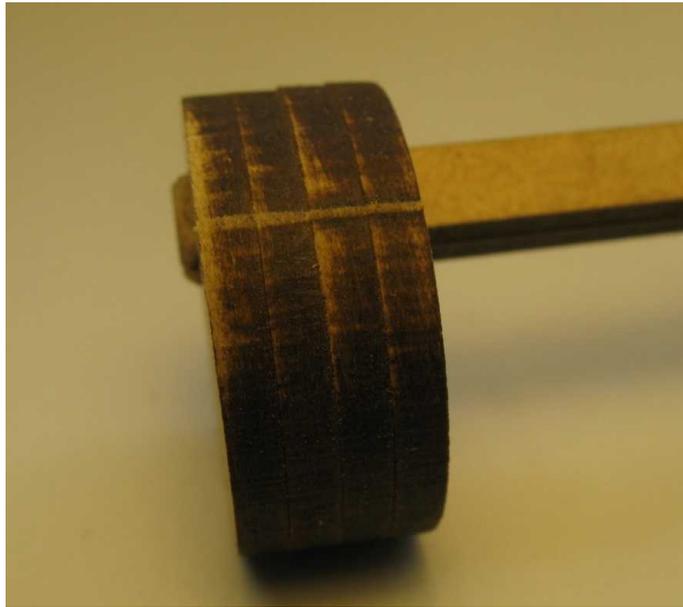
Glue the two shaft halves together. Only use a small amount of glue. If any glue seeps out from the joint then it should be wiped off with a damp rag. You can use the crank handle and one of the spacers to hold the shaft parts together while the glue dries.



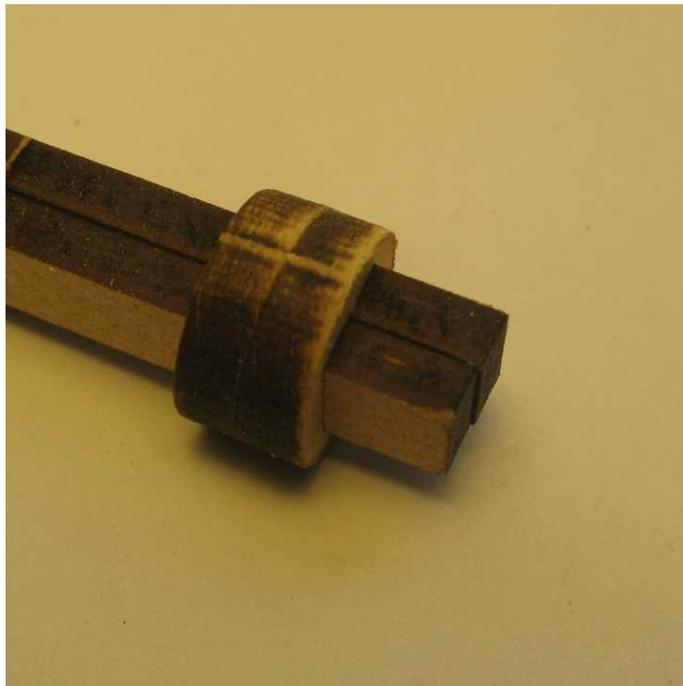
Once dry, chamfer the end slightly so it will be easier to slide the cams and spacers onto the shaft



The cams and spacers need a bit of preparation before the crankshaft is assembled. Slide the 4 cams onto the shaft and sand off the pips so the cams are smooth.



Slide two spacers on the shaft and sand them smooth. These will be at each end of the camshaft and will be turning in the bearing holes in the lifter frame. Check they are a loose fit in the holes.



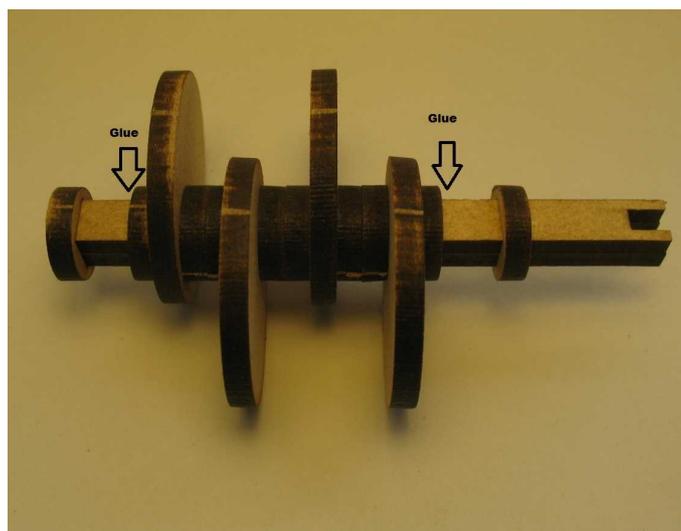
Now onto the camshaft assembly. Slide two spacers onto the shaft so they align with the pip mark towards the end of the shaft that has the cut-out for the crank handle.



Slide on a cam, two spacers and another cam, ensuring the cam is 180 degrees rotated in relation to the first cam. Repeat until all cams and spacers have been used.



Slide the spacers at each end out, apply a small drop of glue onto the shaft between the spacers and slide them back in place again.



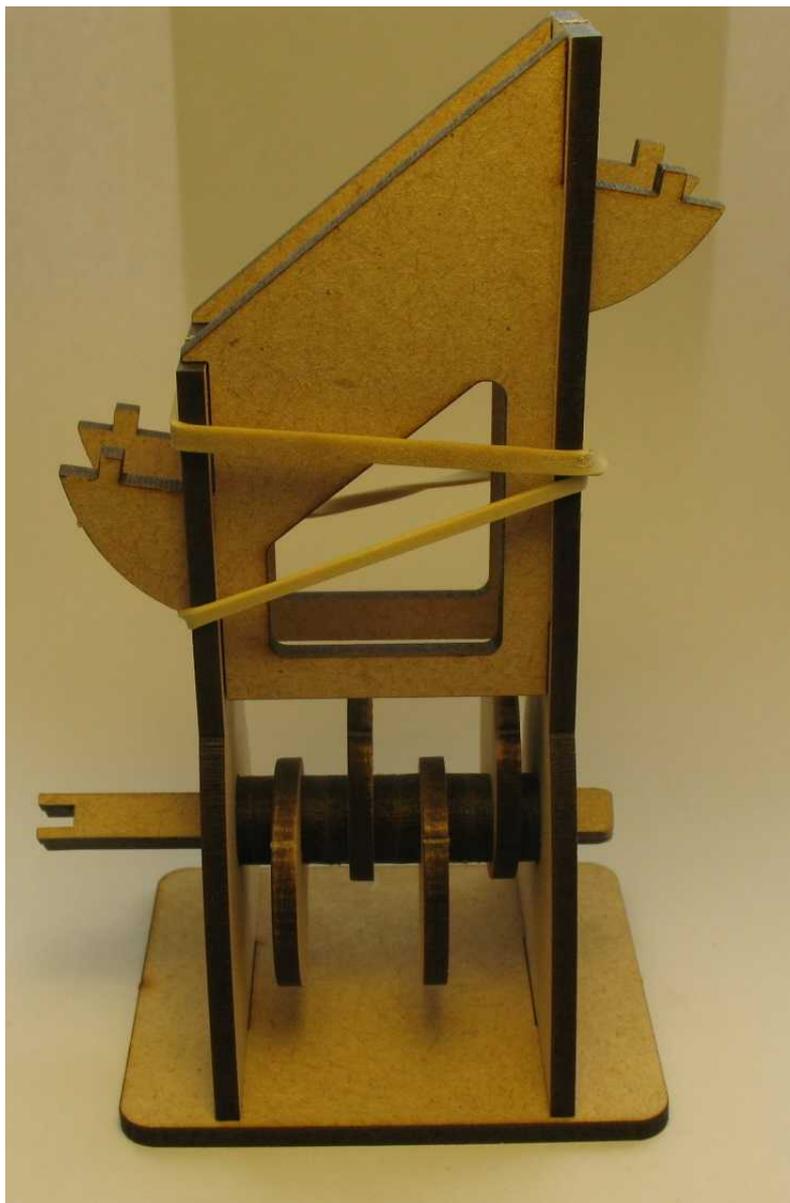
Push firmly on the ends of the spacers so the cams are not wiggling around on the shaft. Leave to dry.

Frame assembly

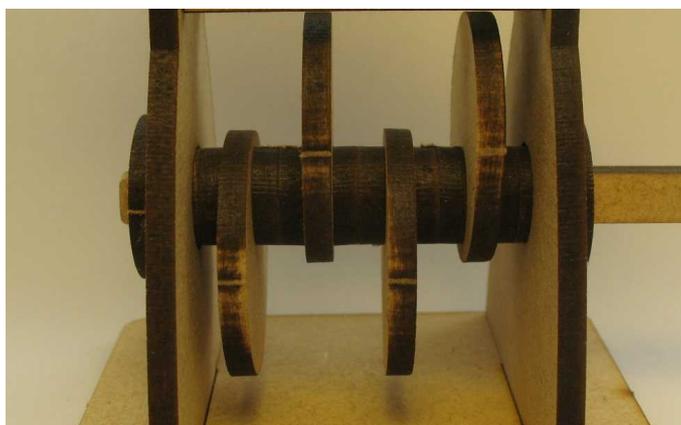
Glue the frame sides into the short upright. You can use the tall upright and base to keep the parts aligned but do not glue these parts together yet. Leave to dry.

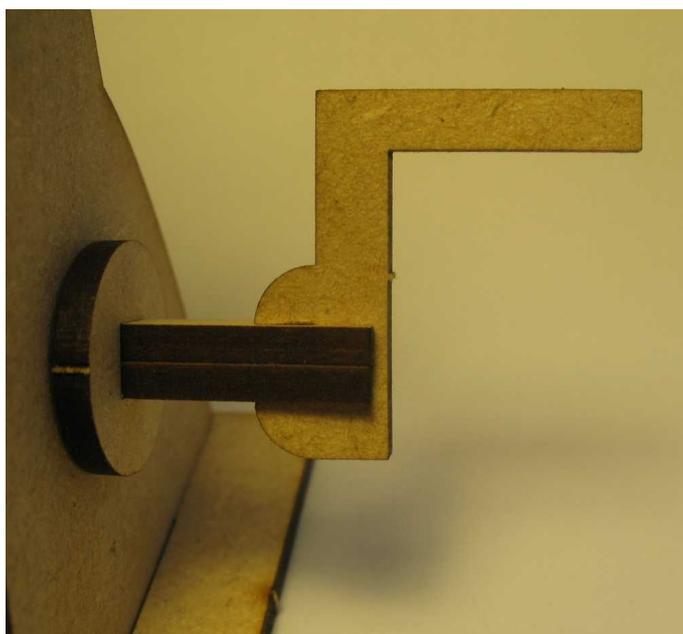
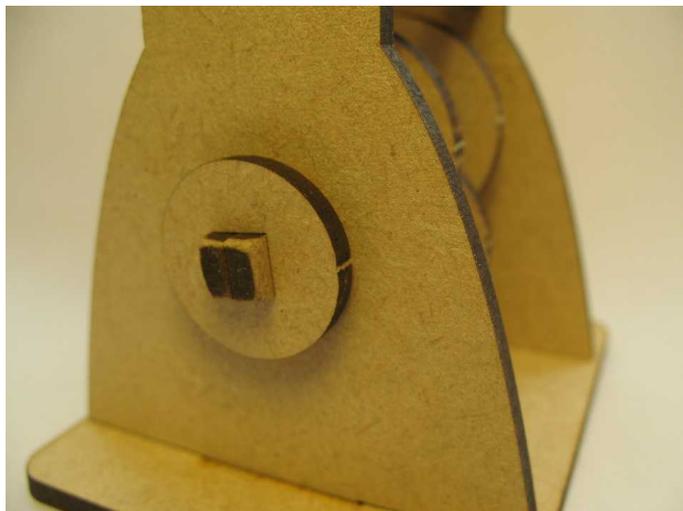


Insert the camshaft between the frames so the crank handle cut-out is on the tall upright side. Glue the tall upright to the side frames and glue the upright to the base. Leave to dry.



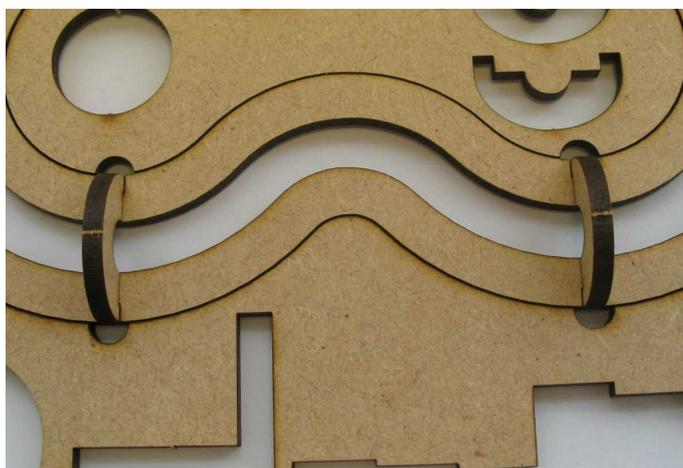
Centre the camshaft between the uprights. Add a small amount of glue onto the shafts near to where they exit from the uprights. Slide the retaining disc in place. Ensure that a bit of sideways movement of the camshaft is still possible. About 1mm is right. Glue the crank handle in place.





Track Assembly

Leave the track parts in the sheet until they are assembled. Glue the two joiners in place and leave to dry. It doesn't matter which side they are on as long as they are both on the same side. Once the glue is dry you can cut the tracks from the sheet.



Glue the track onto the tall side of the frame. Hold it in place with strong rubber bands while the glue dries. PVA glue can be used but it must be allowed to dry thoroughly before proceeding. Alternatively you can use 5min setting epoxy glue or medium thick CA glue. A tip: CA glue cures quicker in the presence of moisture. Lick a finger and wipe it on the back of the track where it is to be adhered to the frame. Put a small amount of CA onto the frame and push the track in place. You only need to hold it in position for a few seconds.

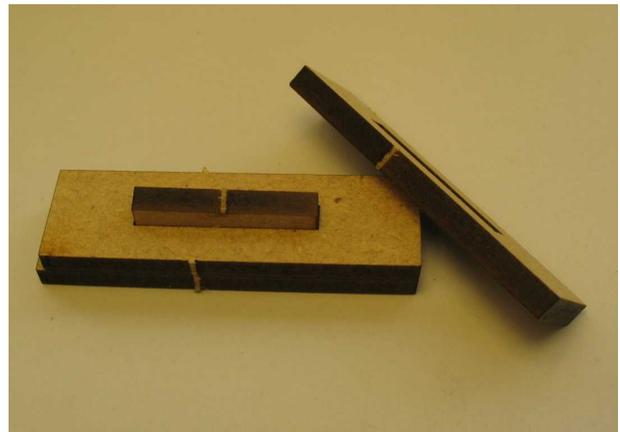
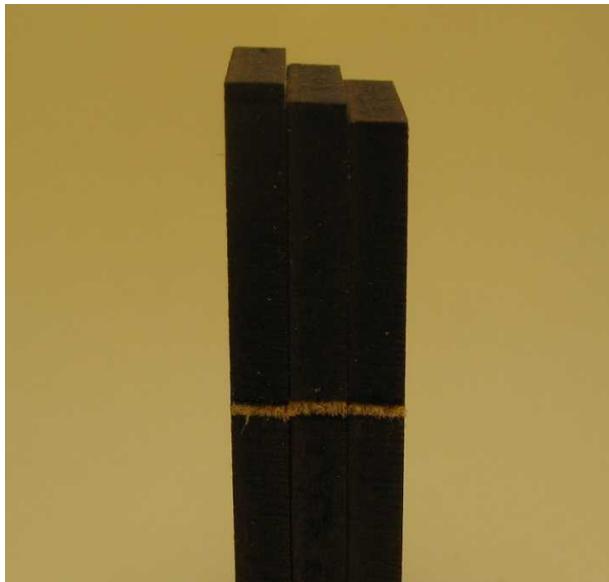


Once the top end of the track is securely mounted you can attach the lower part to the frame. If using a slow drying/setting glue it should be held firmly in place while the glue sets. Use a scrap of MDF and strong rubber bands. Take care not to glue the scrap piece onto the track.

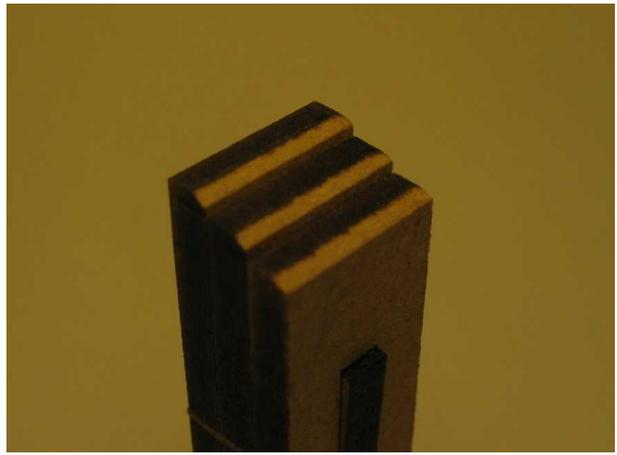


Steps assembly

Each of the four steps consist of 4 parts, 3 step parts and an alignment part. Glue the step parts together and insert the alignment part making sure it does not protrude from either side of the assemble step. Take care to assemble the steps in the right order so each step looks like a set of mini steps as per the picture below.



Once the glue is dry the top of the steps should be chamfered. Only a little bit of the edges needs to be taken off. Hold at an angle against a piece of sandpaper and drag the step backwards 3-4 times so it ends up looking like in the picture below.



Place the marble machine on a level table, put the steps in the frame, put the balls on the track and crank away to your hearts content. It is easiest to crank if the crank handle protrudes over the edge of the table. Crank at a slow, steady pace. If you crank very fast the balls may bounce on the steps and not travel up the steps as intended.

