Swimming Fish Automaton

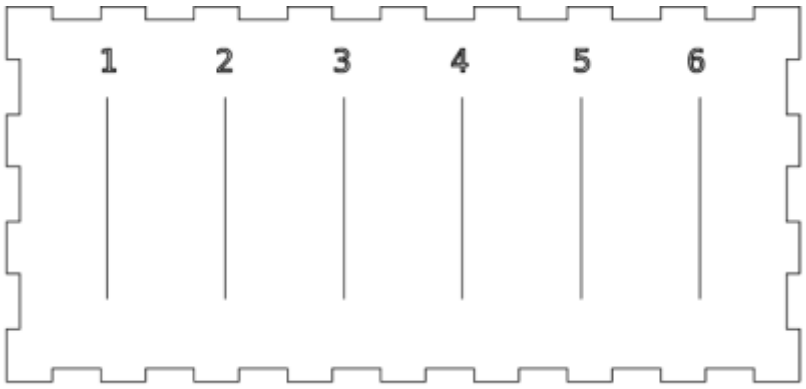
Intro

This model is an improvement on an original proof of concept piece. These improvements include:

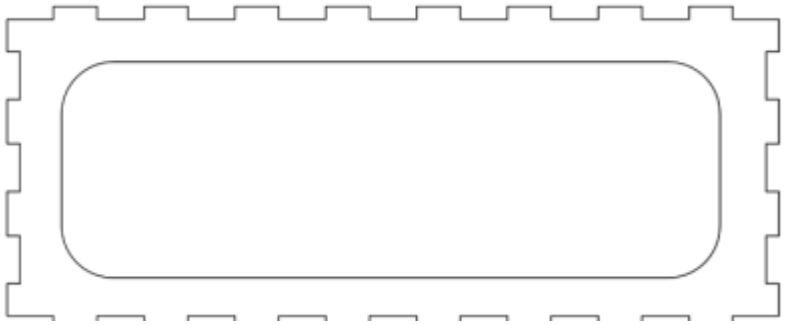
- Better cam followers for a smoother action
- Anatomically more correct fish (the gills now face the right way!)
- A less fussy and better secured “seascape”
- A wider base to reduce interference between the cam followers and the drive shaft
- An open back to that the mechanism can be seen

List of parts

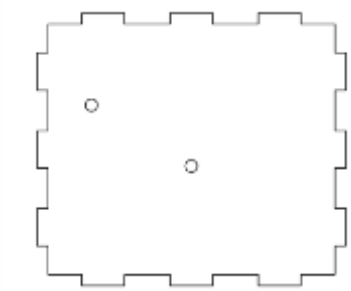
The files are provided as three A4 sheets. These can be cut in MDF or Baltic ply, but use 3mm material to make sure that the tabs fit. The K40 Whisperer convention of using red lines for cutting and blue lines for engraving is used. Settings for each will depend on the machine.



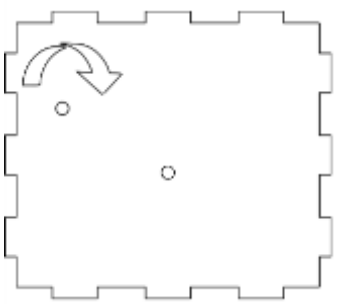
Base bottom plate



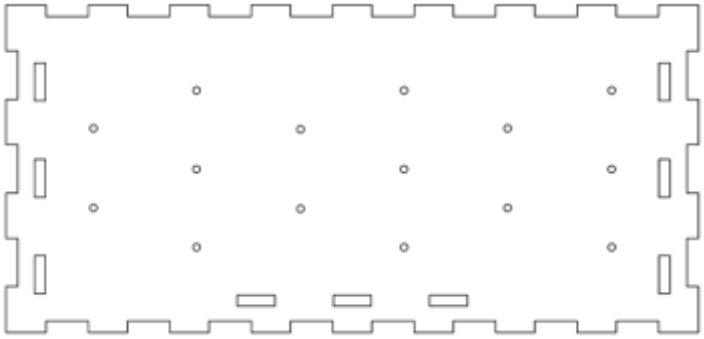
Back plate



Left hand side

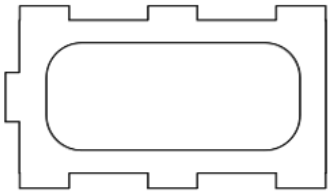


Right hand side

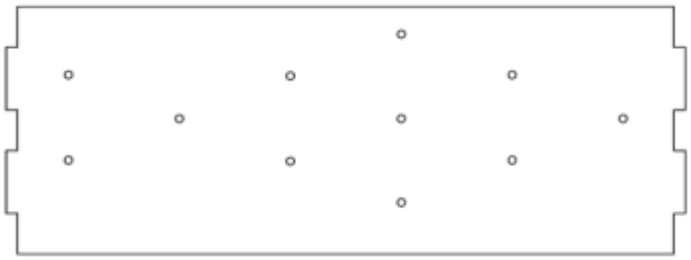


Top plate

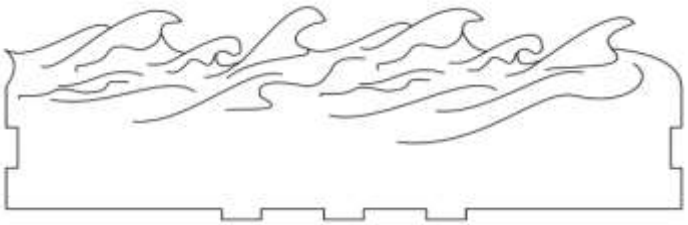
Front plate



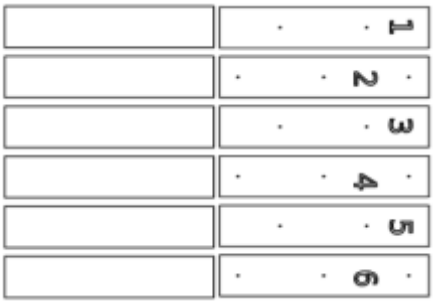
Top supports (2 off)



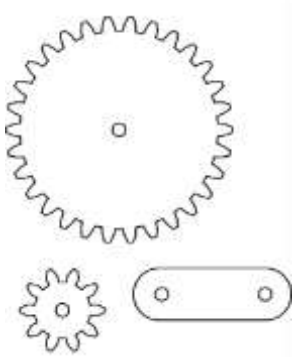
Support plate



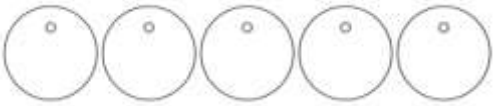
Seascape panel



Cam followers (6 off, 2 pieces per follower)

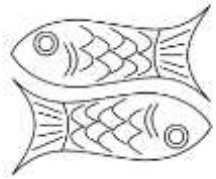


Gears and crank handle



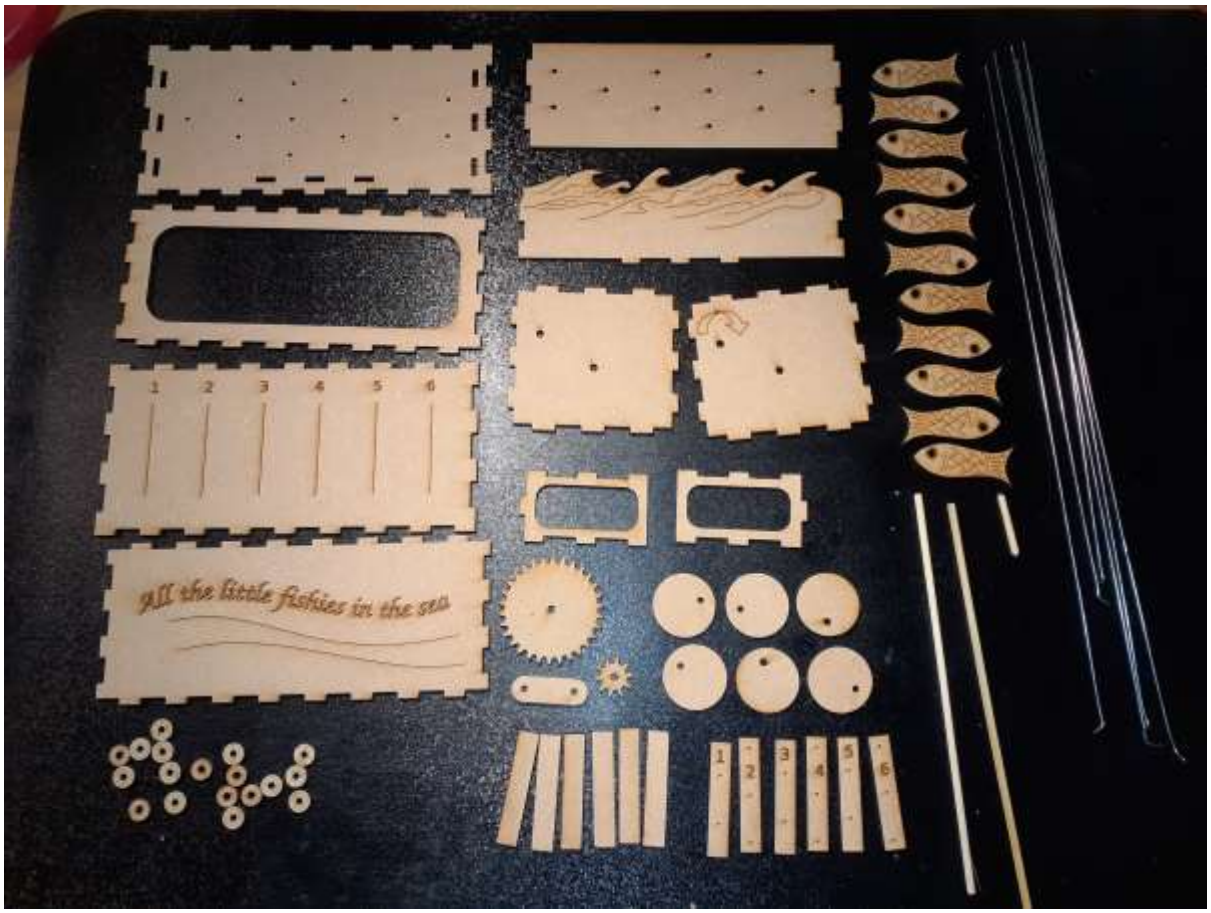
Cams (6 off)

Bosses (18 off)



Fish (11 off)

You will also need approximately 350mm of 2.5 mm dowel or rod (I used bamboo kebab skewers) for the two drive shafts, and approximately 1.5m of .8mm steel wire for the fish supports. I used steel garden wire for this. The steel wire needs to be hardened and straightened for use. The easiest way to do this is to clamp one end in the chuck of an electric drill and hold the other end in pliers or grips. Spin the drill slowly for a few seconds, and the wire will straighten.



Assembly

1. Glue the base bottom plate, back plate and right hand side together. A little PU wood glue on the tabs is sufficient. Tape together or use elastic bands to hold the parts in place until the glue has set.

2. While that is setting, cut the 2.5mm dowel to length. You will need three pieces, 180mm, 190mm and 20mm. These will form the drive shafts and crank handle.

3. Starting with the 180mm length, slip the larger of the gears and a boss onto the shaft. Secure the boss to the shaft with a tiny drop of glue, and then the gear to the boss with a drop of glue. Ensure that 3mm of the shaft protrudes from the boss as shown below:

4. Now slip a boss, a cam and a boss onto the shaft, securing each with a tiny drop of glue as before. This will need to be repeated six times. The cams can be correctly aligned on the shaft using the marks engraved on the bottom plate as guides. Also ensure that each cam is rotated slightly from the one before it, as shown below:

5. Finally, slip and glue a final boss on the end of the shaft, leaving approximately 3mm of shaft extending beyond the boss. Dry-fit the shaft and left-hand side panel to the glued-up base to ensure that the shaft spins freely. Adjust the final boss as required to ensure a free spin.
6. Onto the 190mm shaft, fit and glue a boss, the smaller gear and another boss, leaving approximately 13mm of shaft protruding beyond the boss. Fit a third boss at the other end, leaving 3mm of shaft protruding. Dry fit as before to ensure free rotation of this shaft.

7. Assemble the two shafts and the left hand side panel, gluing the side panel in place. Ensure that the shaft with the cams is placed in the centre holes of the side panel, and the smaller drive shaft is in the uppermost holes, with the longer end protruding from the right-hand side panel. Both gears will lie to the right-hand side.

Secure with tape or elastic bands as before to let the glue dry.

8. Glue the 20mm dowel into the crank handle, and then the handle to the protruding shaft.

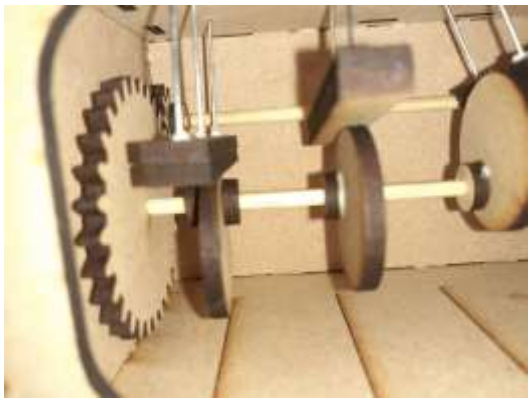
9. Prepare the cam followers as follows. Glue a plain follower to the bottom of the numbered followers to create a piece of double thickness. Cut the straightened steel wire into 15 lengths, approximately 100mm long. This does not have to be accurate, as they will be trimmed later.


10. Dip an end of each wire into a drop of glue, and then insert into each of the tiny holes in the followers. Be careful to ensure that the wires are fully inserted, and are not bent. They must remain parallel to each other in the follower.

11. Fit the two top supports to the top plate, ensuring that the tabs in the short side face towards the front. Note that the plate has three rectangular holes along the front edge.
12. Hold the top plate upside down and insert each of the followers into the holes in the plate. The followers are numbered, and must be inserted in the right order. Note that the followers should be inserted with the numbers towards the back edge.

13. Carefully turn the top plate and followers and glue it to the base, again noting that the edge with the three rectangular holes goes towards the side with the engraved writing (the front). Ensure that the followers do not get caught up in the drive shafts, and that the wires are not bent. Hold with tape or elastic bands until the glue sets.

Make sure that the followers are properly lined up with the cams, and move freely.



14. Check the support plate, and note that in two locations (2 and 6) the top plate has three holes (and three wires protruding), whilst the support plate only has one hole. These followers have three wires to support the follower, but will only have one fish attached. In these locations (and only these!), the outer wires must be trimmed. Rotate the drive shaft until the cam is in the ***lowest*** position, and then trim the outer wires only flush with the top

of the top plate. Repeat for the other follower. Note also that the follower at position 4 also has three wires, but all will have fish on and will be trimmed later.

15. Carefully thread the support plate over the wires and glue in place.

16. Glue the seascape panel in place.

17. Carefully drill a 1mm hole in the lower edge of each fish so that it can be placed on a wire. This hole does not need to be any deeper than 3-4 mm, just enough for the wire to fit snugly. It is easiest to do this on a pillar drill if you have one.

18. Trim the wires to different lengths, so as to suggest a shoal of fish. Place a tiny dot of glue in the hole of each fish, and place on the wire. This can be a bit fiddly!

Enjoy your shoal of fish!