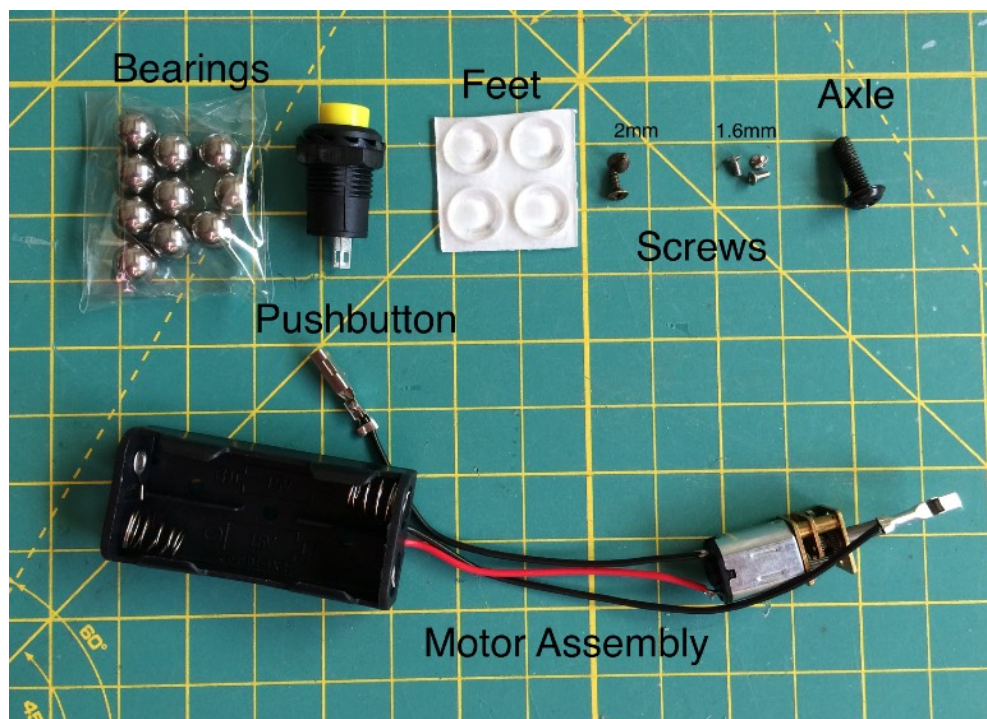
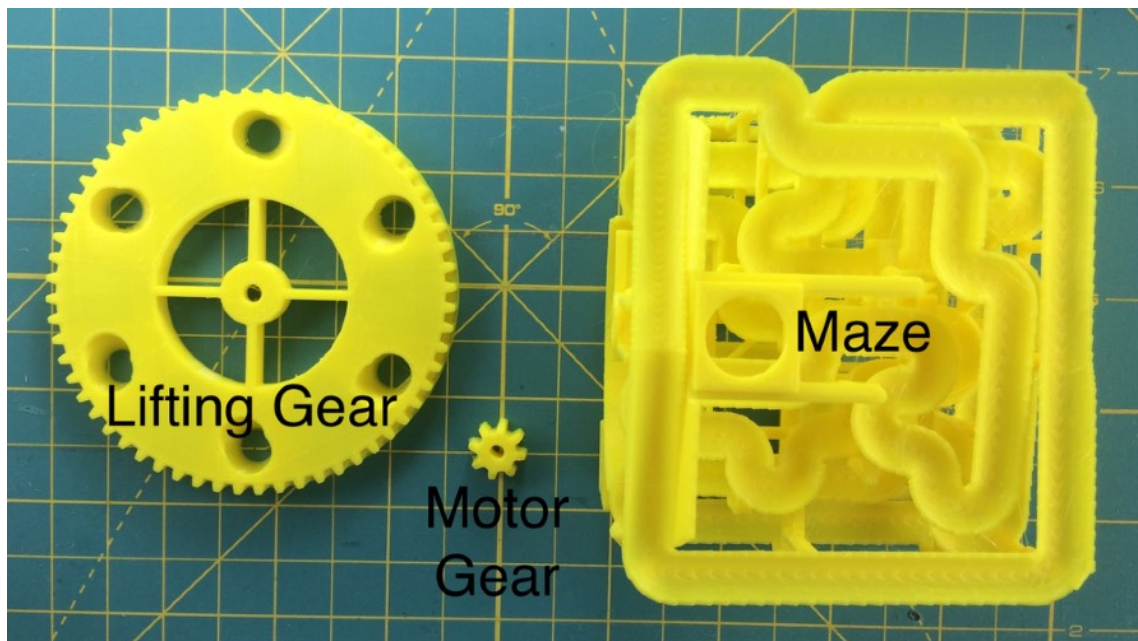


Small Gear model

Assembly Instructions

December 14th, 2018

Follow these instructions to print and assemble the battery operated Small Gear model. You will need a PH0 or smaller Phillips screwdriver, tweezers and a small hobby or pocket knife. You'll also need 2 AAA batteries. Everything else is included in the kit.

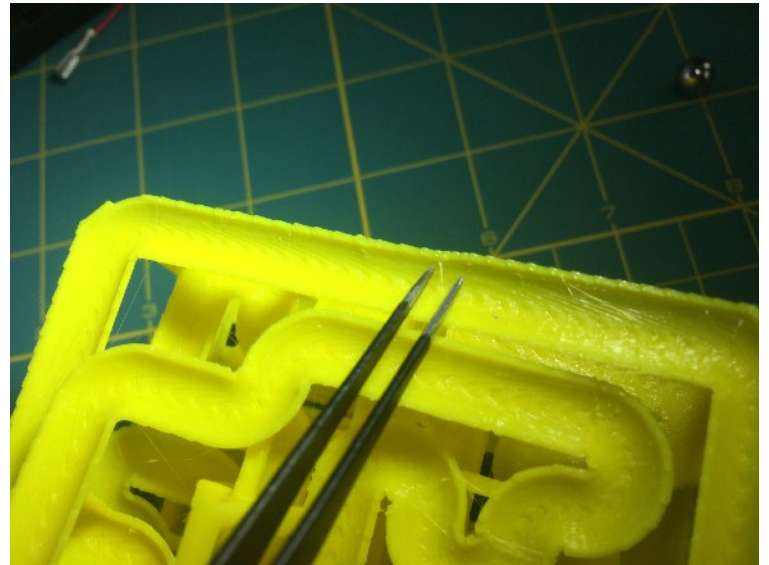




Gather the tools and the kit parts. Ensure that you have three 3D printed parts: A Lifting Gear, a Motor Gear and a Maze. You should also have ten metal bearing balls, a pushbutton, four feet, two 2mm tapered screws (depending on your battery box, you may only need one of these), three 1.6mm silver screws (you'll only need two of these — an extra one is included), a 4mm Axle, and a Motor Assembly that consists of a motor and a battery box, along with two connectors.

Not included in the kit, the tools you'll need are a PH0 or smaller Phillips screwdriver and tweezers. You may optionally want to use a small pocket knife for cleaning the plastic. You'll also need two AAA batteries.

Inspect the printed parts for any print failures. Remove any small stray bits of plastic. Many of these can be cleared just by rubbing with your fingers, but tweezers or a knife are needed to get deeper into the model. Take your time and make sure all the tracks are clear — it's easier to do that now before the model is assembled.

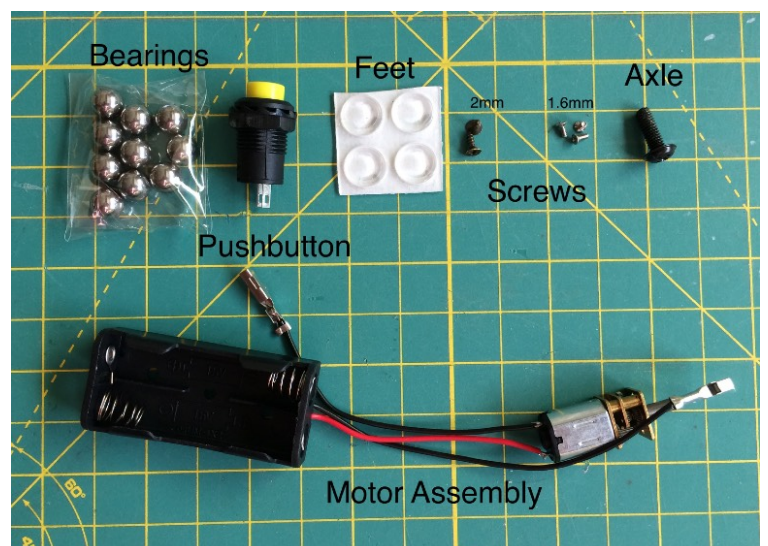


Be sure to inspect the Lifting Gear as well. The six ball chambers in the Lifting Gear should all look the same, although rotated differently with respect to the gear. If you see excess plastic in the holes clear it away with tweezers or a knife.

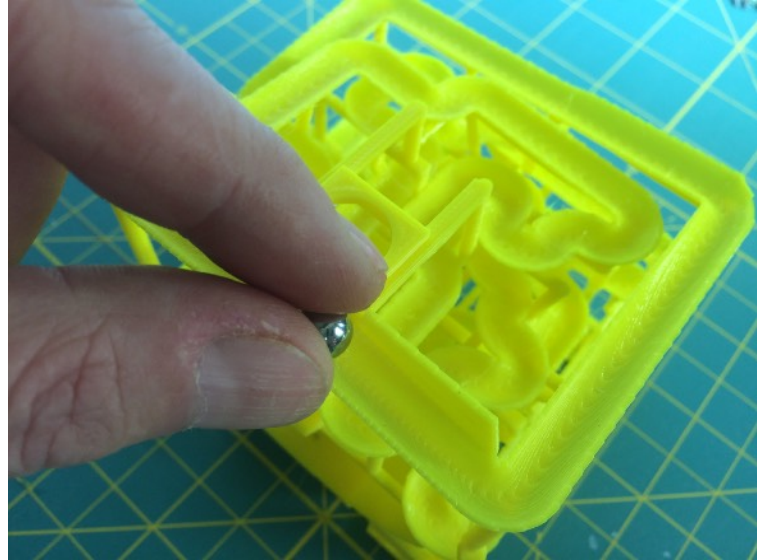


Gather the components:

- 2 AAA batteries (not included)
- 1 or 2 2mm tapered battery screws
- Motor assembly
- Axle (black 4mm Phillips screw)
- Pushbutton
- 2 1.6mm silver motor mount screws
- 4 rubber feet
- 10 metal bearing balls



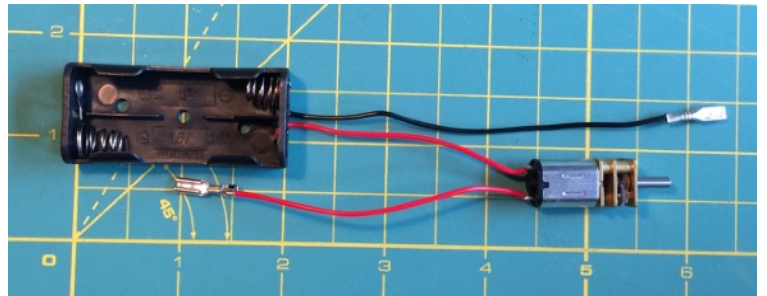
Place metal bearing balls onto the top of the track and see if they roll all the way down and out the loading hopper at the bottom of the Maze. Remove any stray pieces of plastic that may be obstructing the paths.



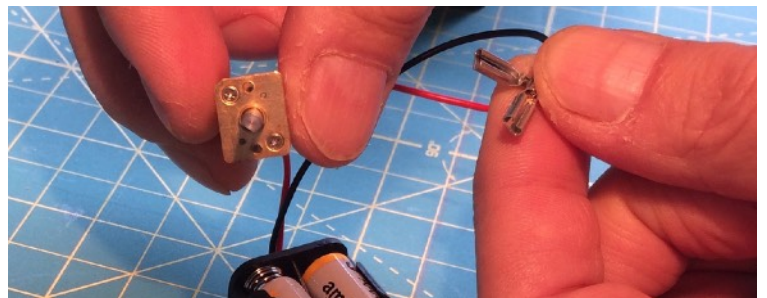
Once the balls roll down both tracks a few times without getting stuck you're ready to continue with the assembly.



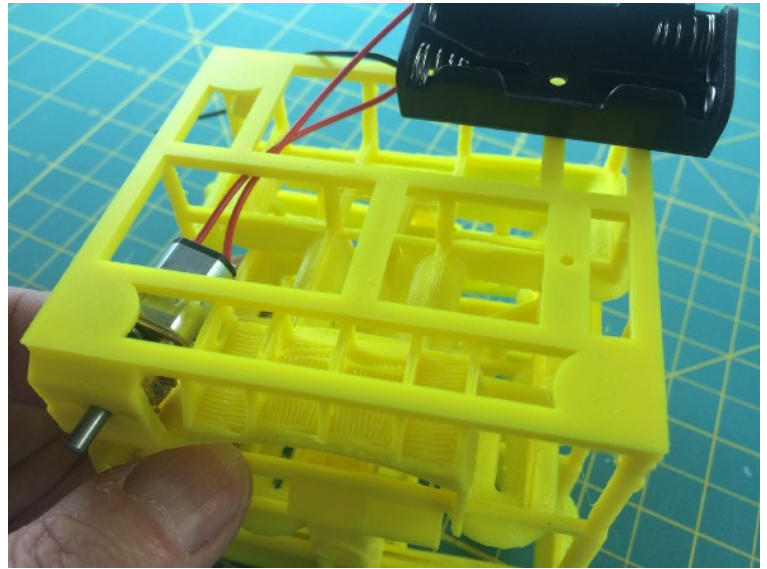
Locate the Motor Assembly.



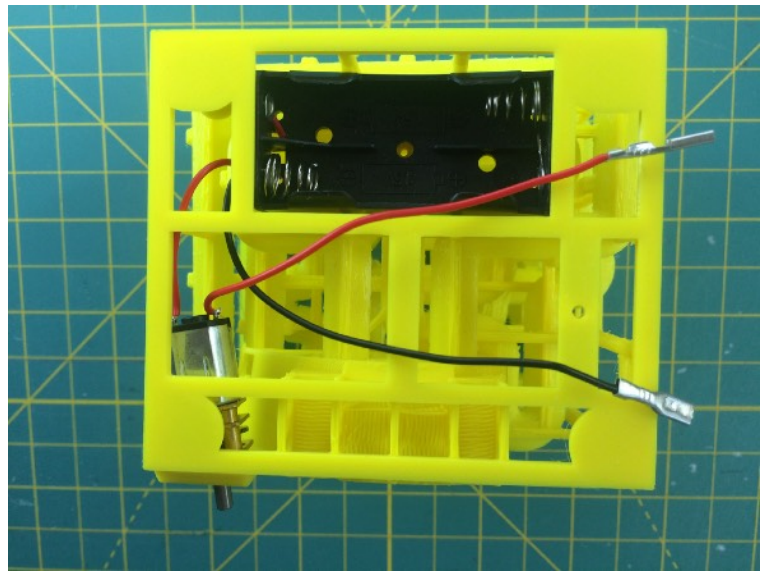
Temporarily install two AAA batteries into the battery holder and hold the on/off pushbutton terminals together. Make sure the motor is rotating in the clockwise direction when looking at its axle, as shown in this picture.



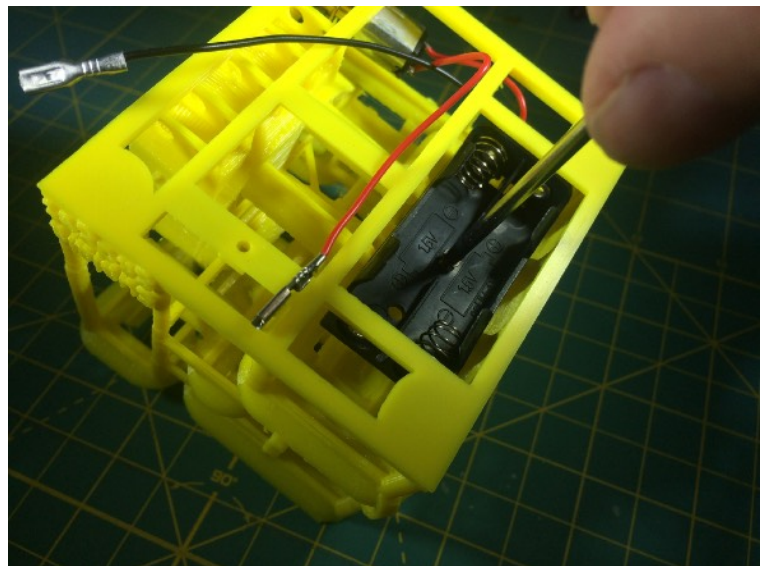
Insert the motor through the gap between the motor mount and the battery compartment locations as shown here.



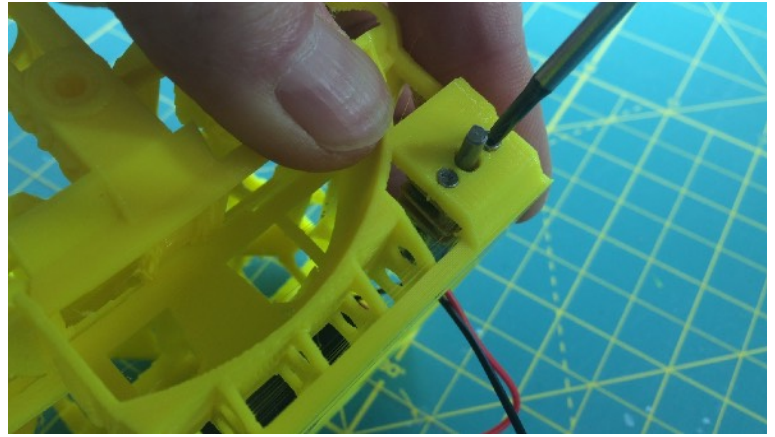
Pull the motor into the motor mount, position the battery box and route the connectors out the bottom of the model. The battery box is positioned correctly when you can see the small yellow screw hole through the central battery box mounting hole. (There's only one mounting screw in this example).



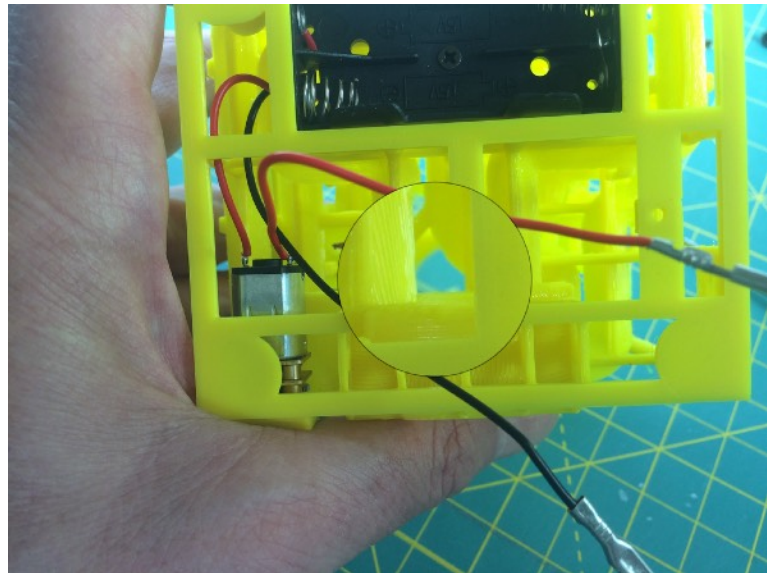
Attach the battery box using the 2mm diameter tapered screw.



Hold the motor so that its mounting screw holes line up with the two screw holes in the Maze, and attach it with two 1.6mm silver screws. Make sure both screws are properly threaded into the motor before tightening them. Be careful not to over tighten.



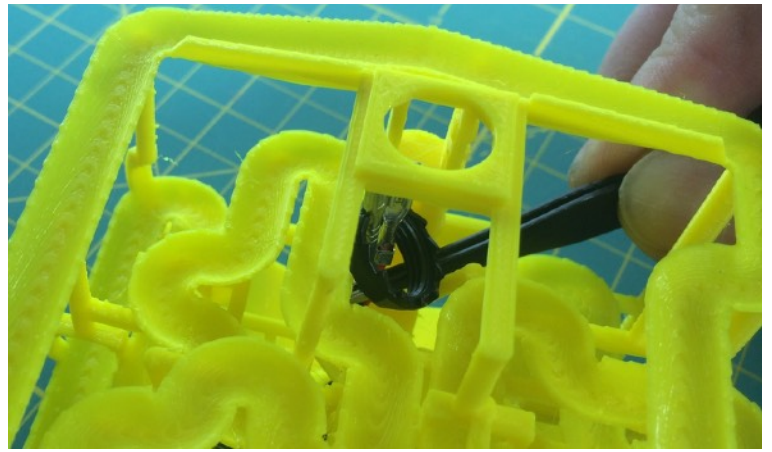
Route the pushbutton connectors between the two bottom tracks and up through the small somewhat triangular opening (magnified in this picture).



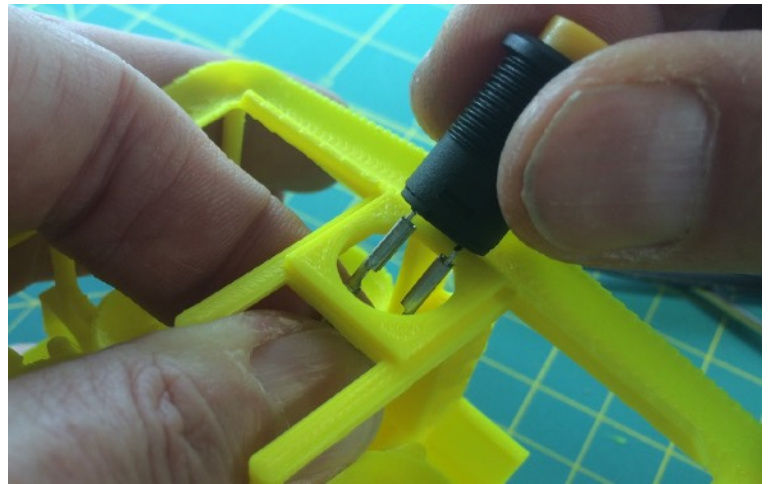
Viewed from above it looks like this. (This picture is looking through the pushbutton mounting hole on the top of the model down towards the triangular passage the connectors are routed up through).



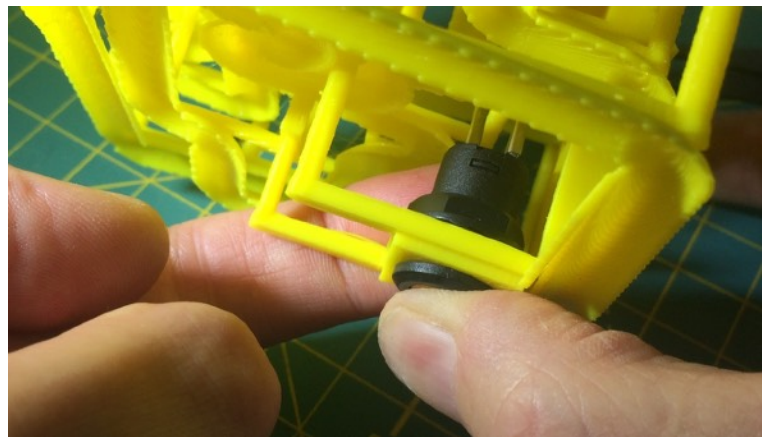
Remove the black plastic nut from the Pushbutton and hold it below the pushbutton mounting hole on the top of the maze. Route the Motor Assembly connectors through this nut. Make sure that the “ratchet” side of the nut is pointing towards the Pushbutton mounting hole in the Maze. It may help to hold the wires with tweezers.



Push the connectors up through the round mounting hole and attach them to the Pushbutton.



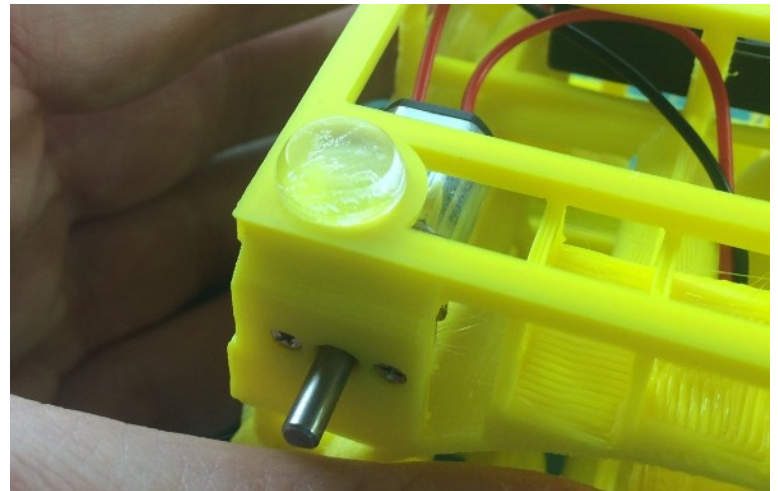
Insert the pushbutton into the top of the mounting hole and finger-tighten the nut. Note that the model is being held upside down in this photo.



This photo shows a closeup of the connectors after they have been attached to the bottom of the pushbutton.



Attach the feet to the four bottom corners of the Maze. Now is a good time to test the motor's operation. Insert batteries into the battery compartment, press the Pushbutton and confirm that the motor turns in the clockwise direction.



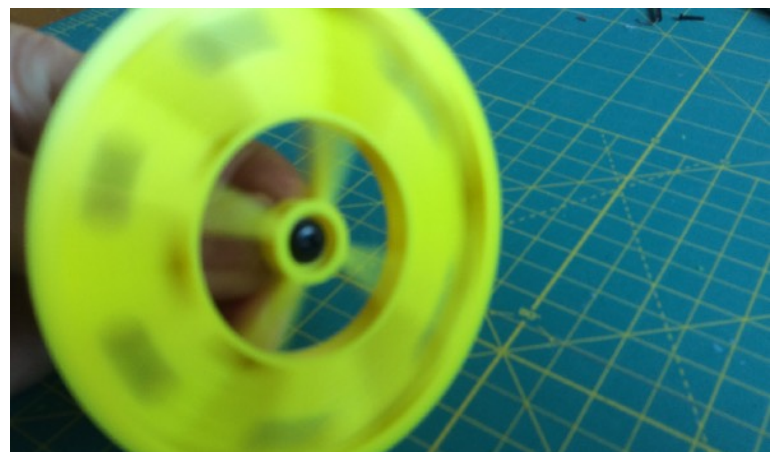
Attach the Motor Gear. Notice that the tapered side points outwards from the Maze.



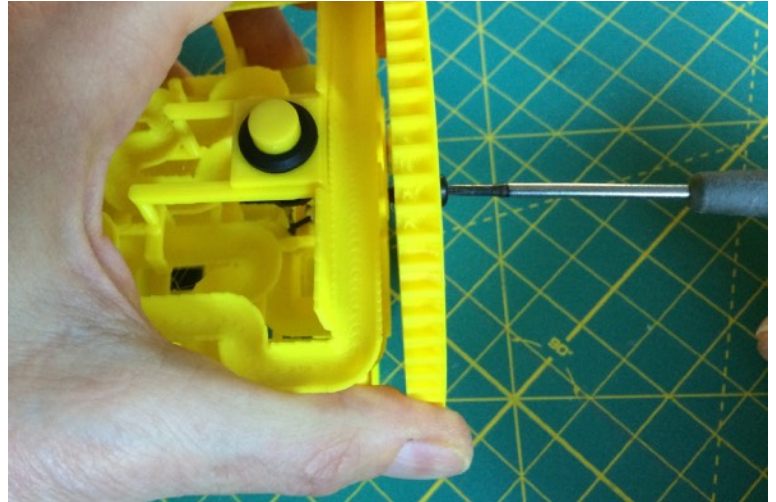
Install the black 4mm diameter Lifting Gear Axle screw into the Lifting Gear. You want the axle head to be on the side of the lifting gear with the cutouts.



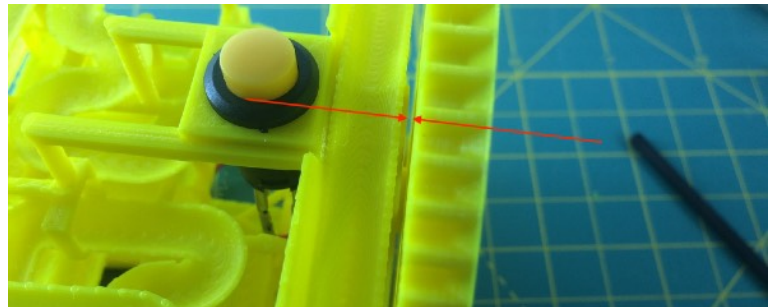
Make sure the lifting gear spins freely. The axle shouldn't fit too tightly, but you also don't want it too loose. It may be necessary to spin it with your finger a few times to get it to loosen up.



Attach the lifting gear to the maze. Be sure to align the Axle screw with the hole in the maze so that it doesn't go in crooked. The axle will self-tap into the plastic. This attachment should be fairly tight.



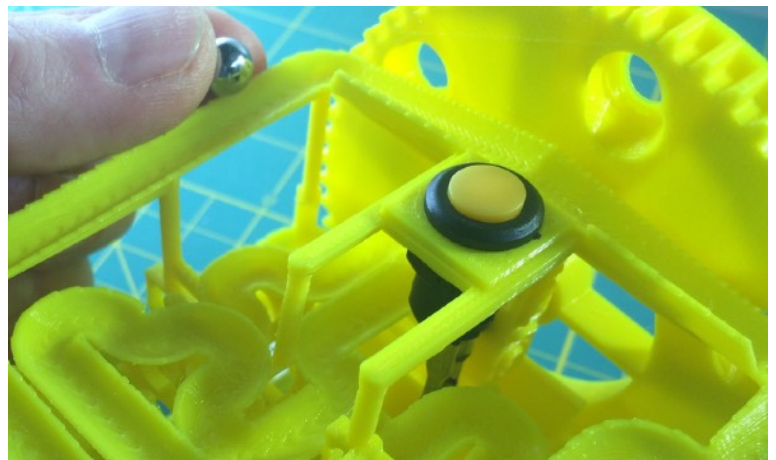
Tighten the axle screw all the way, then back it off about a quarter of a turn. You want a small gap between the maze and the lifting gear, so that the gear will turn freely, but you don't want it so loose that it wobbles.



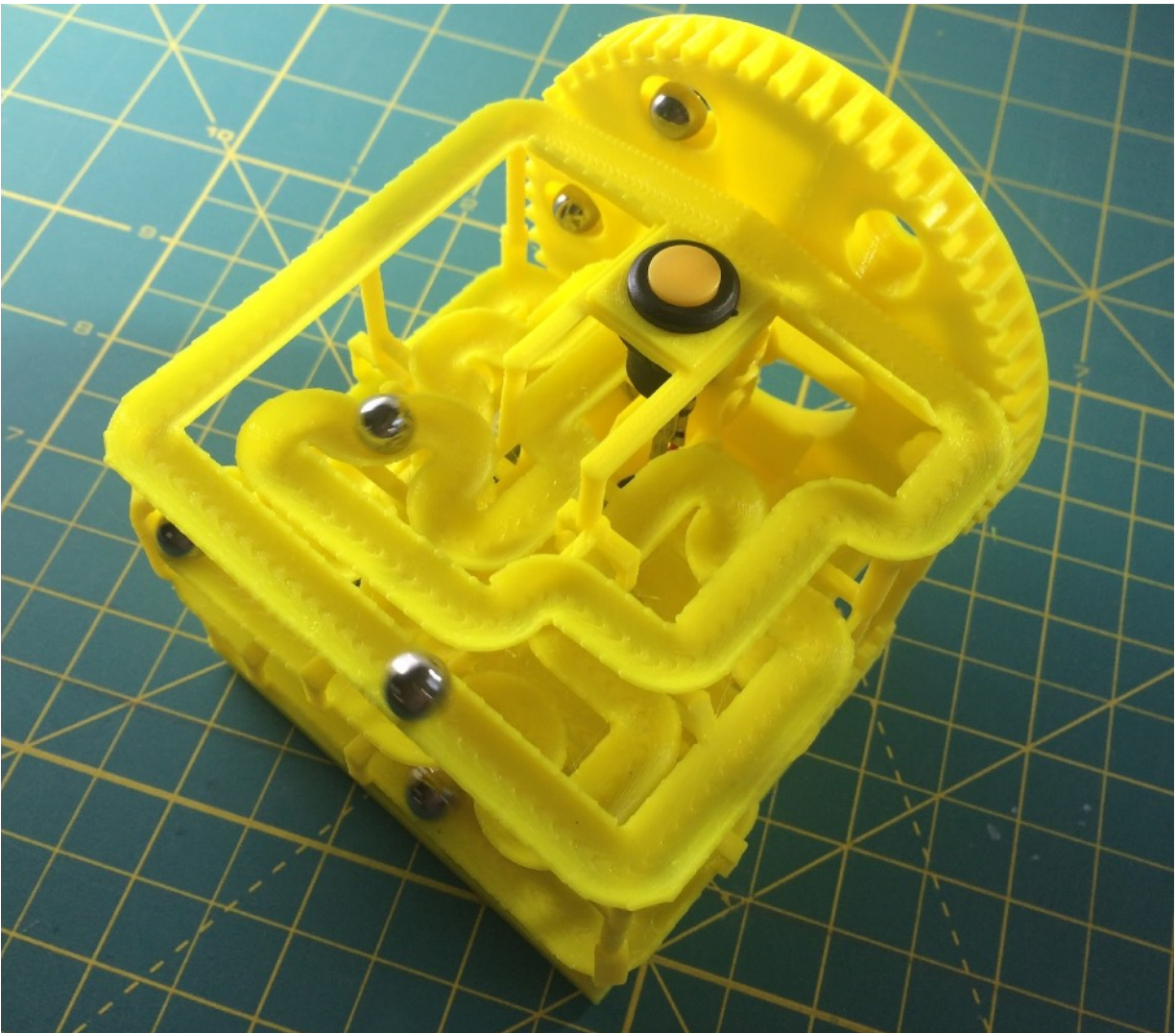
Insert batteries.



Add the balls to the maze.



Turn the model on — you're done!



If the balls stop rolling after a while, find where they are getting stuck and clean out whatever is obstructing the paths. If the balls are falling off the track, there could be stray plastic obstructing them, or your table may not be level.

The lifting gear is designed to drop balls either earlier or later in its rotation, so that the balls proceed down either the left or right path. Three of the lifting holes drop early, and three drop late. If they are not behaving this way there could be a small problem with the shape of the lifting holes, which can be corrected by trimming the plastic with tweezers or a small knife at the edge of the holes.

If the gear isn't rotating freely loosen the axle slightly — there should be very little resistance, and you shouldn't hear the motor struggling. When operating correctly the motor should continue to turn for at least 30 hours on a set of batteries.