Smartphone Support Building Instructions

Materials

Base

- Three 2.25 inch screws, two 6-32 nuts
- Base support - four 2-56 ½ inch screws, four 2-56 nuts, 4 2-56 washers (or 6-32)
- 4 rubber bumpers

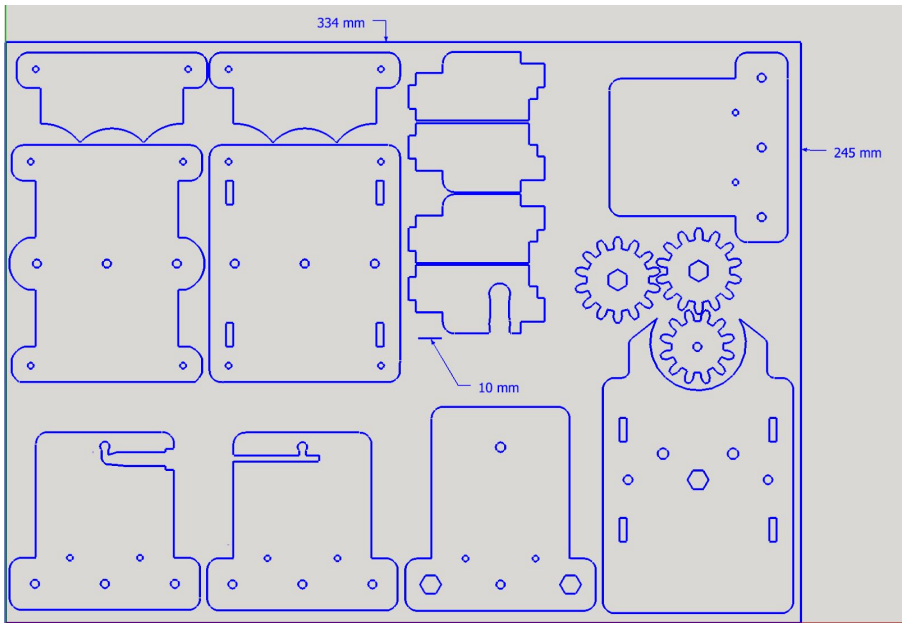
Sandwich

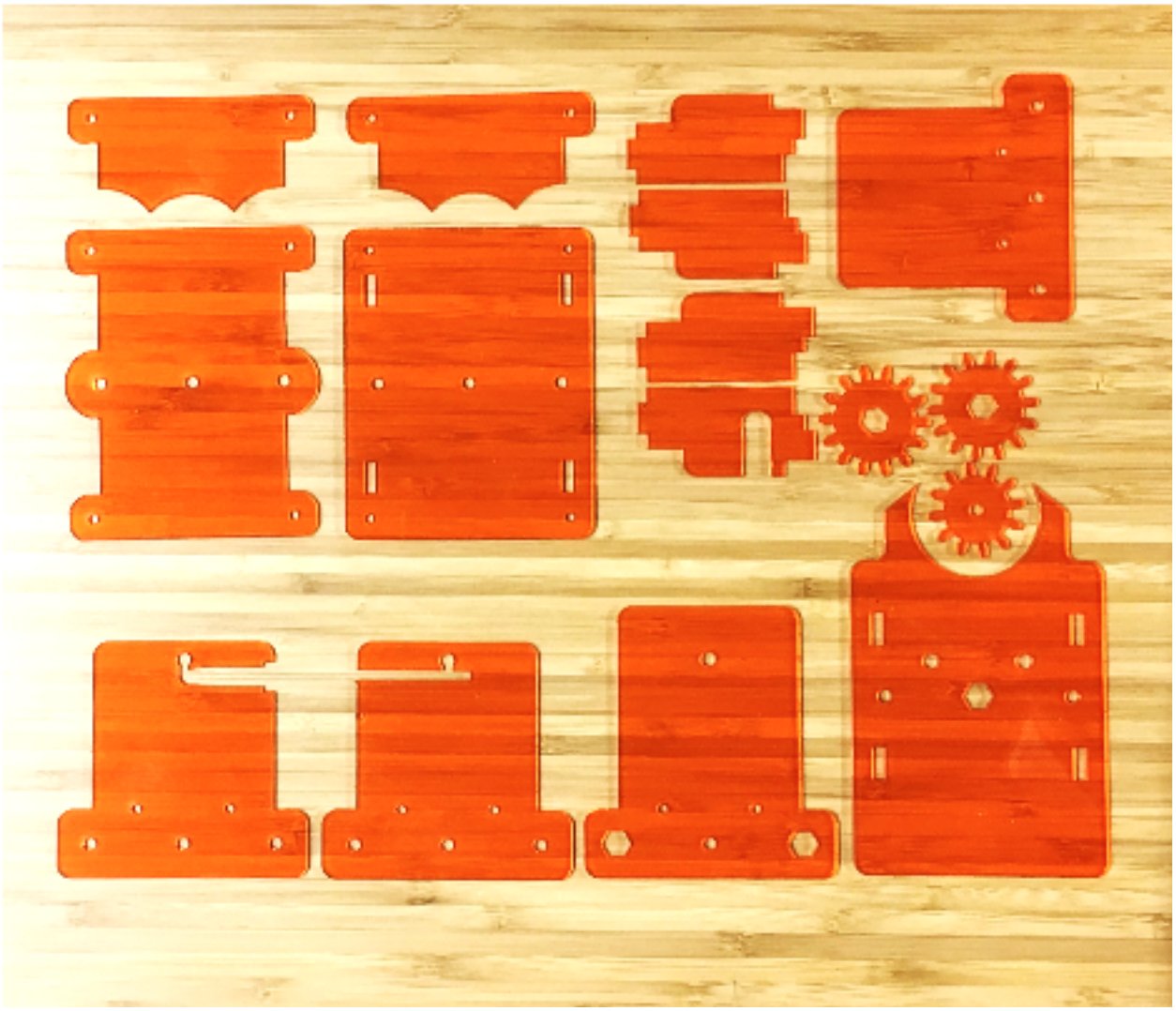
- 2 thinner bumpers
- two ⅝ screws, two 2/56 nuts, two 2-56 nuts
- two 6-32 nuts
- 120 Ohm resistor
- bright white mini-LED
- Wire
- 9V connector
- Mini-switch
- heat shrink

Top

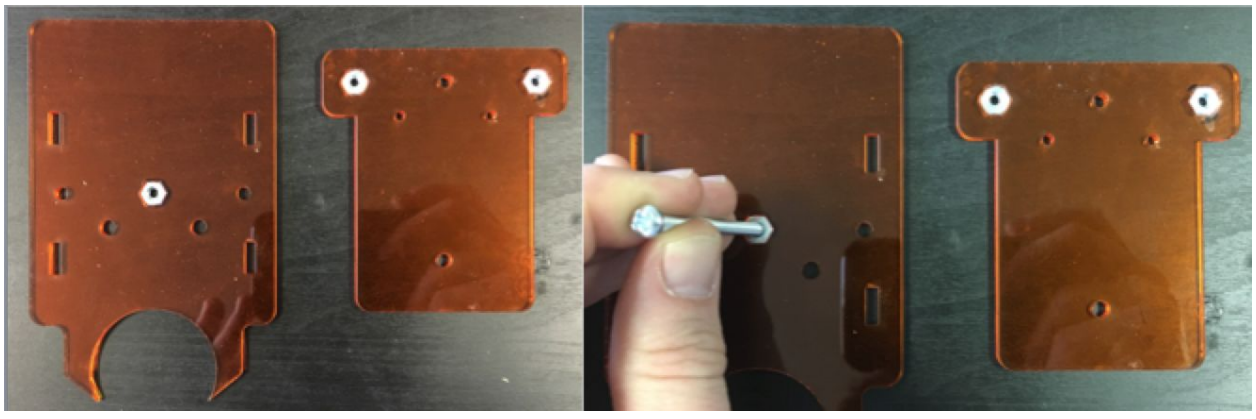
- One 6-32 nut
- Two pieces of copper

Laser Cut Parts



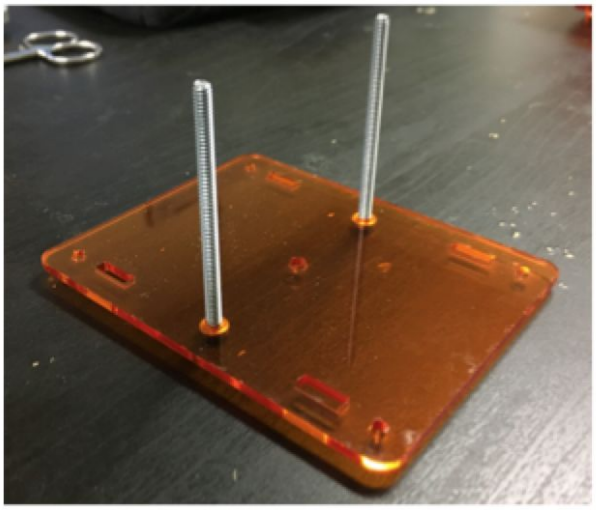


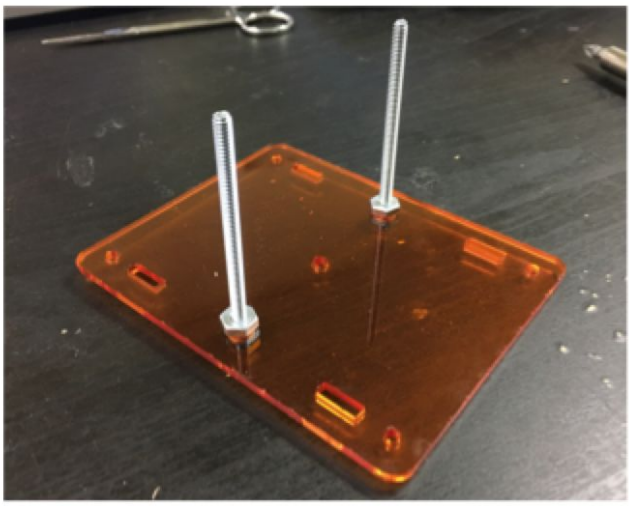
Step 1: Glue Nuts



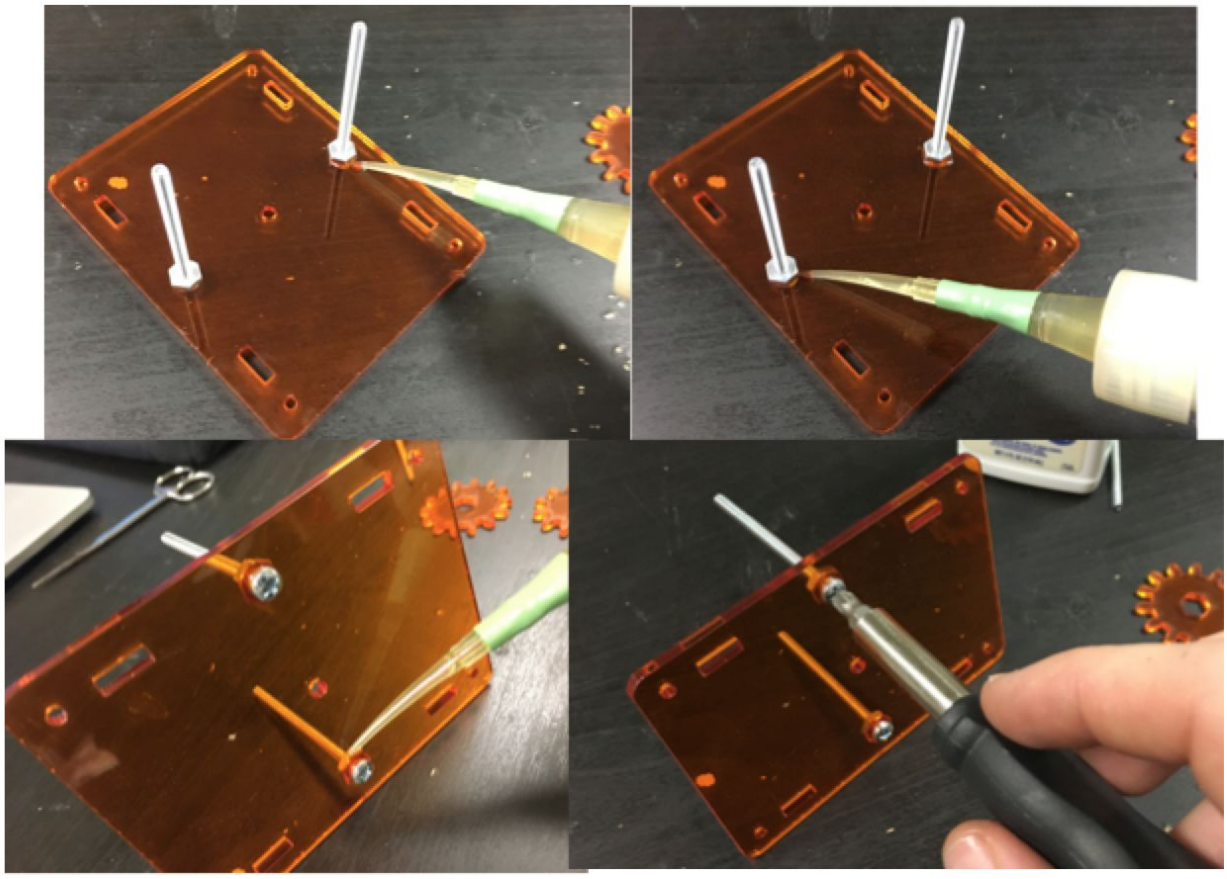
Glue the three nuts per the usual method, ensure they are flush with bottom by pushing down, using a 6-32 screw as a tool

Step 2: Build Base

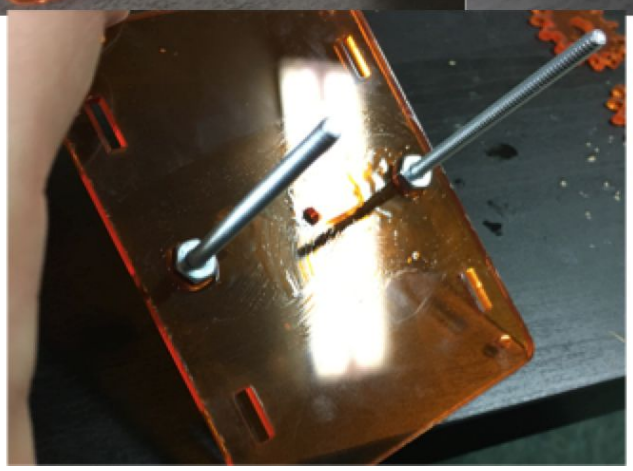




1. Glues 6-32 nuts on two 2.25 screws on the base piece in the usual manner.

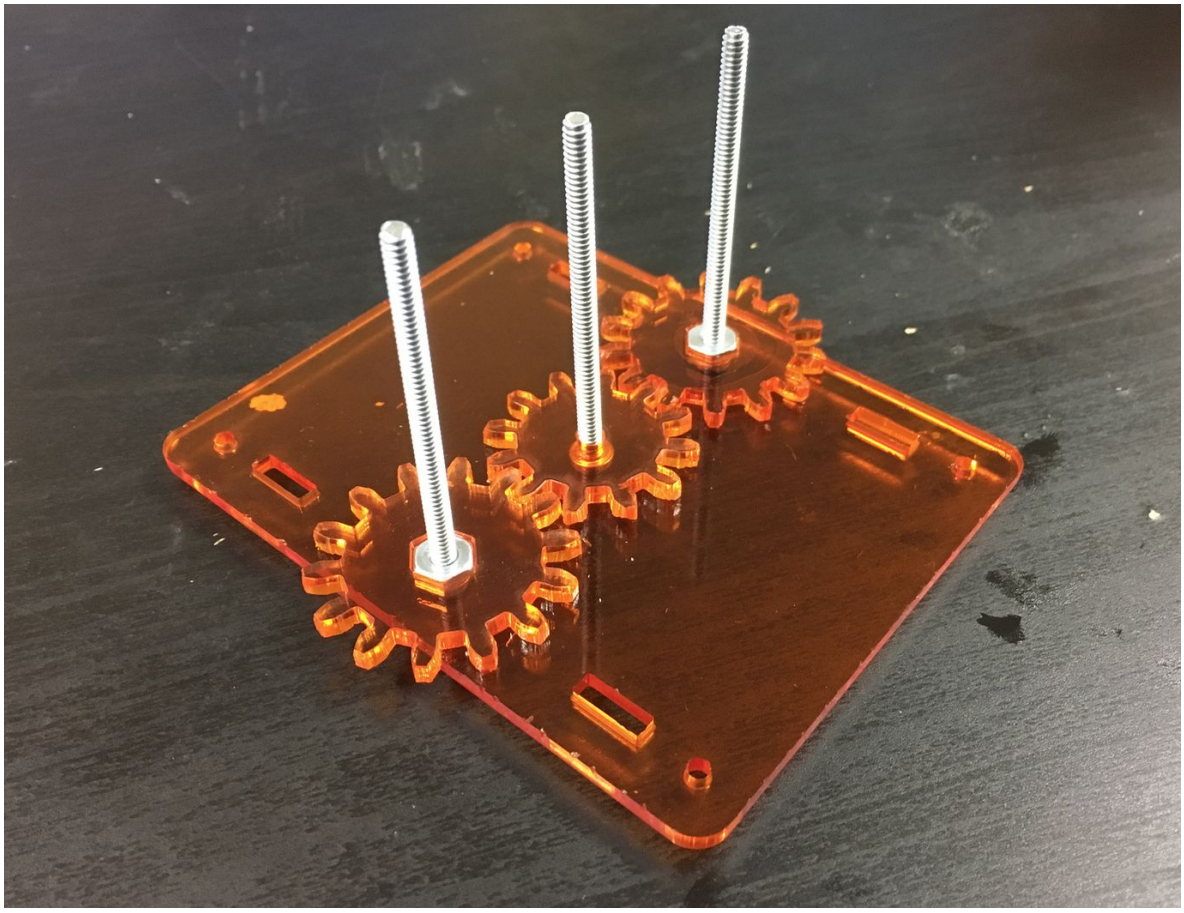


2. Add oil between both sides of the nut and head of nut, and turn screw until motion is smooth. If motion never becomes smooth, rebuild, as any roughness will be amplified as unit is assembled.

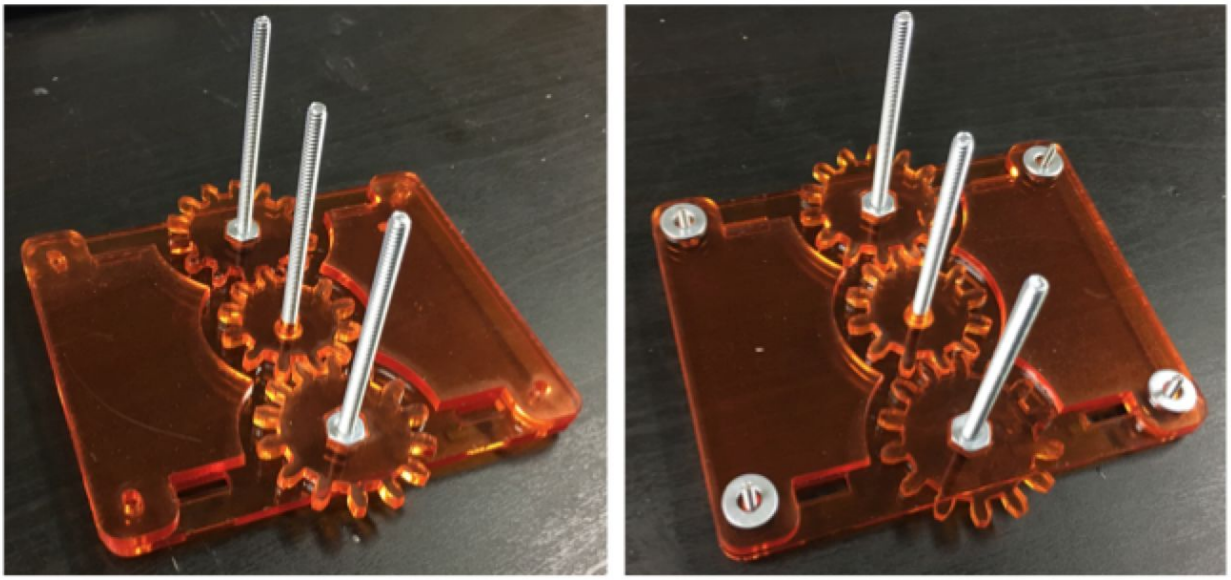


Smear light layer of oil on dorsal surface with Your finger

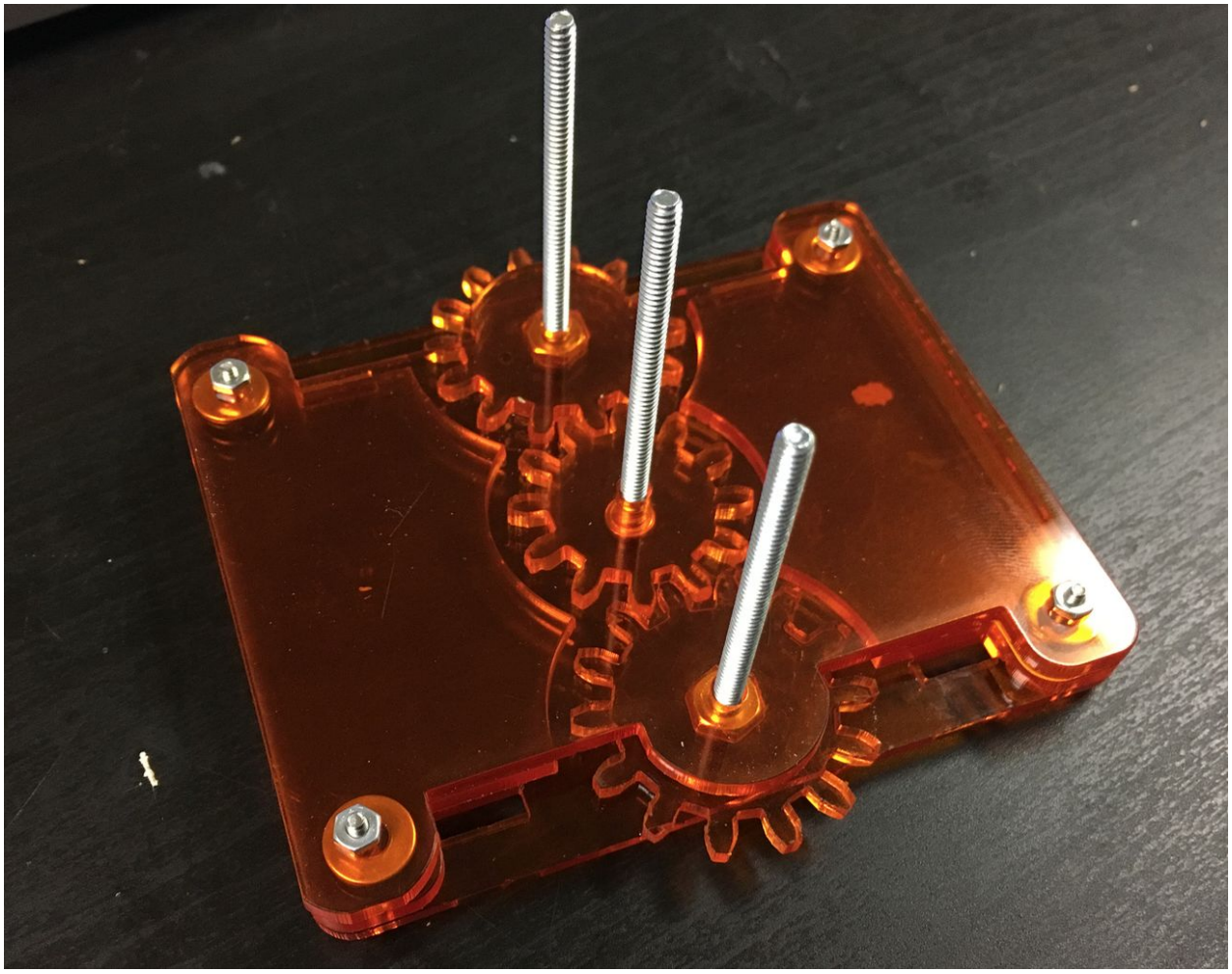
3. Add oil to dorsal surface



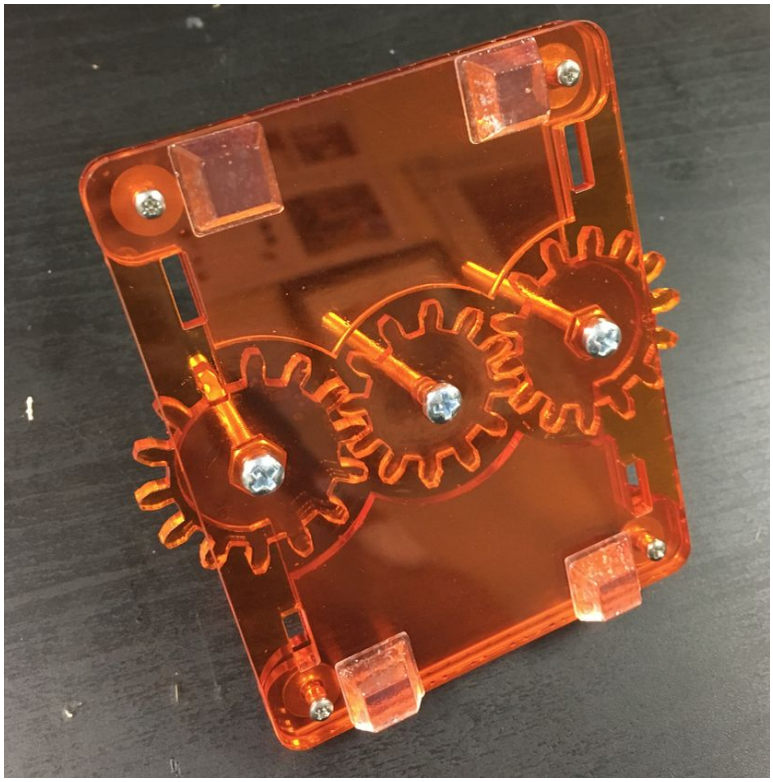
4. Add gears with nut center, insert third 2.25 screw, and third screw



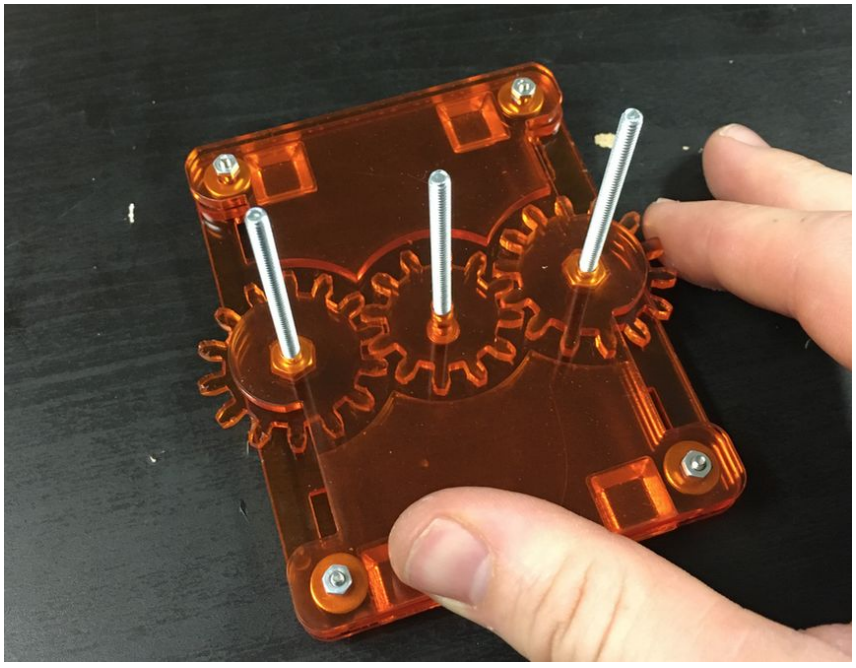
5. Add side pieces, and install ½ 2-56 screws and washers (can use either 2-56 or 6-32 washers)



6. Secure with 2-56 nuts



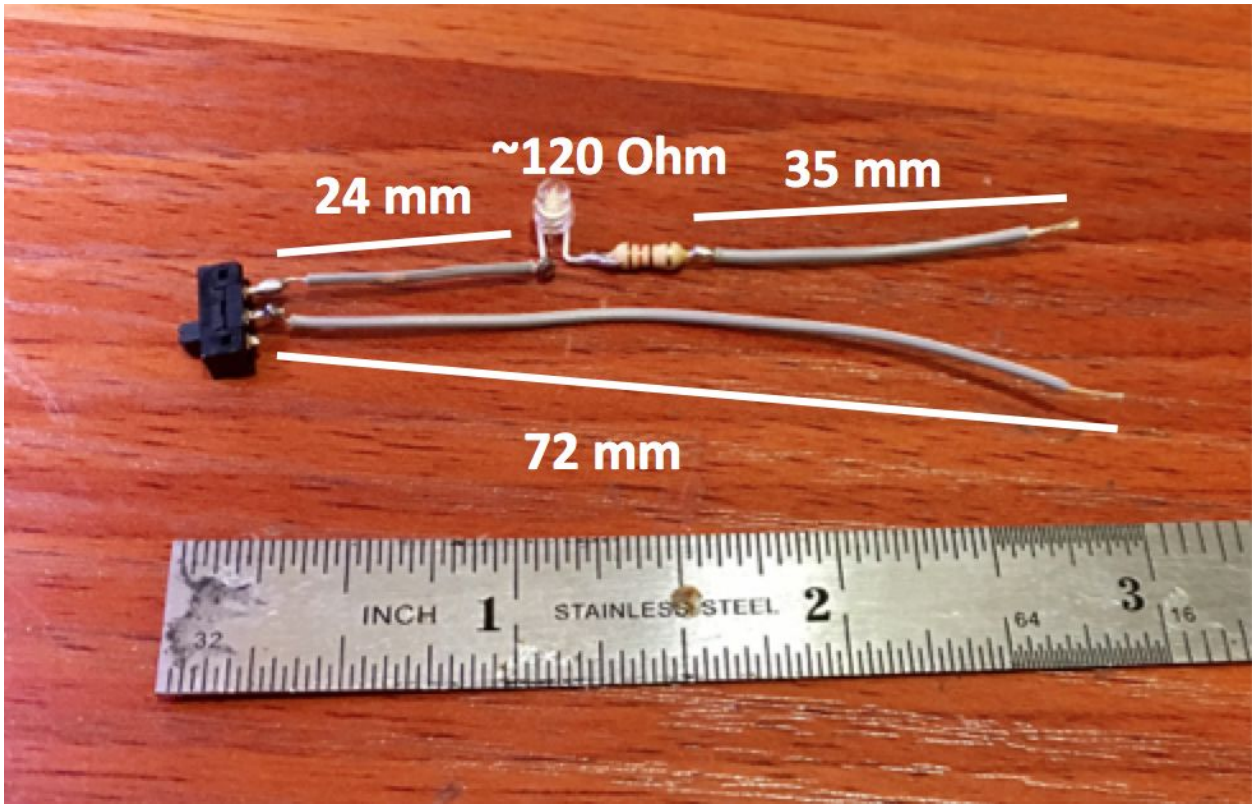
7. Add heavy bumpers to the bottom



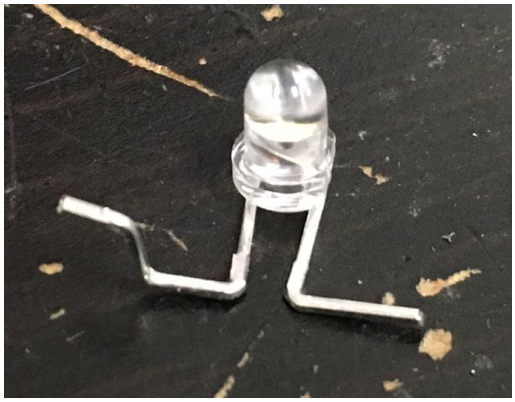
8. If necessary, move gears back and forth until movement of gears is smooth, to “break in gears”

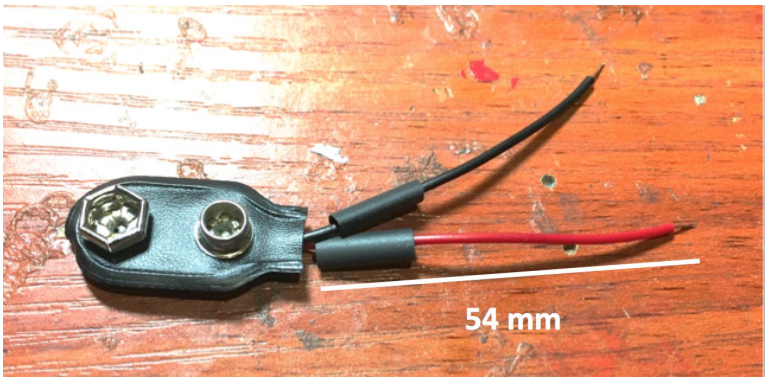
DONE WITH BOTTOM!

Step 3: Build the Sandwich

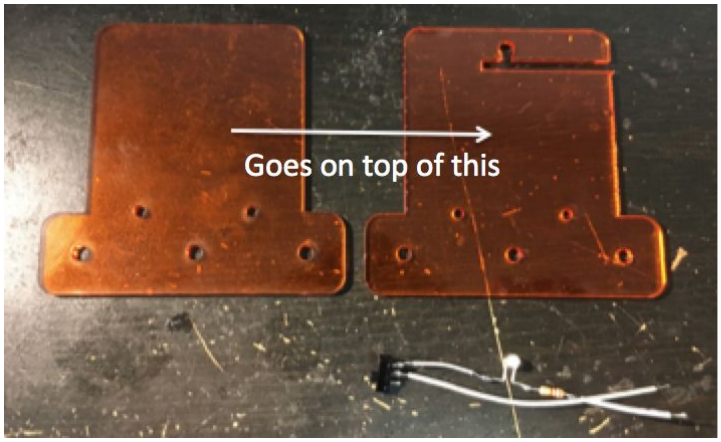


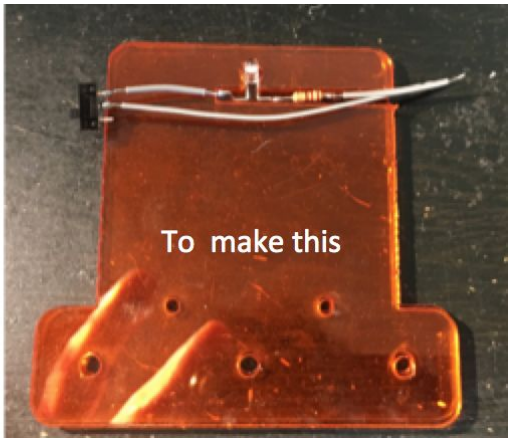
The LED fits better in the sandwich if it is pre-shaped like this:



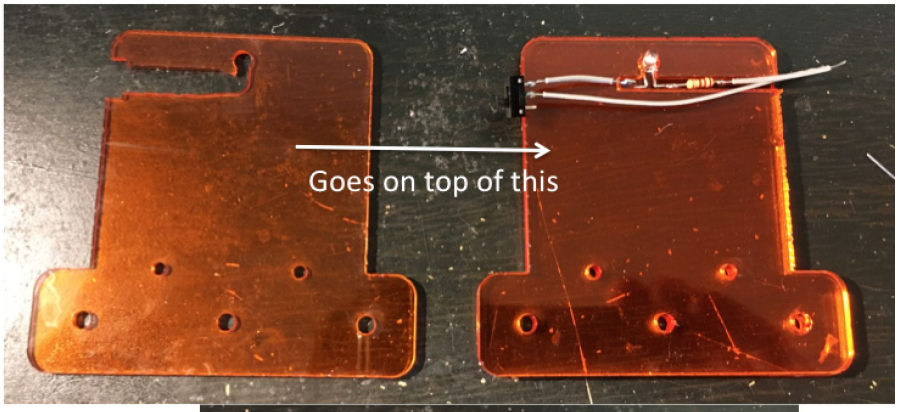


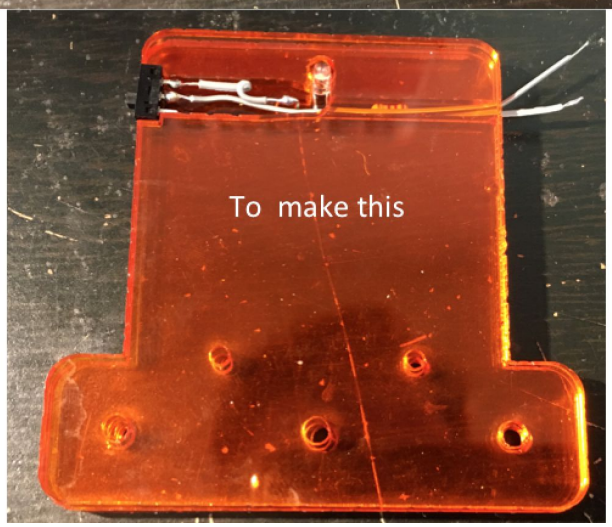
1. Prepare the electrical harness above



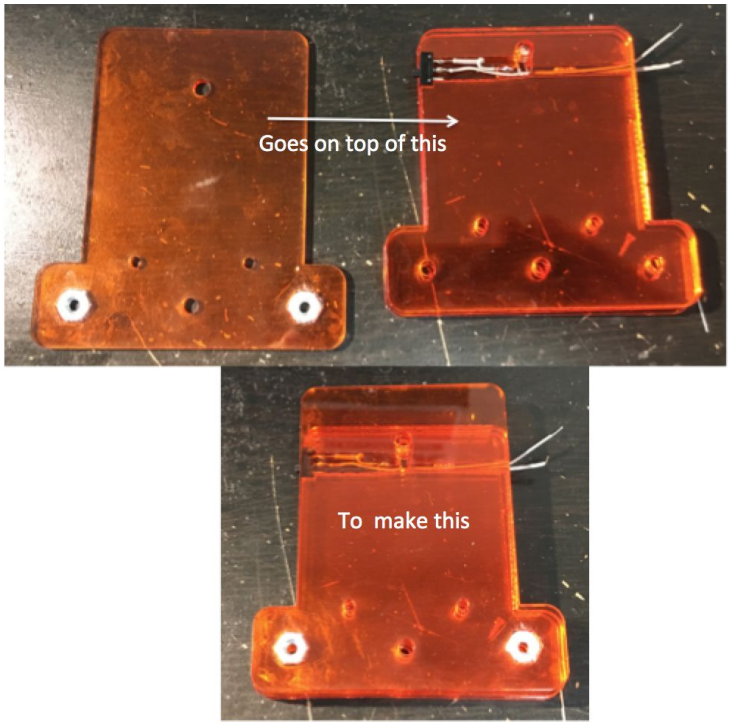


2. Prepare the first two layers of sandwich

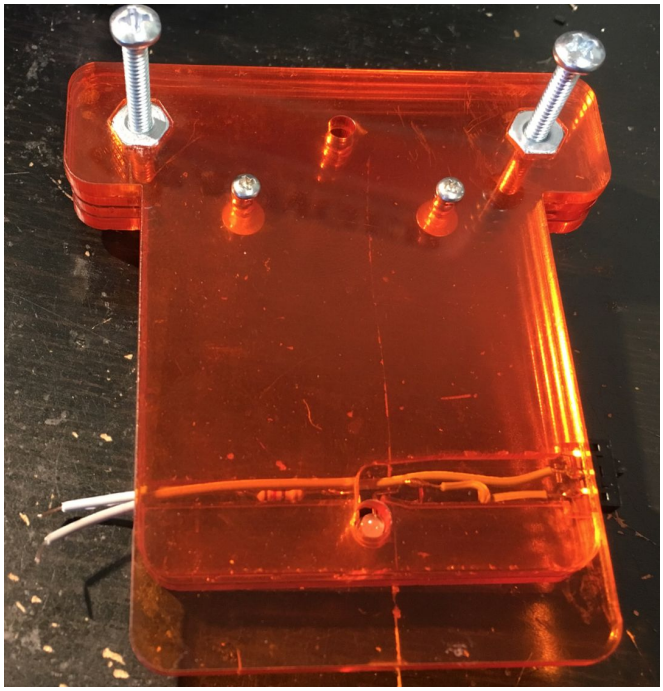




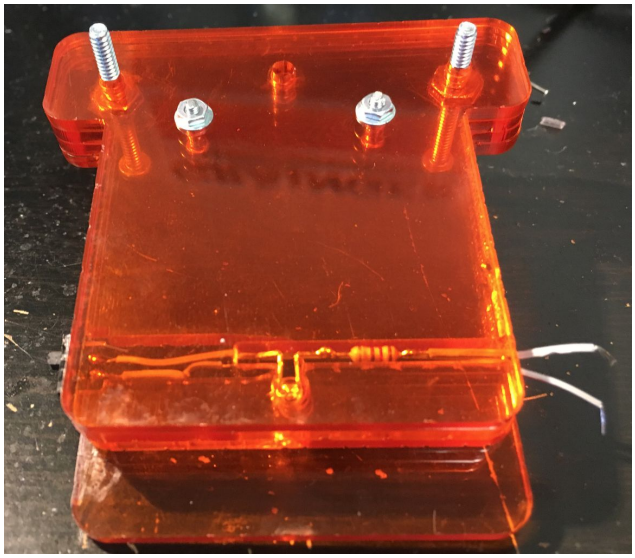
3. Prepare the third layer of the sandwich



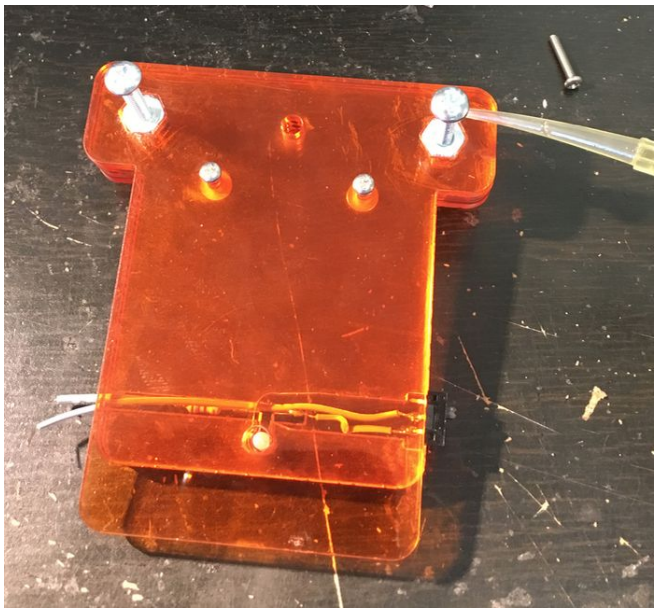
4. Add the fourth layer of the sandwich



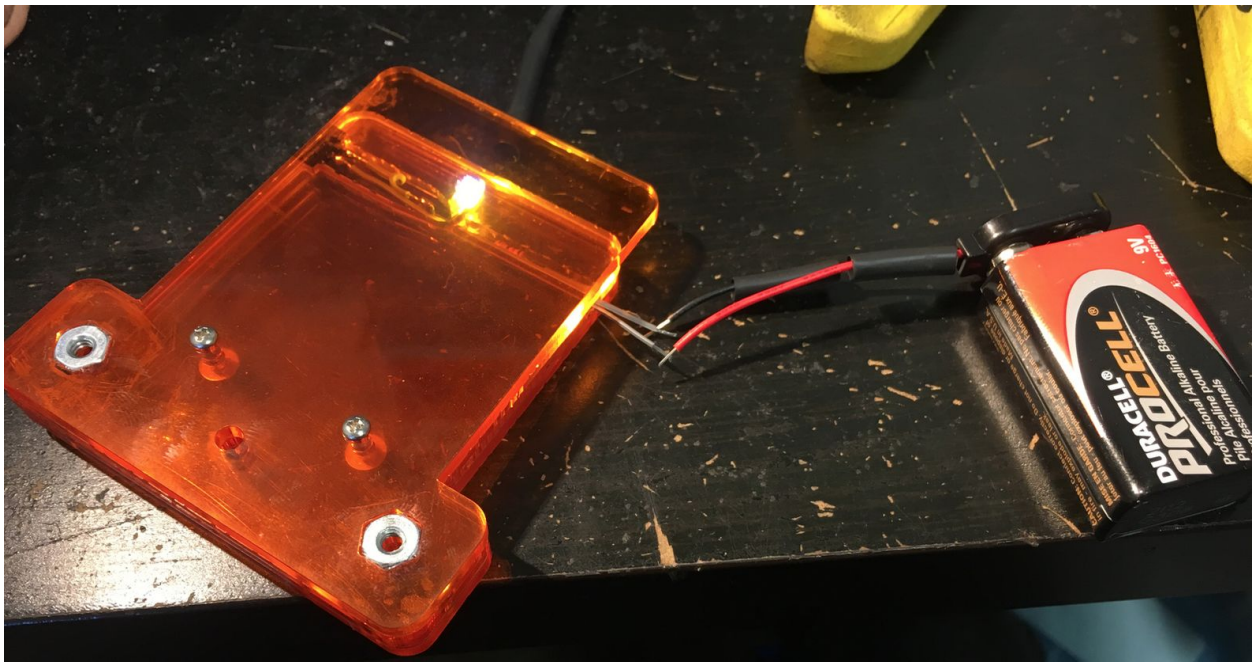
5. Temporarily using 6-32 screws helps align the sandwich. Insert the two ⅝ 2-56 screws.



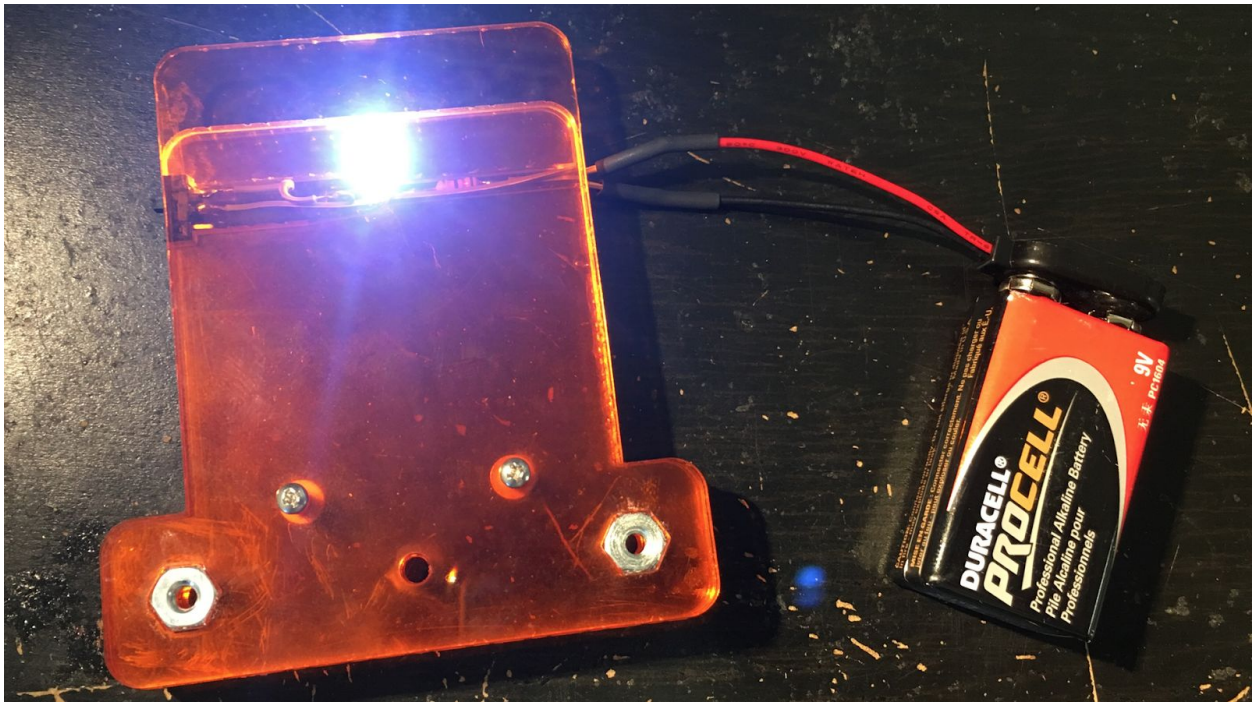
6. Secure sandwich with 2-56 washers and nuts,



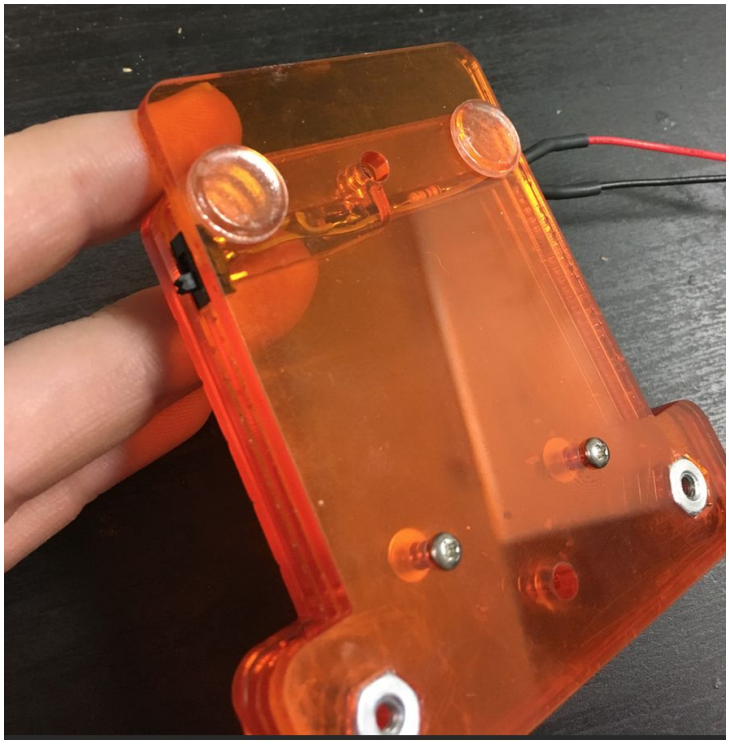
7. Add oil to both screws and work screws up and down the 4 layers of the sandwich to lubricate it.



8. Momentarily touch wires of 9 V connector to wires of sandwich to determine correct polarity, then solder. Make sure you have heat shrink tubing on beforehand.



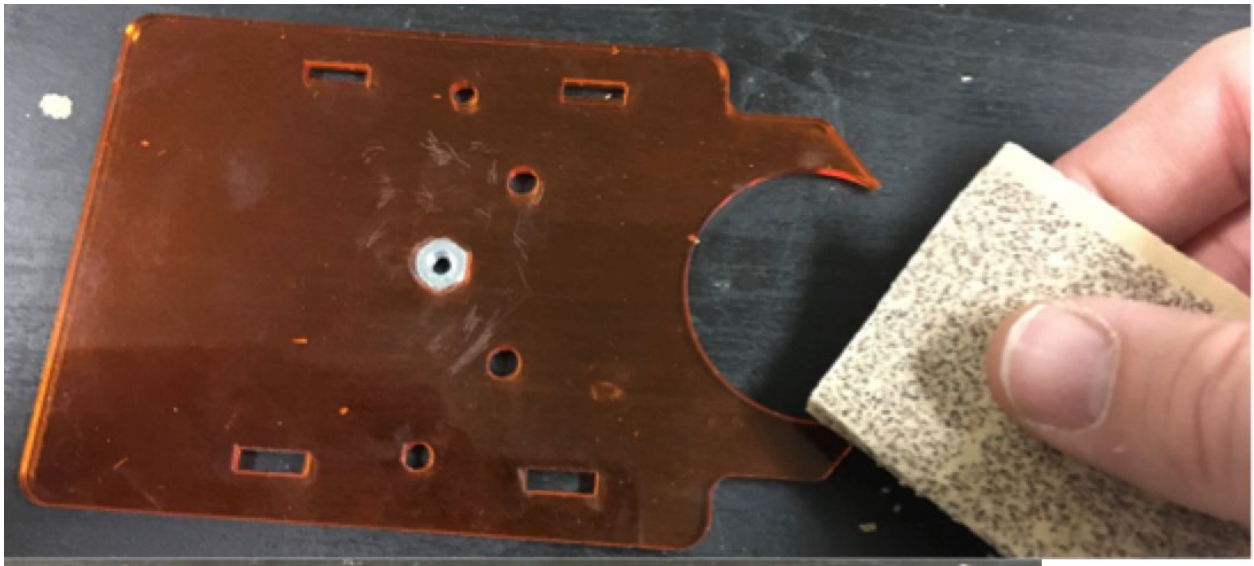
9. After soldering, heat shrink the tubing.

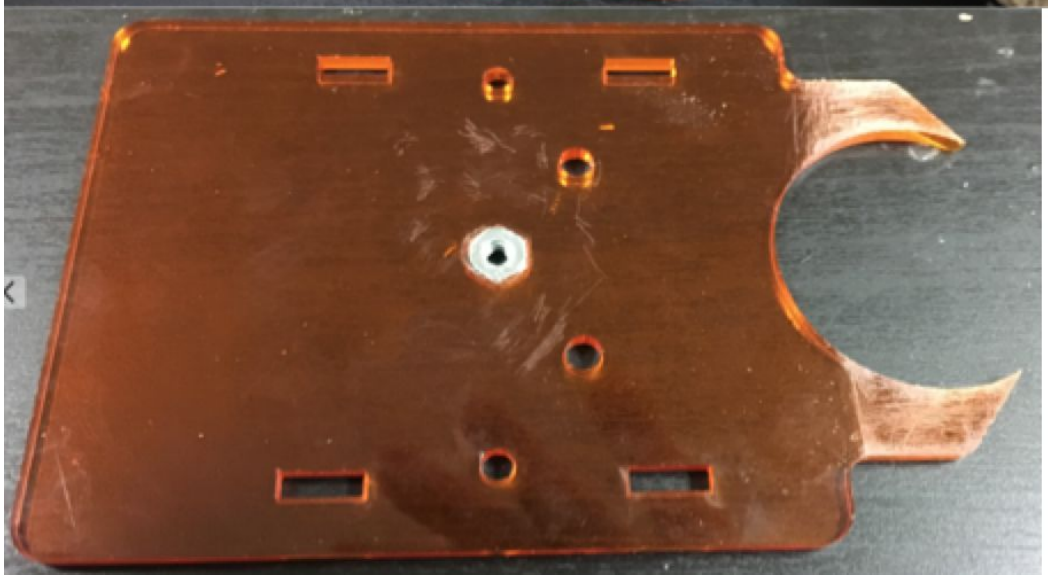


10. Add THIN bumpers (different from bottom of microscope) on either side of the LED. This is too secure slide and also prevent over-focusing (bringing sandwich all the way to top piece)

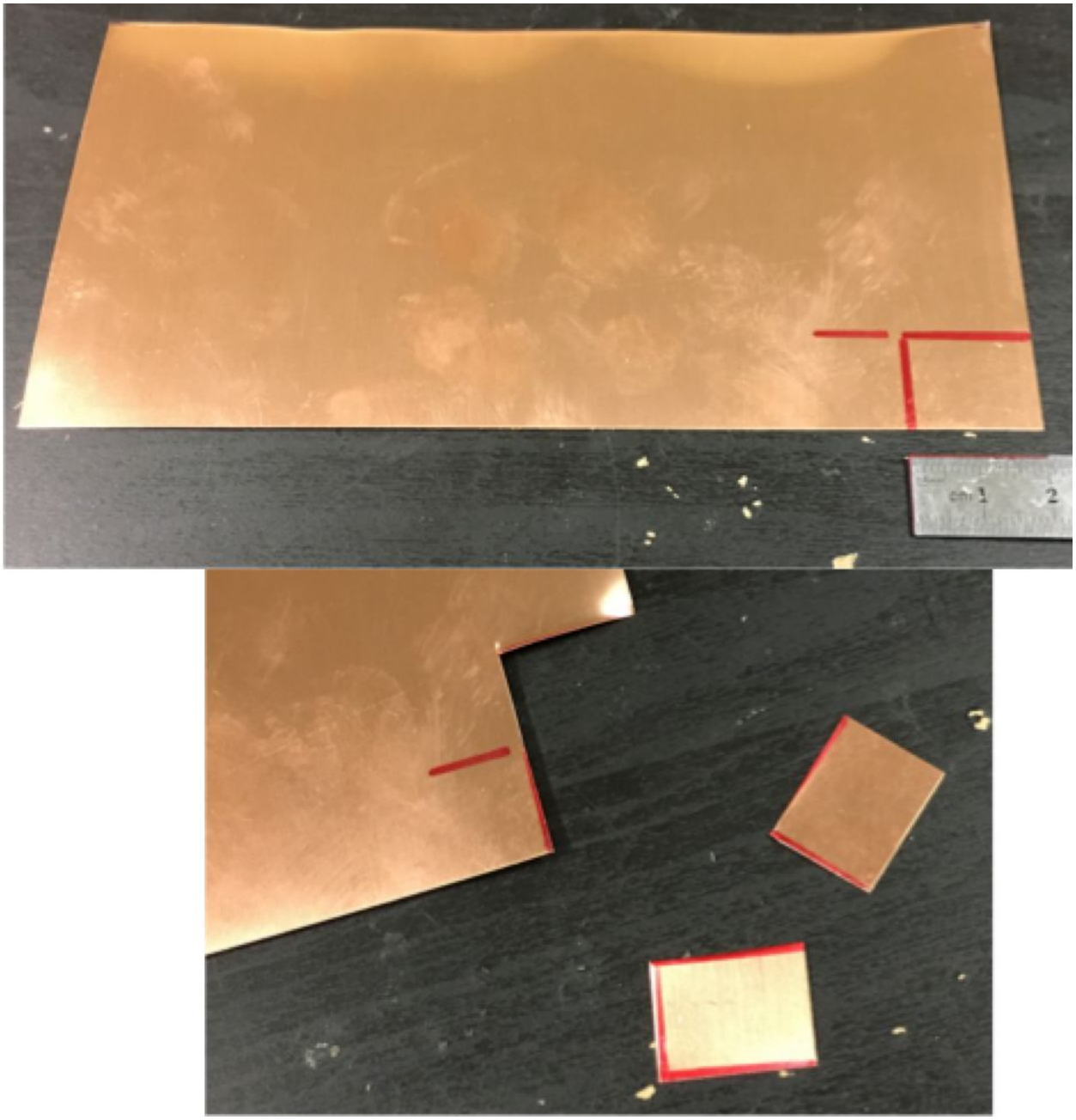
SANDWICH IS DONE!!

Step 4: Build the Top

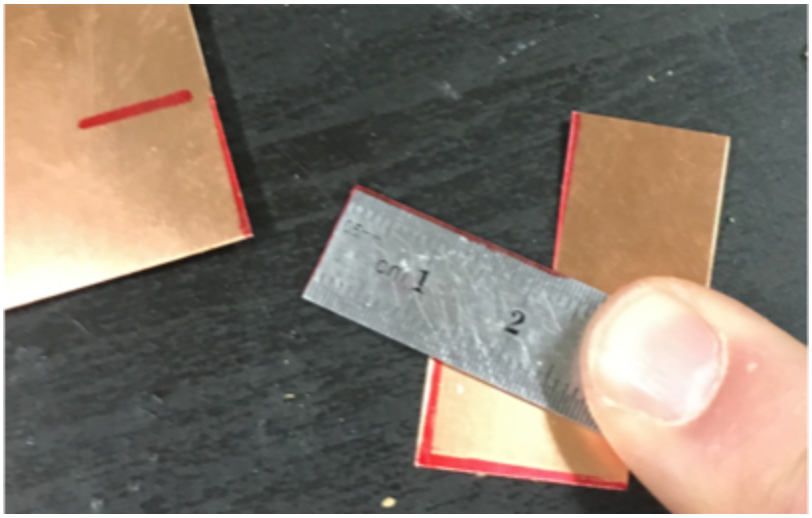




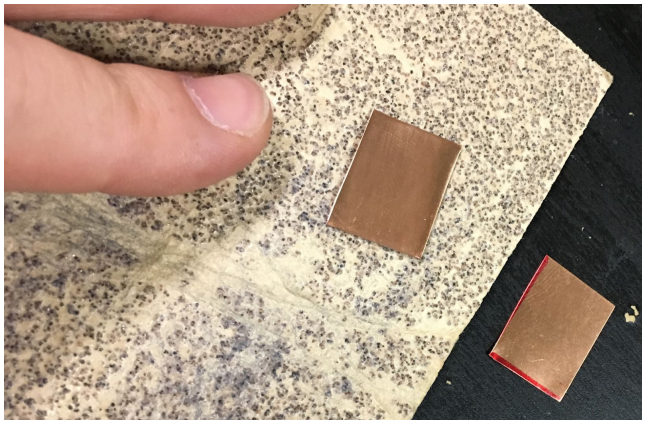
1. Important - this microscope is pushing the limits of focus due to ball lenses having short focal lengths. This is why we have to use thin copper plate inside of another acrylic layer. Thus, sand the side of the acrylic that is flush with the 6-32 nut (the bottom)

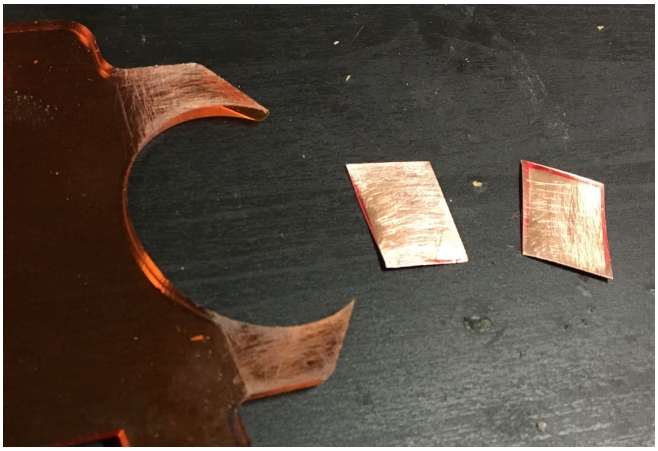


2. Cut out two 2 cm x 1.5 cm rectangles of copper plate (thinner the plate the better, but can't be a fragile as aluminum foil, needs a degree of strength that won't excessively bend with use)

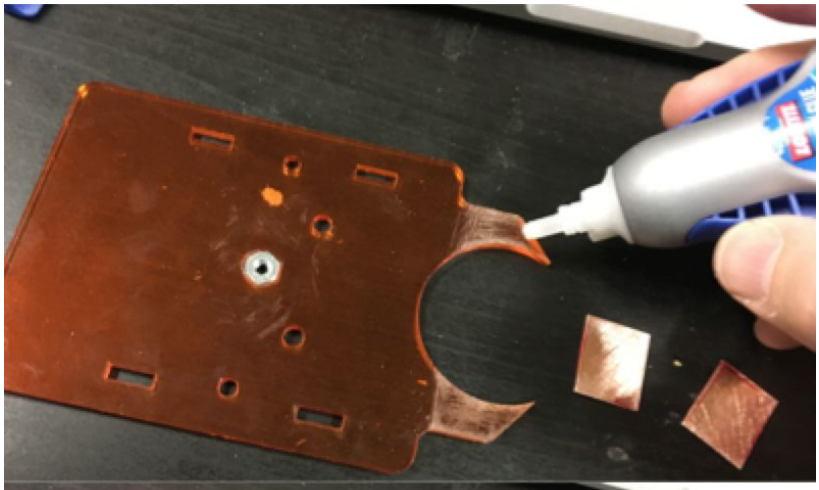


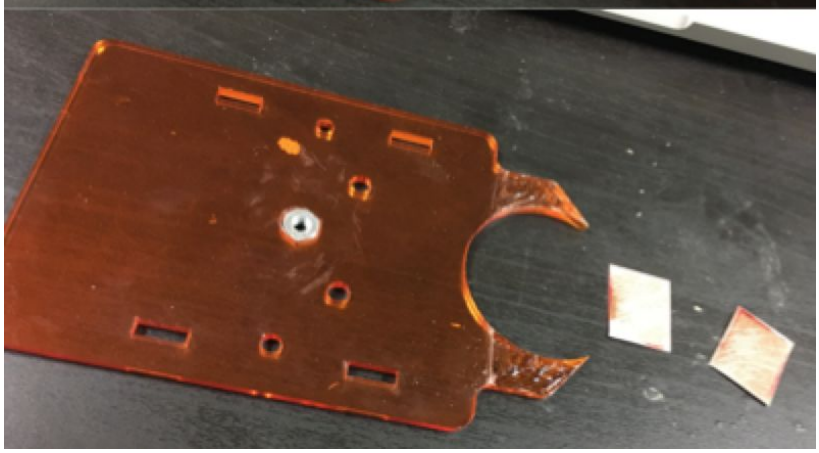
3. Cutting with heavy duty scissors will cause metal plate to curl - re-flatten by applying pressure with a straight edge



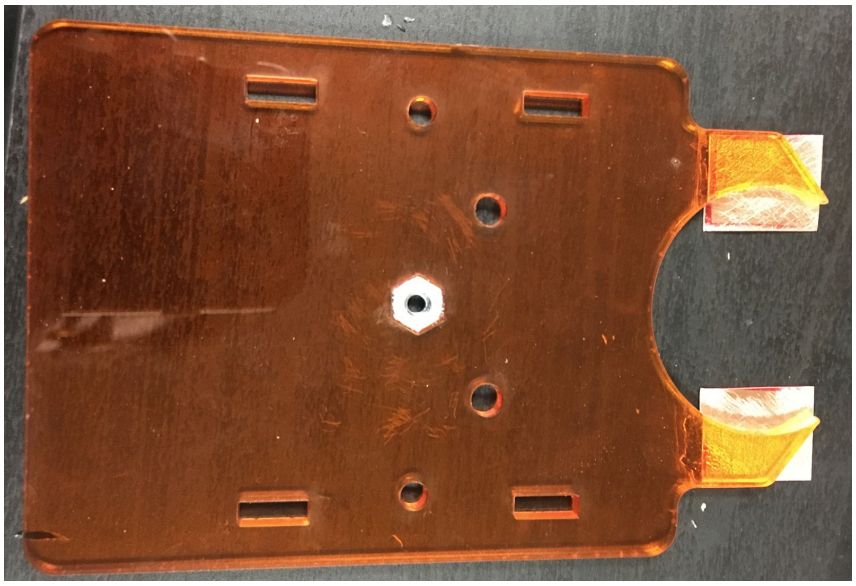


4. Sand one side of each copper rectangle

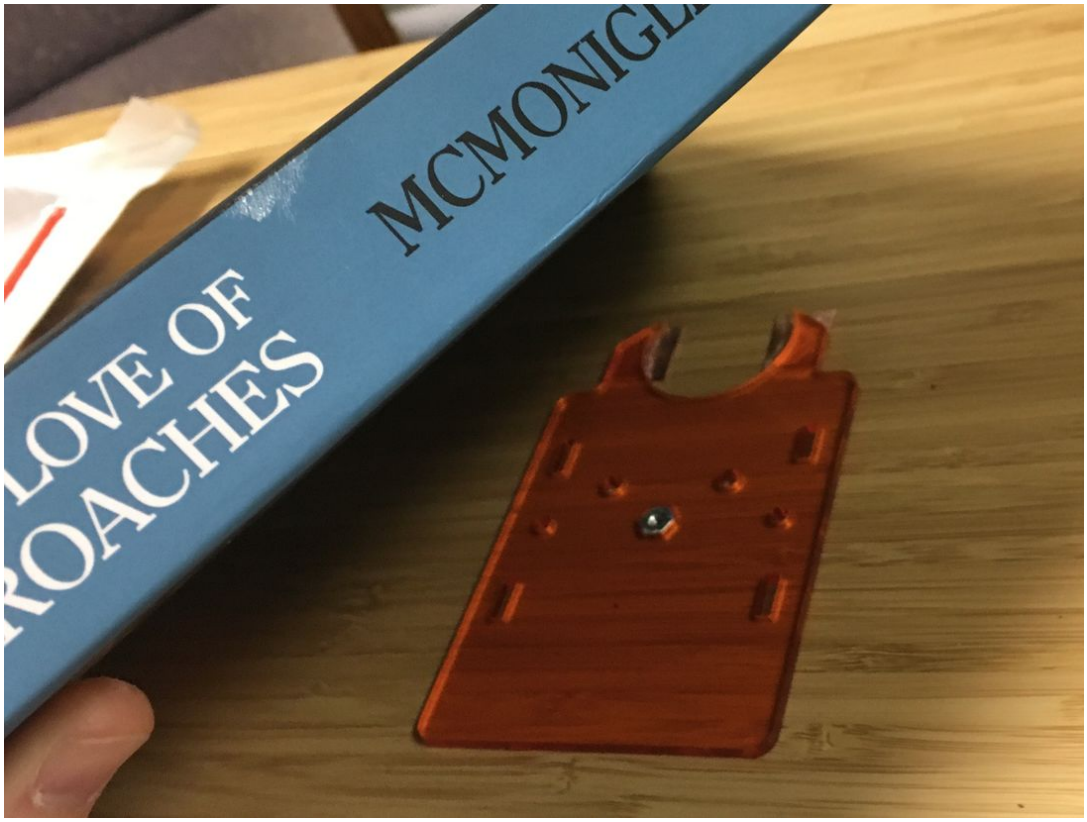




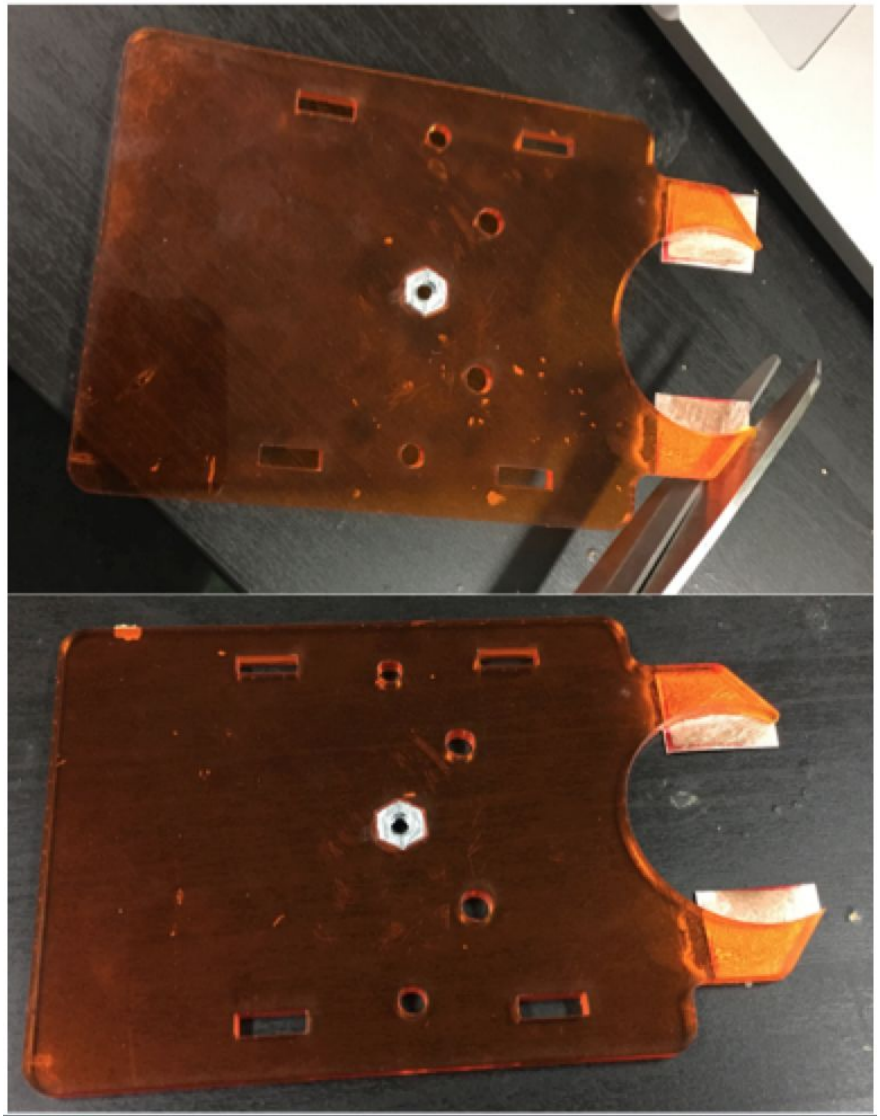
5. Add a layer of glue to each side…



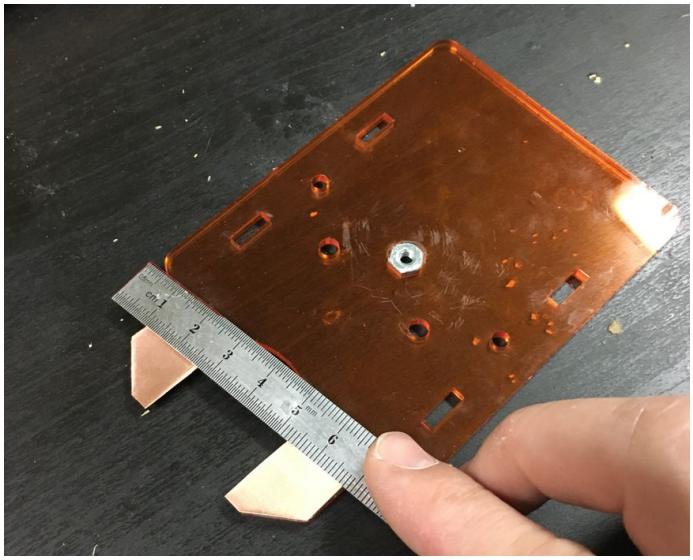
6. Add attach sanded faces together



7. Laying a heavy book on top of the piece will help the glue set and keep everything flat



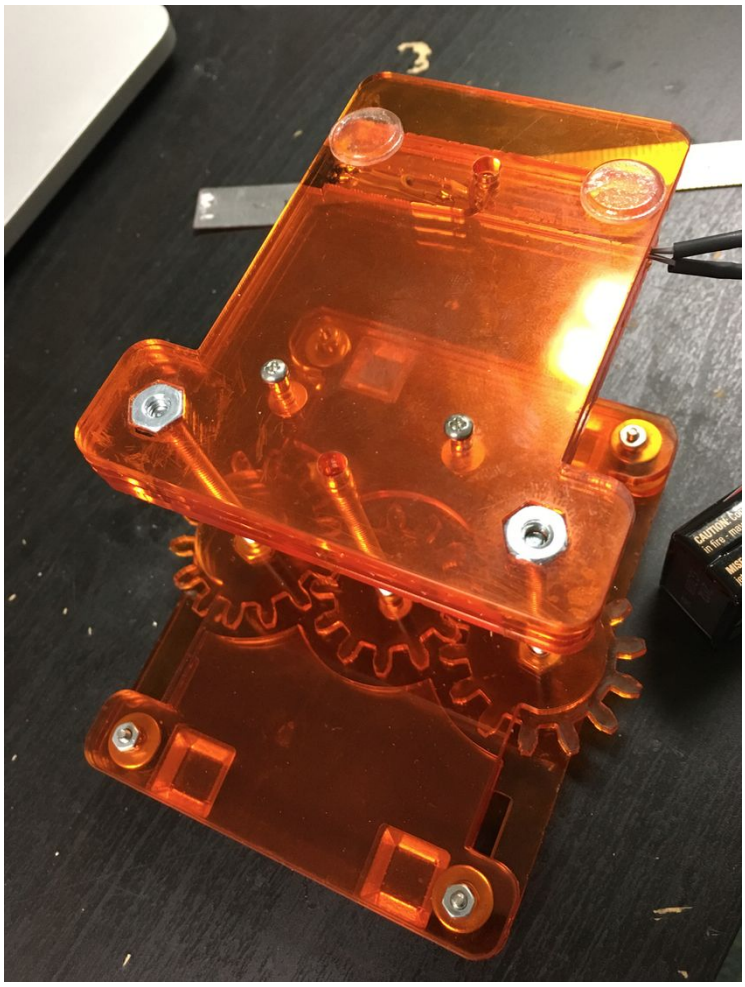
8. Cut edges to be flush with angled corners



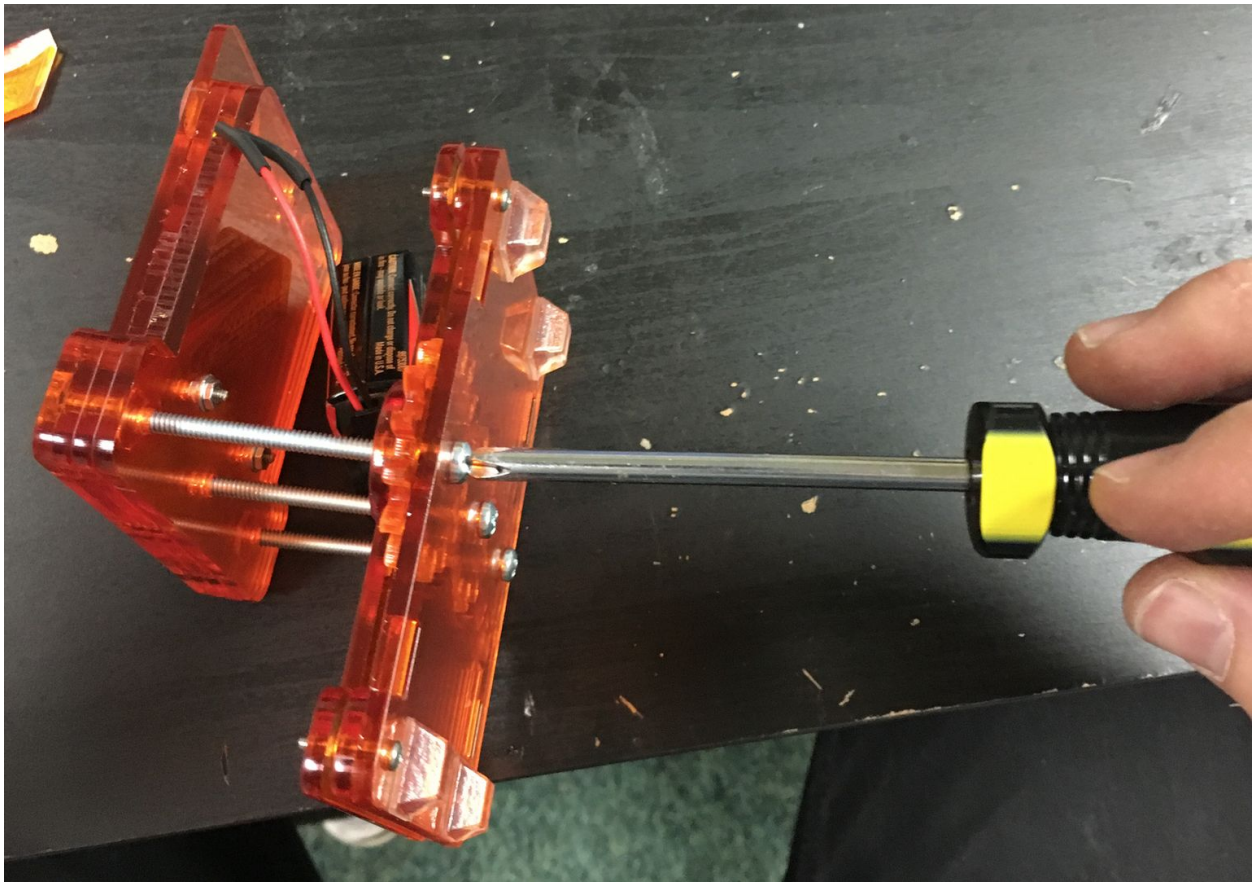
9. Flatten Bottom with Straight Edge if necessary to keep copper plates flat

YOU HAVE FINISHED TOP PIECE, NOW TIME FOR FINAL ASSEMBLY

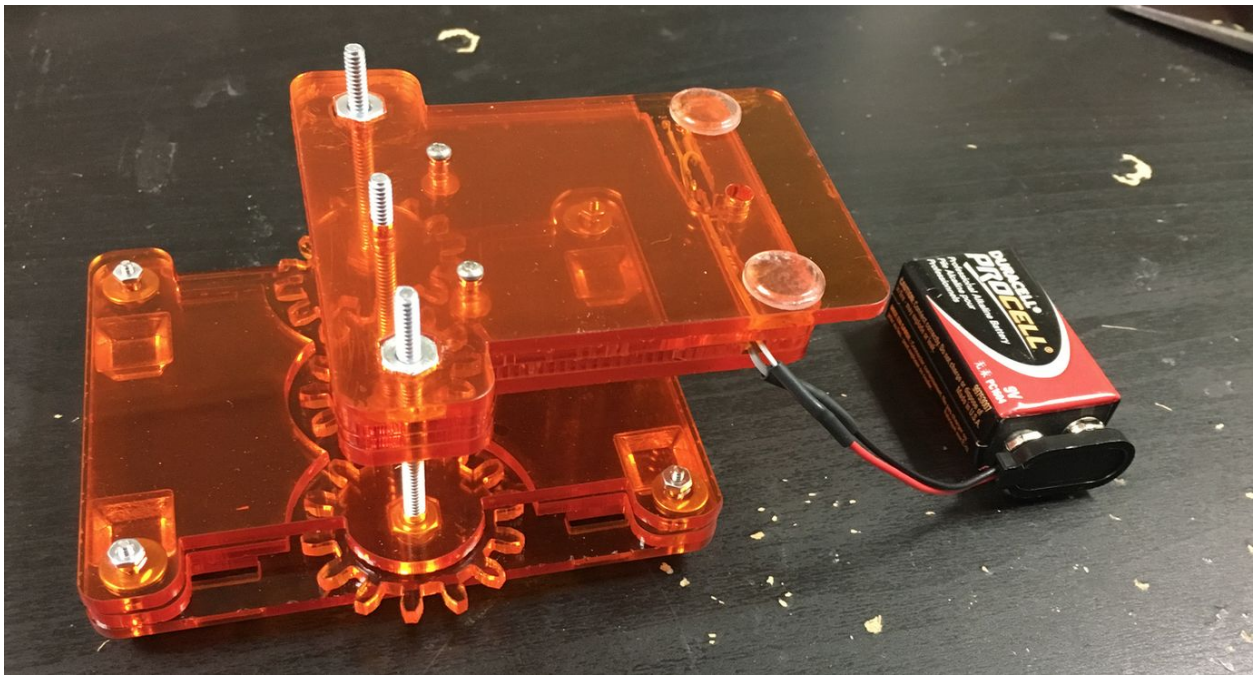
Step 5. Final Assembly



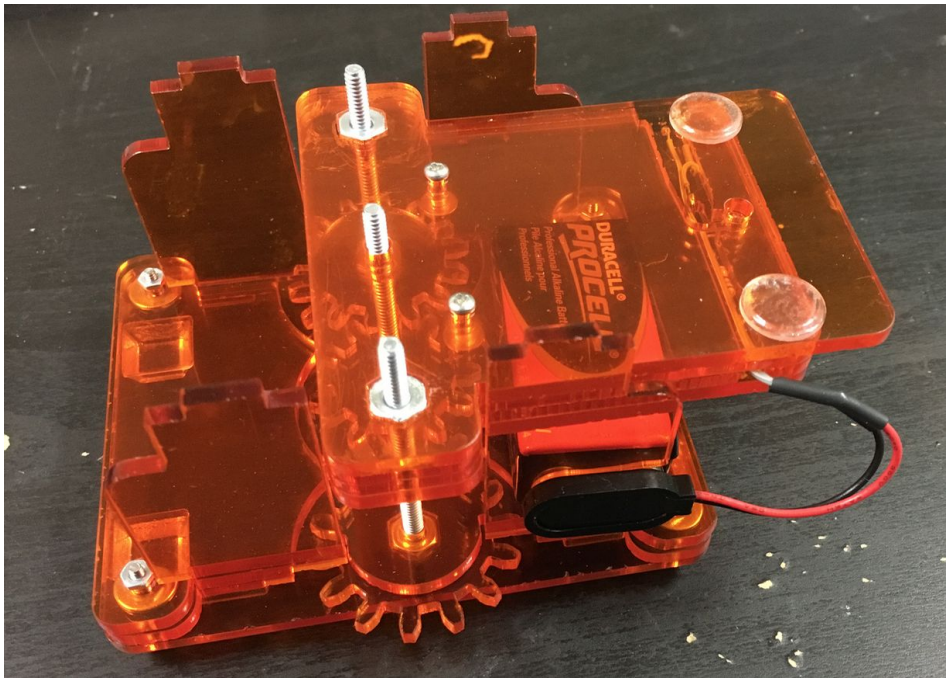
1. As carefully as you can, place sandwich on screws, trying to get it as horizontally aligned and flat as possible



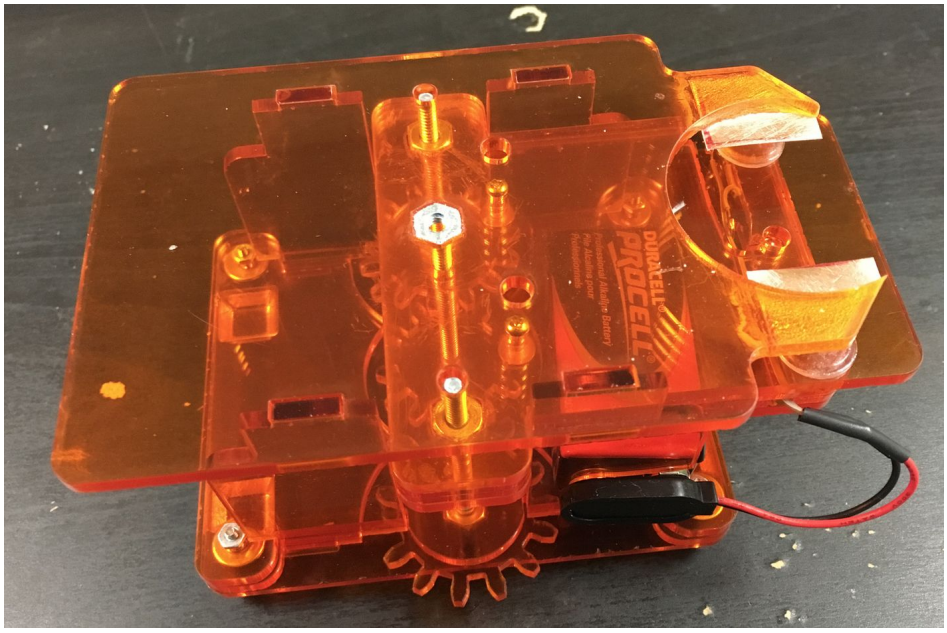
2. Using screwdriver, bring sandwich down on screws



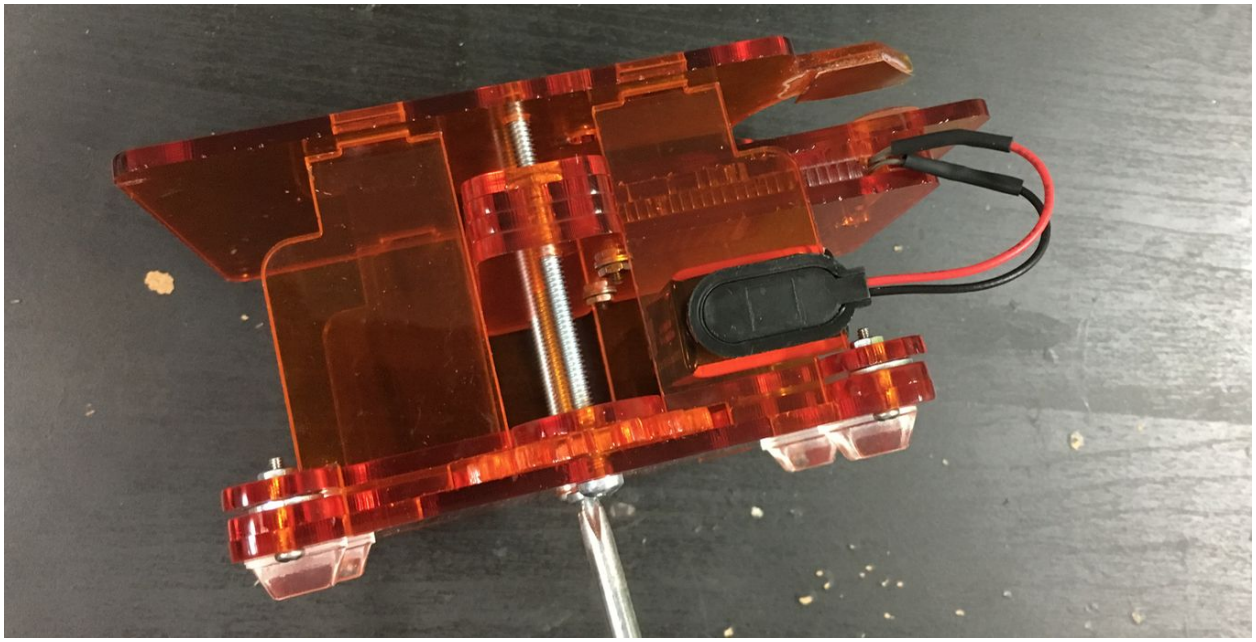
3. Again, check than sandwich is level (not cocked, not crocked), on screws



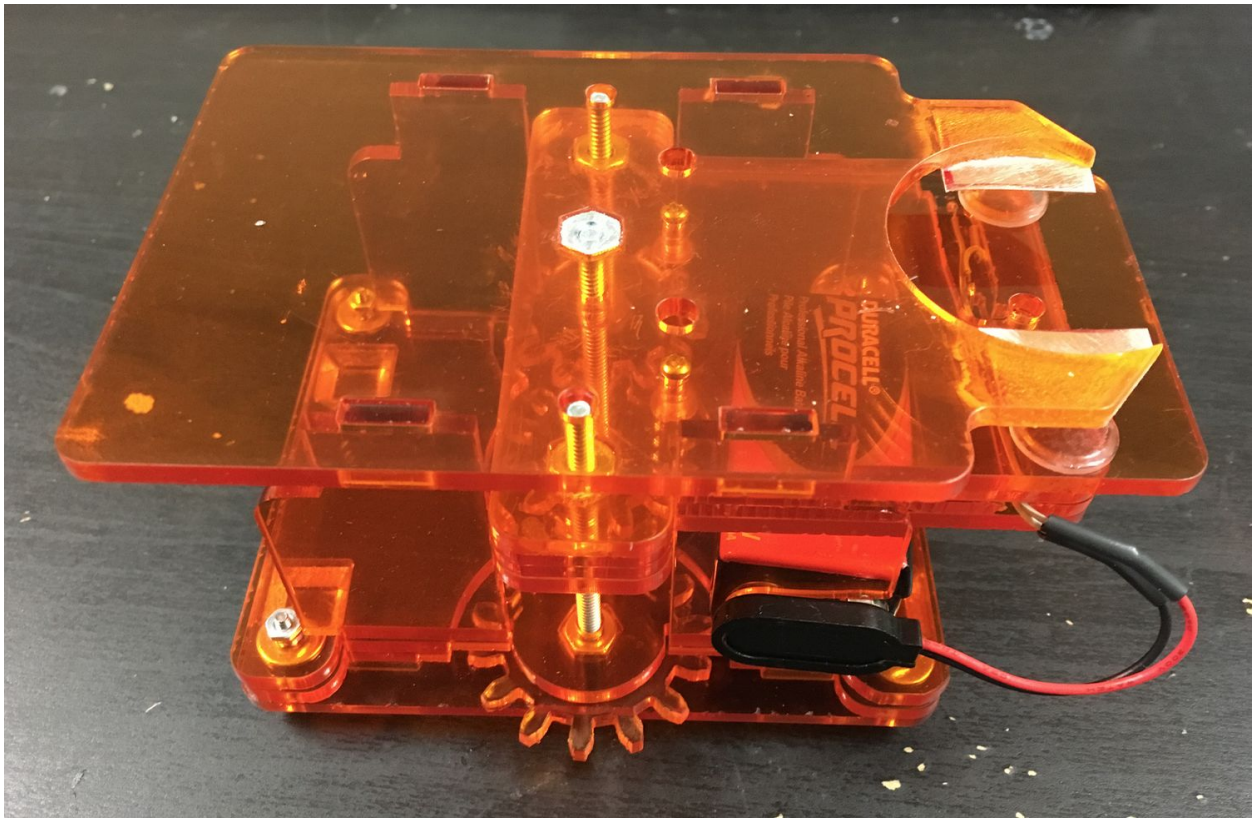
5. Add side bars, noting position of side bar with battery holder



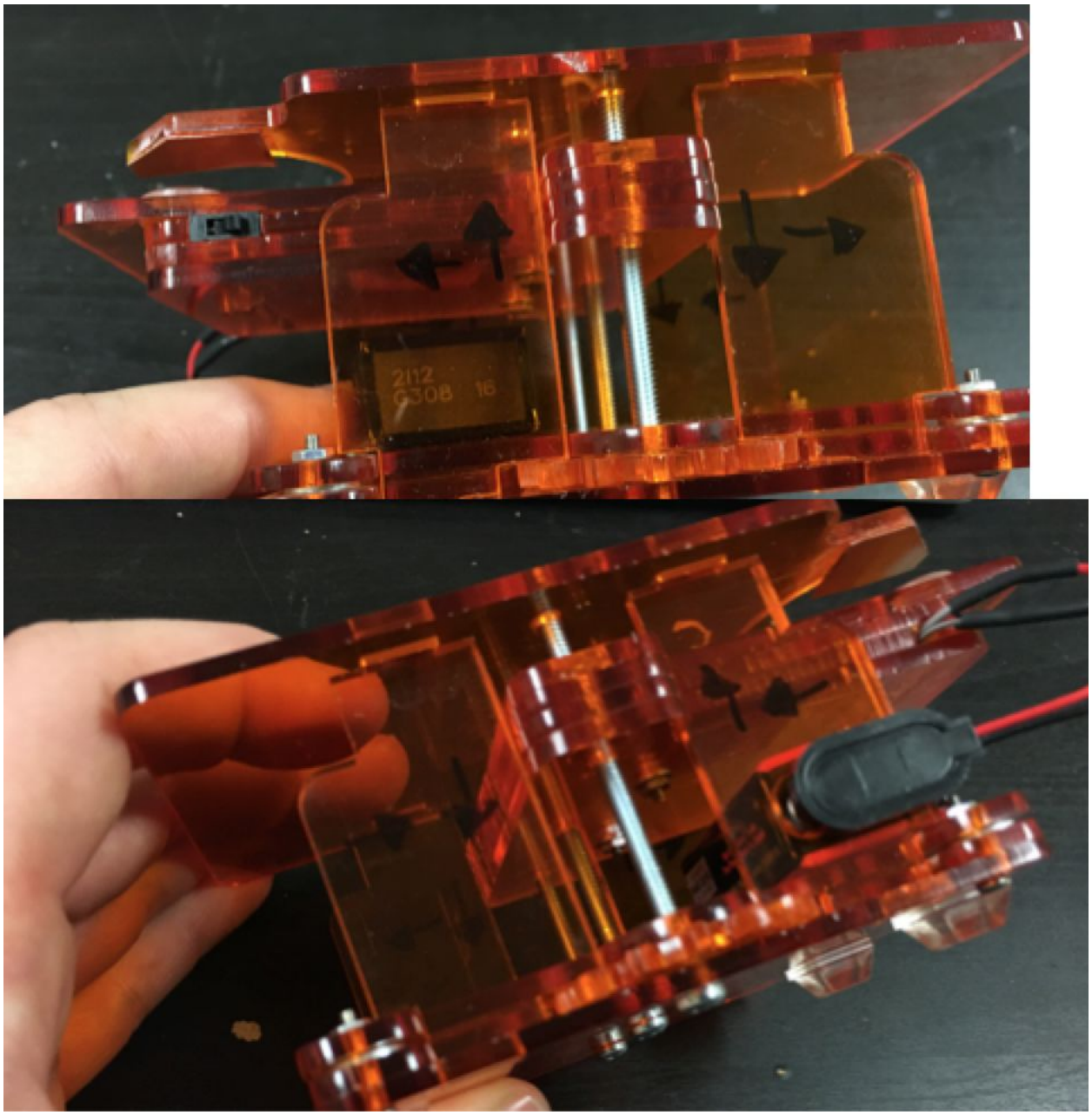
6. Place Top Piece



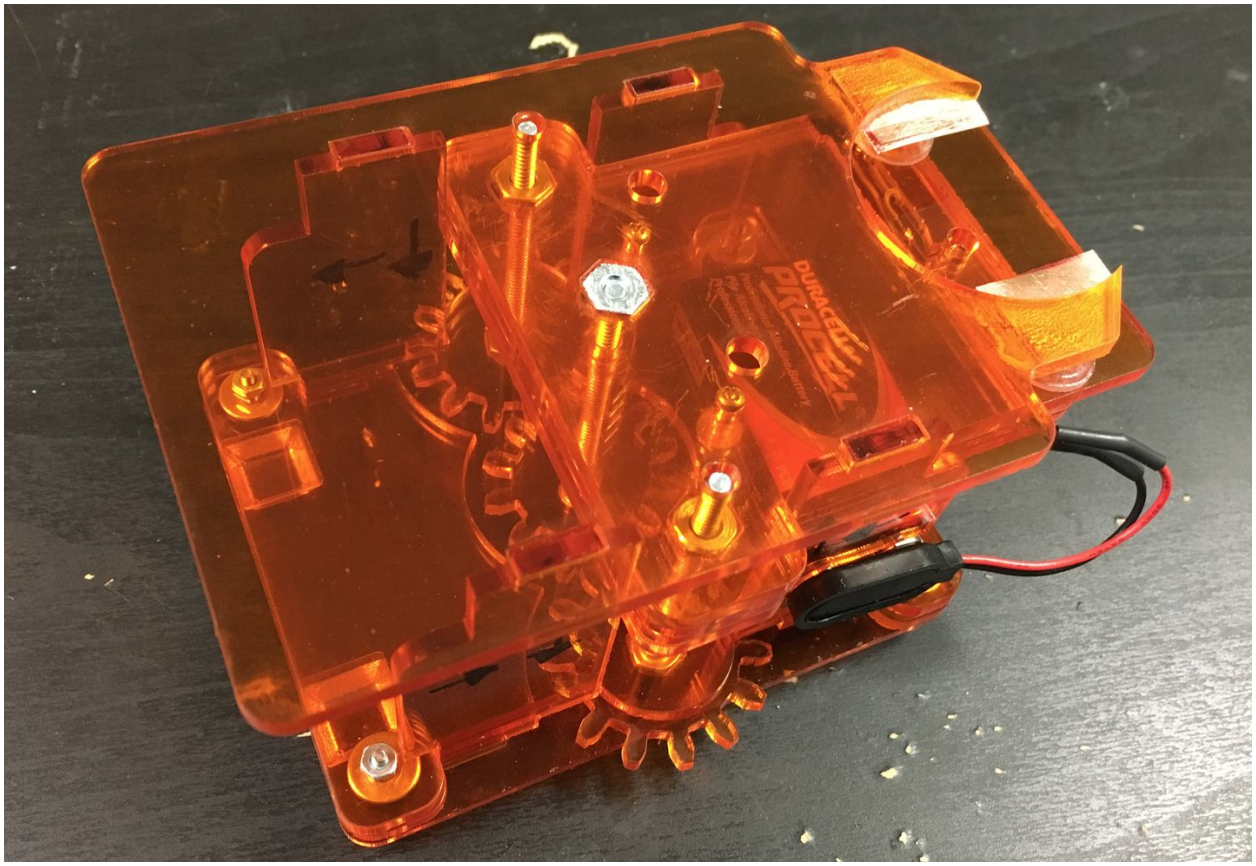
7. Tighten Down Top Piece with center 2.25 inch screw. Overtighten and focussing mechanism will be too hard to move, undertighten and construction is too loose



8. Almost done! Test freedom of up and down movement by sliding gears



9. I write markers in sharpie ink as guides to know what is up and what is down...since our focus is tight on ball lenses this is helpful - we can etch this.



AND YOU ARE DONE WITH THE SMARTPHONE SUPPORT LASER-CUT ASSEMBLY