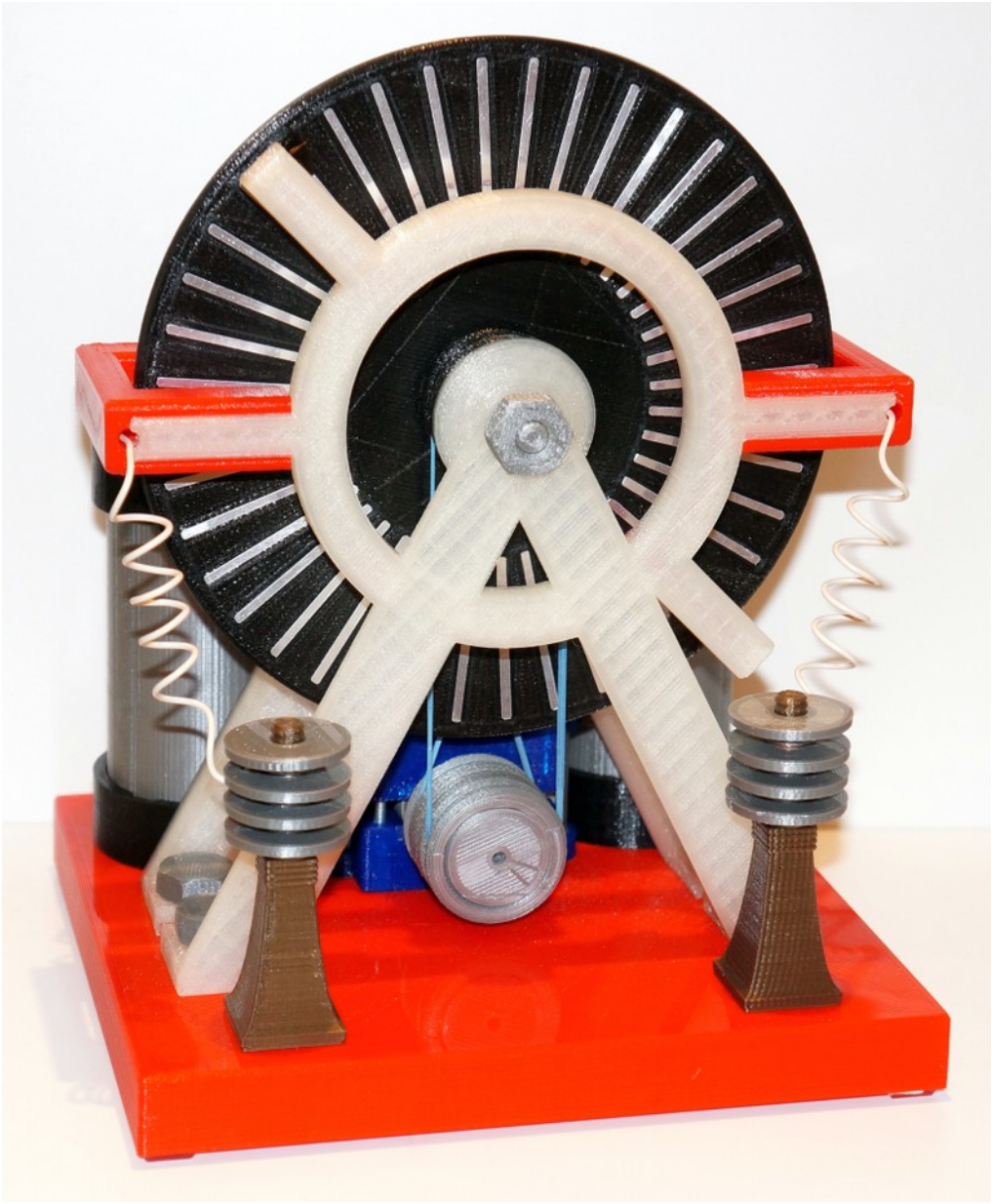
Wimshurst Electrostatic Machine WH16



Caution, risk of electric shock

This machine is intended for an adult technical audience.
Use at your own risk!

private science project
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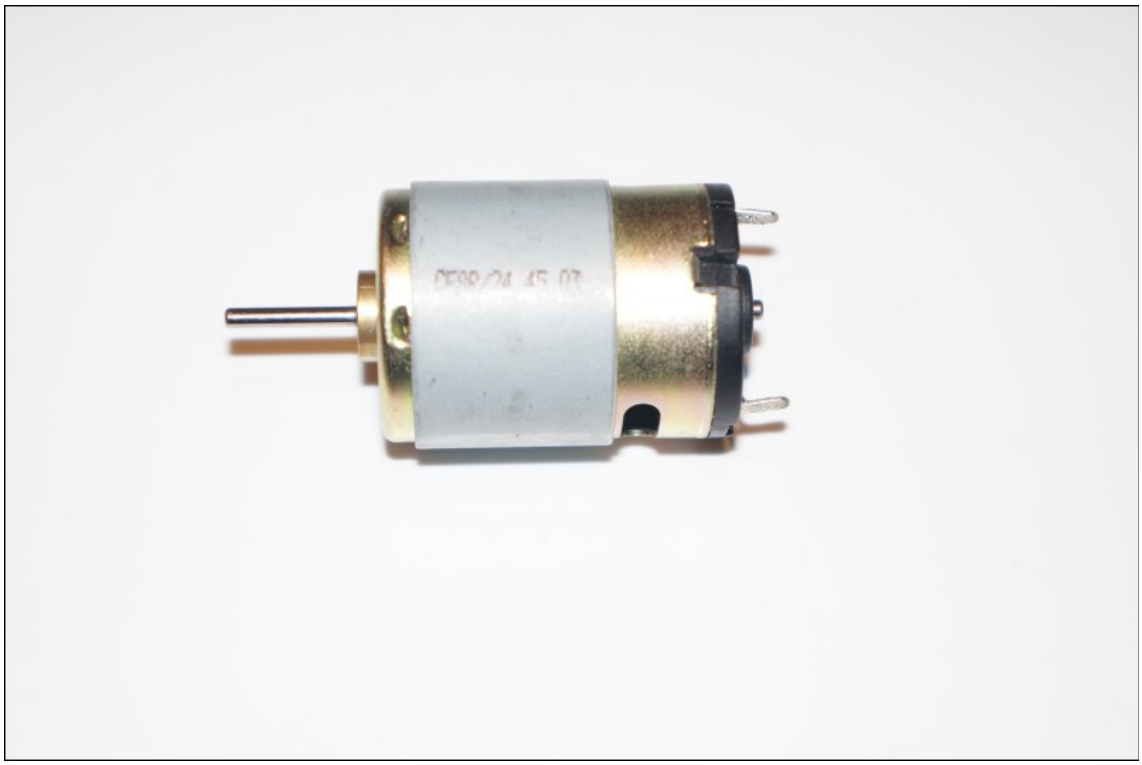
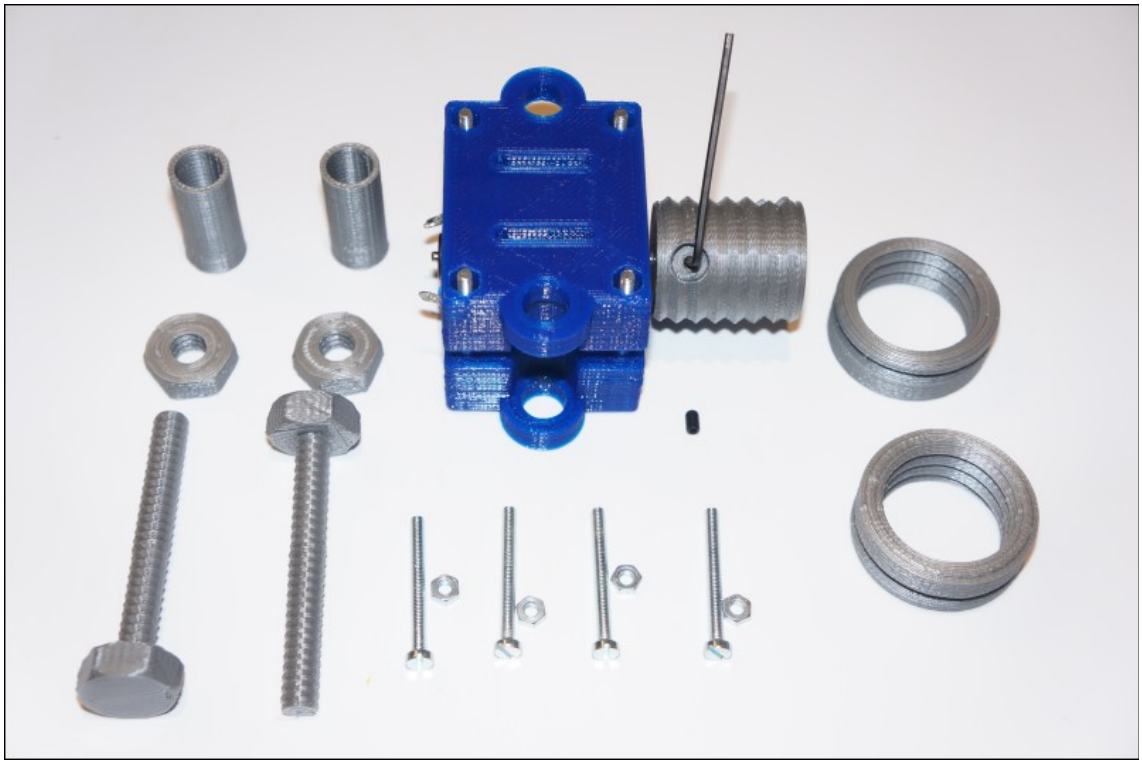
Standard Inline Skater (Skateboard) bearing 22/8 x 7mm width (e.g. ABEC) from local sports store. 4 bearings required

Cleanup the hole in the backside of the disc and press two bearings into the disc carefully Use a third bearing to make sure you moved them completely down into the hole.

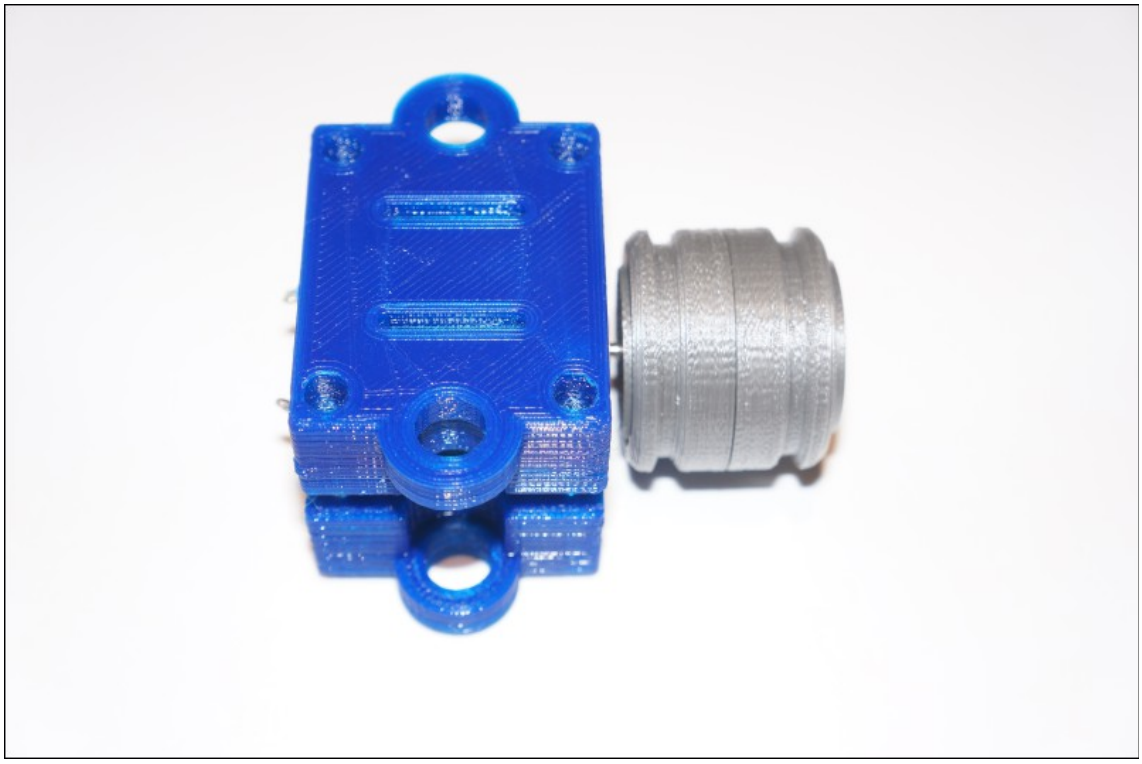
Use aluminium foil or plate (max. 0.5mm, opt. 0.3mm) and cut 40 mm wide stripe out of it. Then further cut the sectors 2mm, round the edges and glue the sectors on the disc. Other disc design is included for aluminium foil 5/15 40 mm sectors



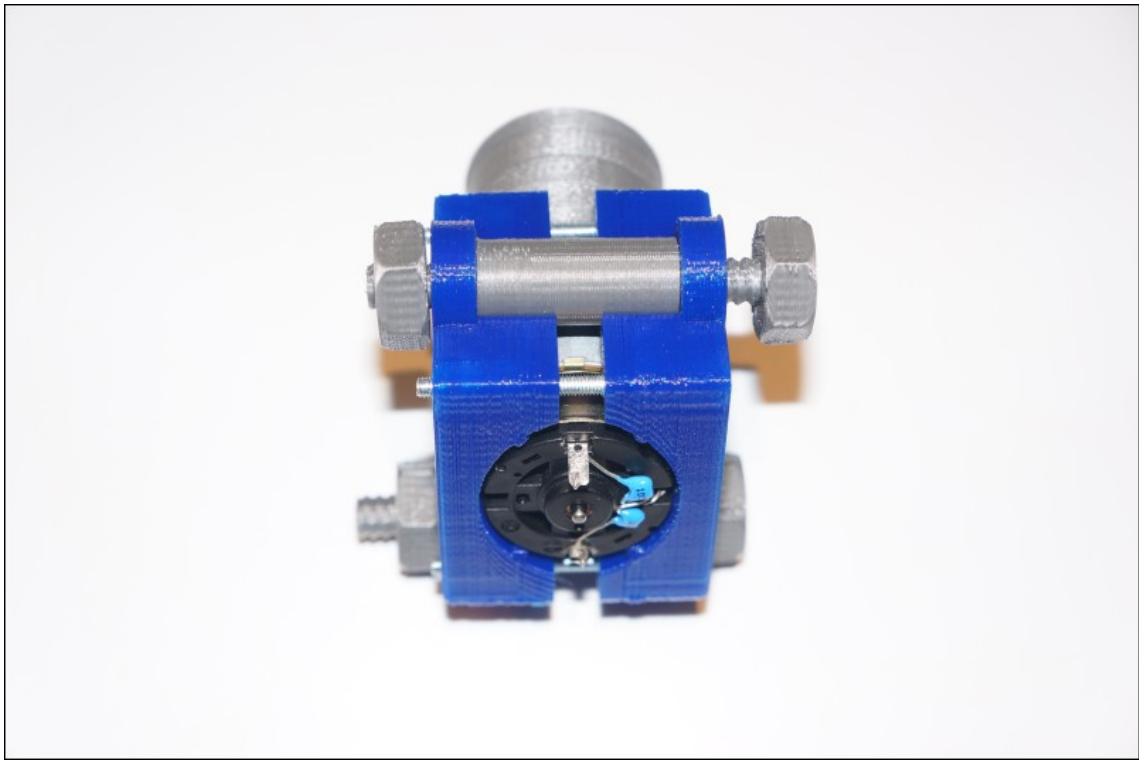
Toy Motor: Up to 35 mm diameter, at least 1 cm shaft space for roller mount. The image above shows the used motor with 29 mm diameter, 1.4mm shaft and 42 mm motor part length. For smaller motors you can add some tape around until it fits.



M3x30 (better M3x40mm, can be fixed into base plate shown later), shaft screw can be M3 screw or headless screw. Use the motor mount parts and the motor and assemble them as shown above. Then attach the roller (The shaft diameter hole needs maybe further drilling depending on your motor shaft)



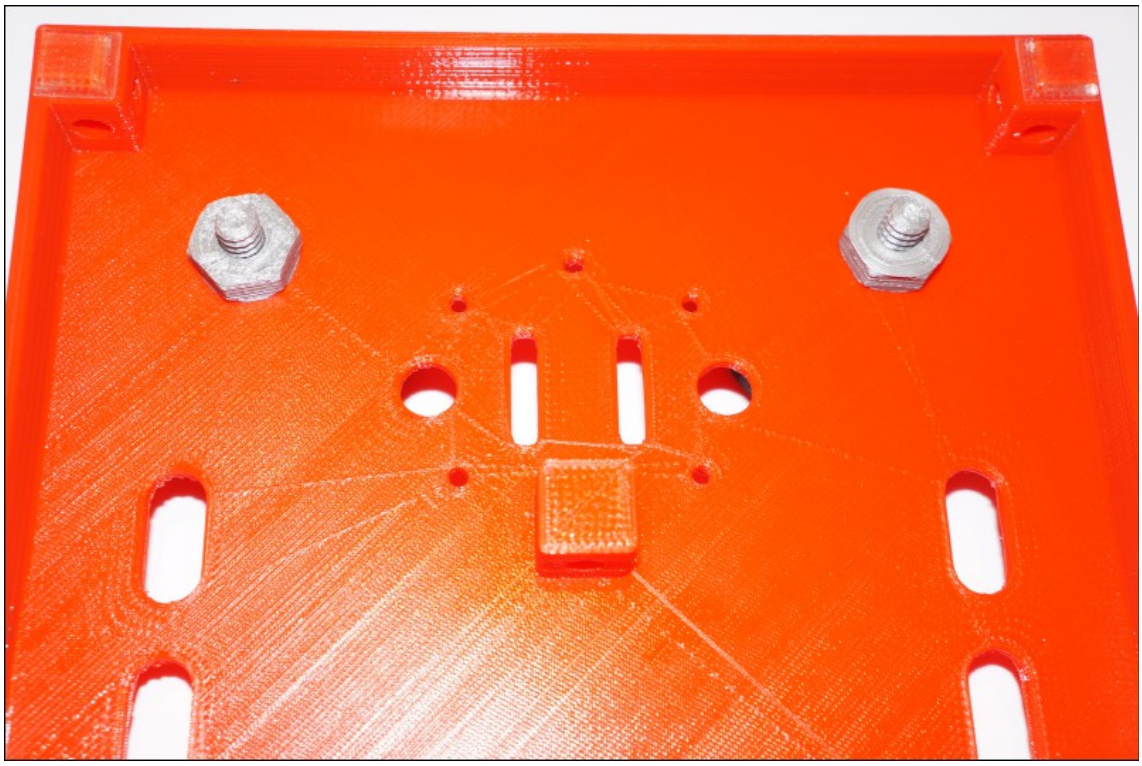
Roller nuts are used to center disc belt. Put them in the middle for now



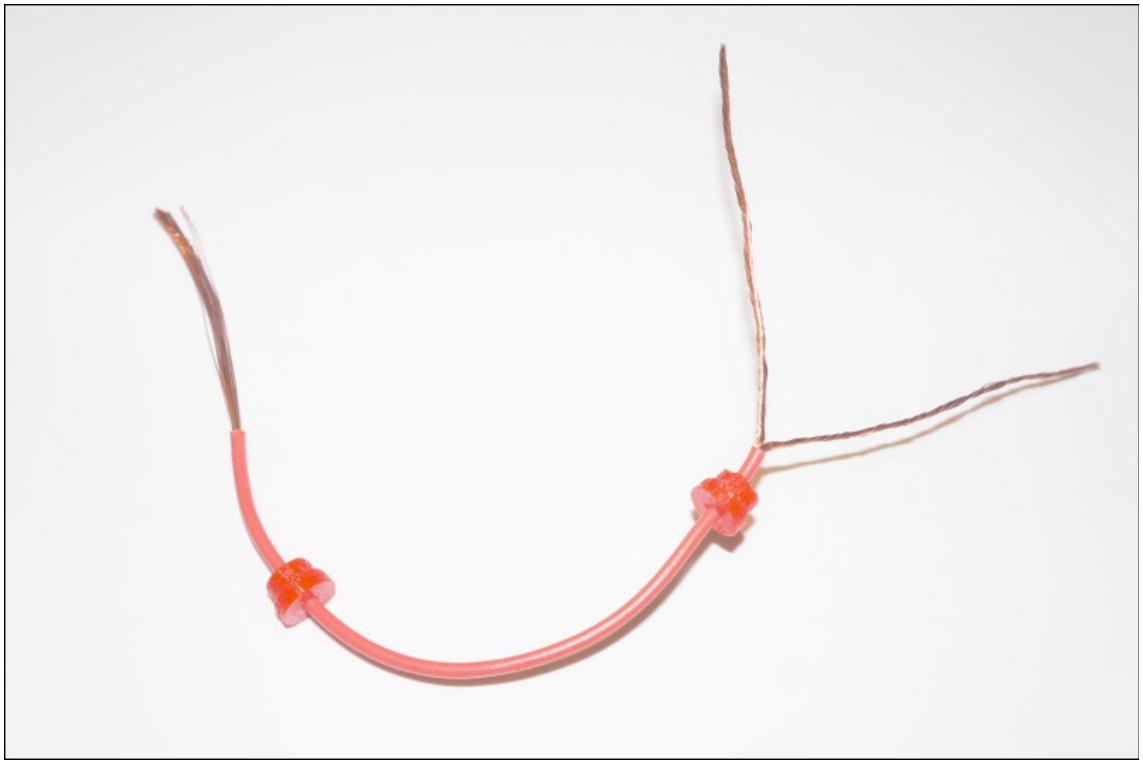
add the base mount screws

all the parts for one leyden jar. You need two leyden jars for this machine

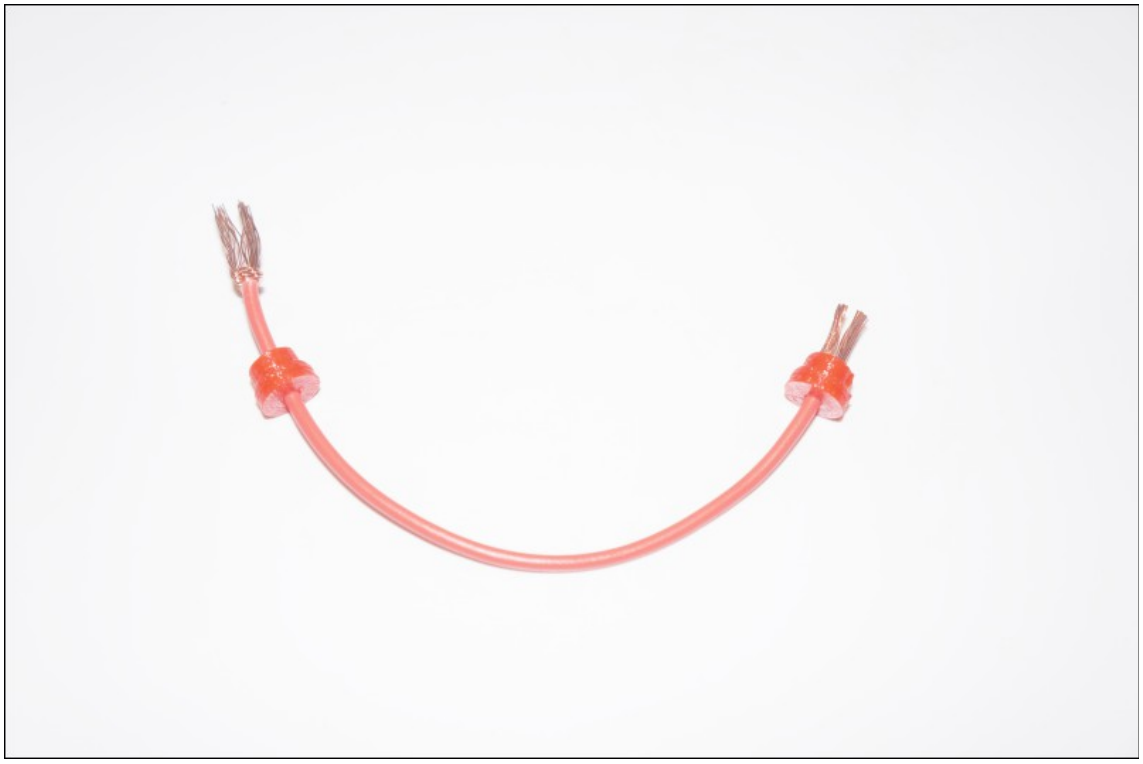
Use M8x20 screws and fix the bottom parts on the base plate. The bottom parts of the leyden jars DON'T have small holes – please check this



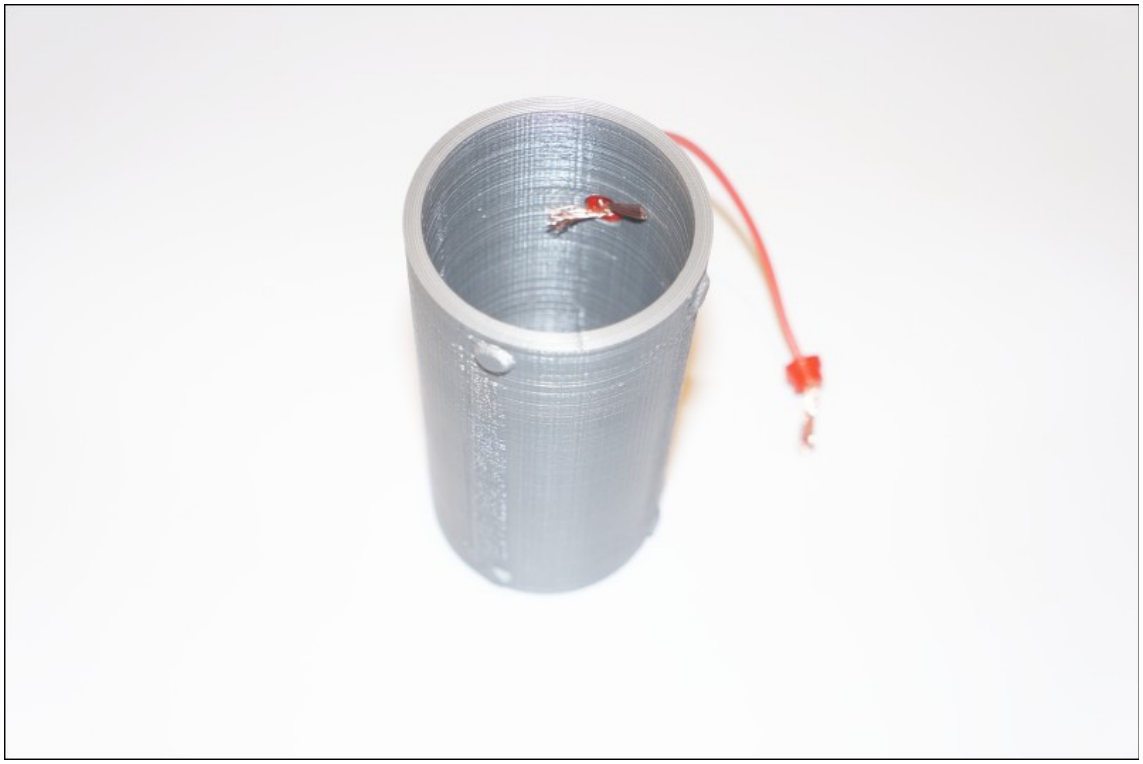
In the middle you can see the holes for the motor mount and where the added screws should be visible.



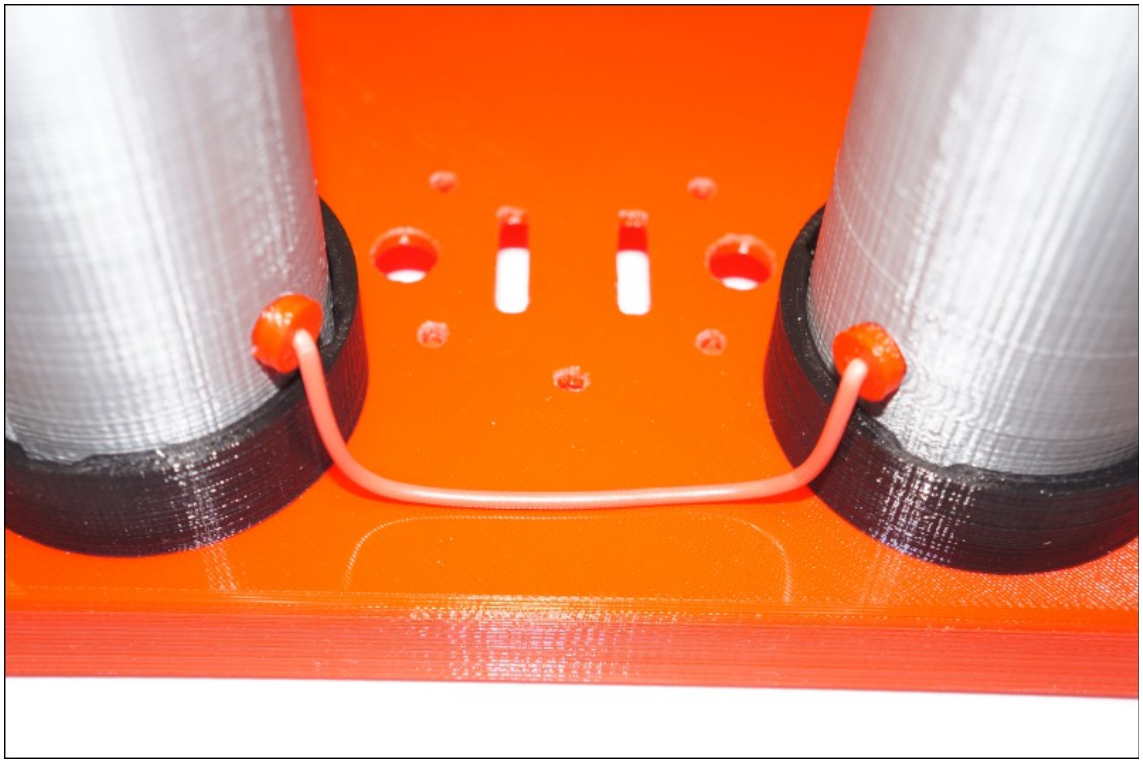
Stranded wire (~2mm with insulation). Red isolated part is ~13.5 cm



Put in a node and cut it with ~1 cm wire ends

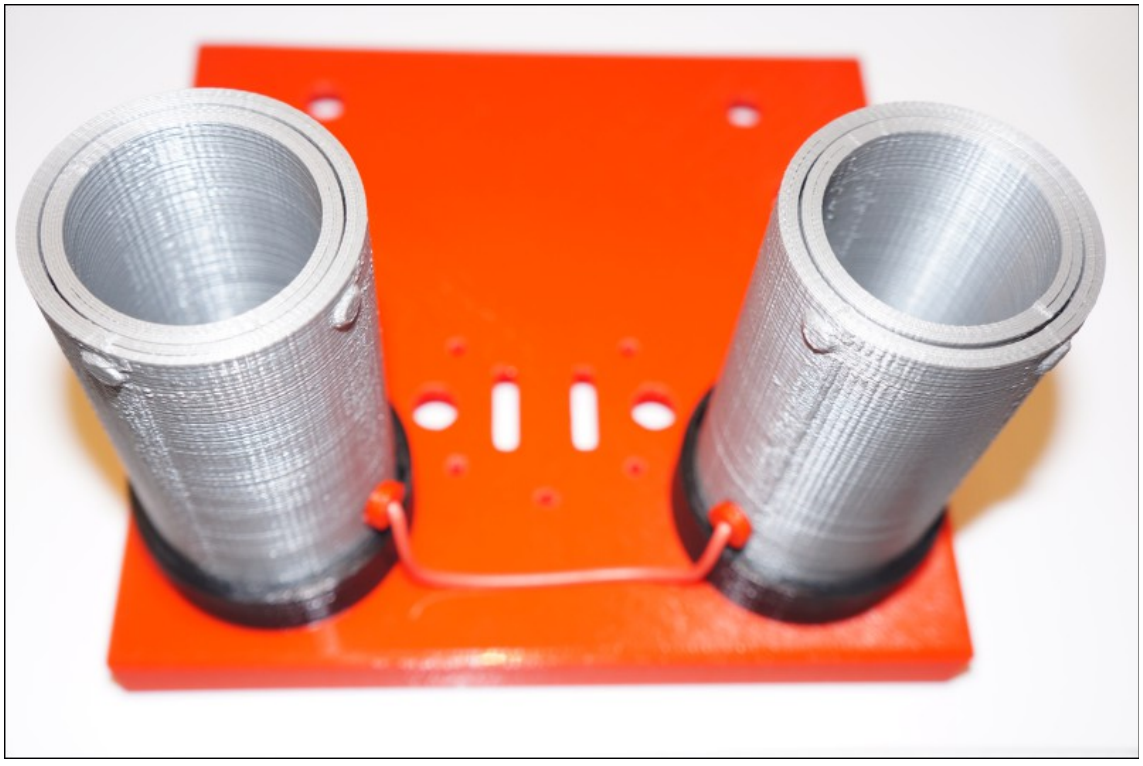


Push the pin into the hole of the biggest cylinder and bend the wire ends apart

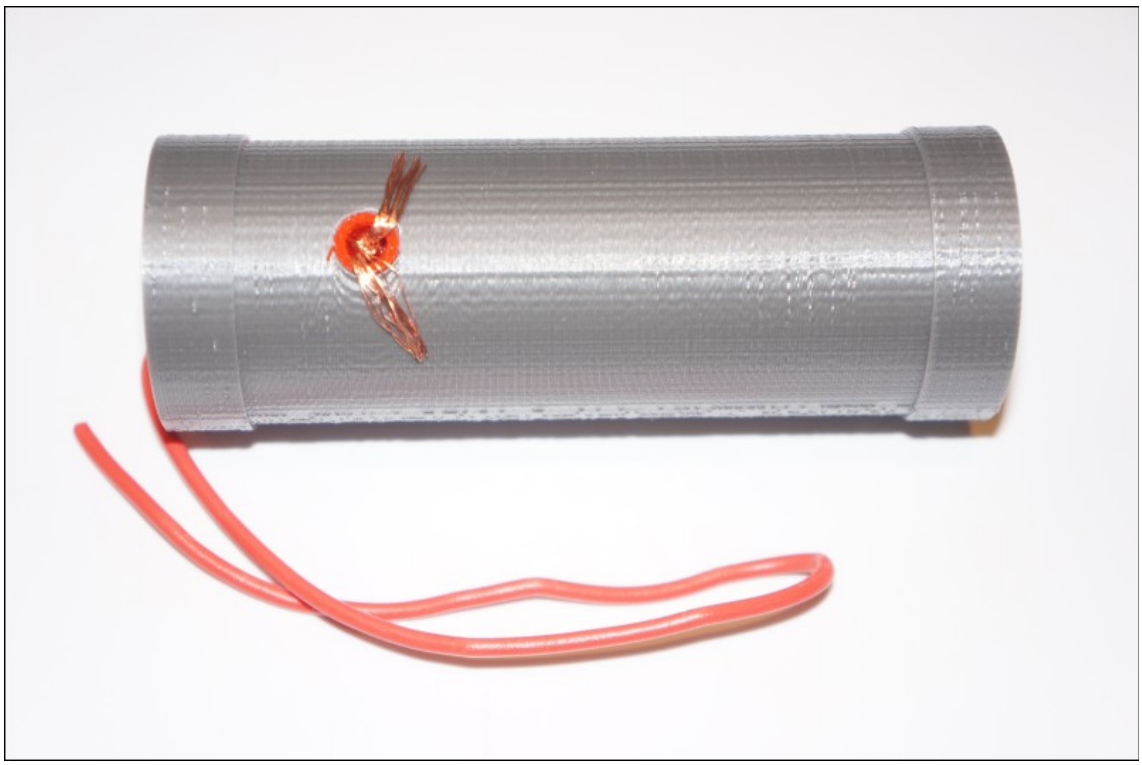


Do the same for the second leyden jar and turn the cylinders into their bottom parts

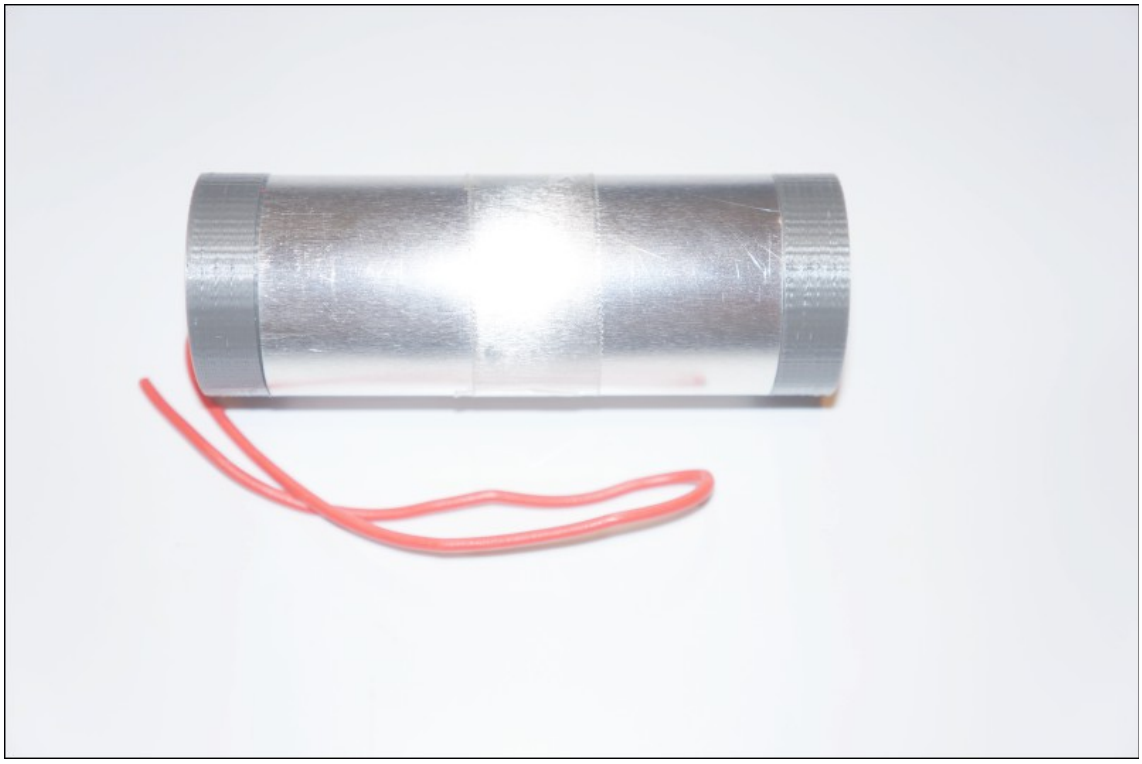
Use middle part of the cylinders and fix aluminium foil or plate with a tape.



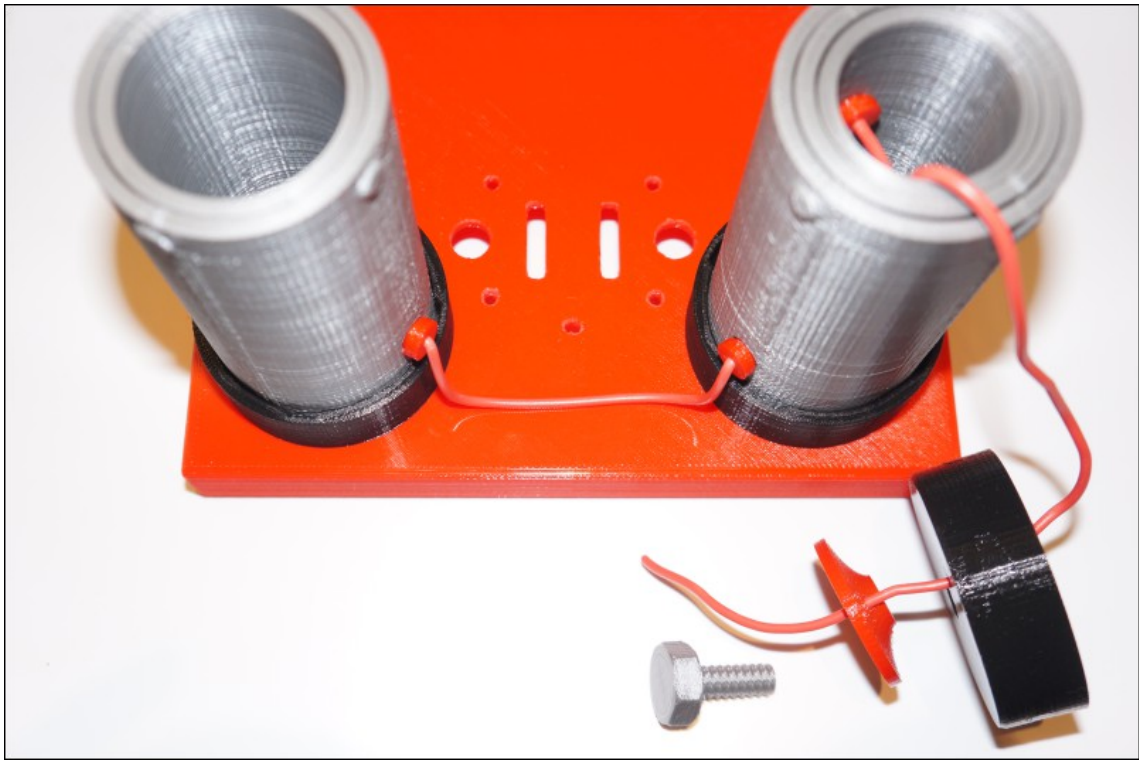
Stick the middle cylinders into the bigger cylinders of the leyden jars. Be careful if you have used thin foil.



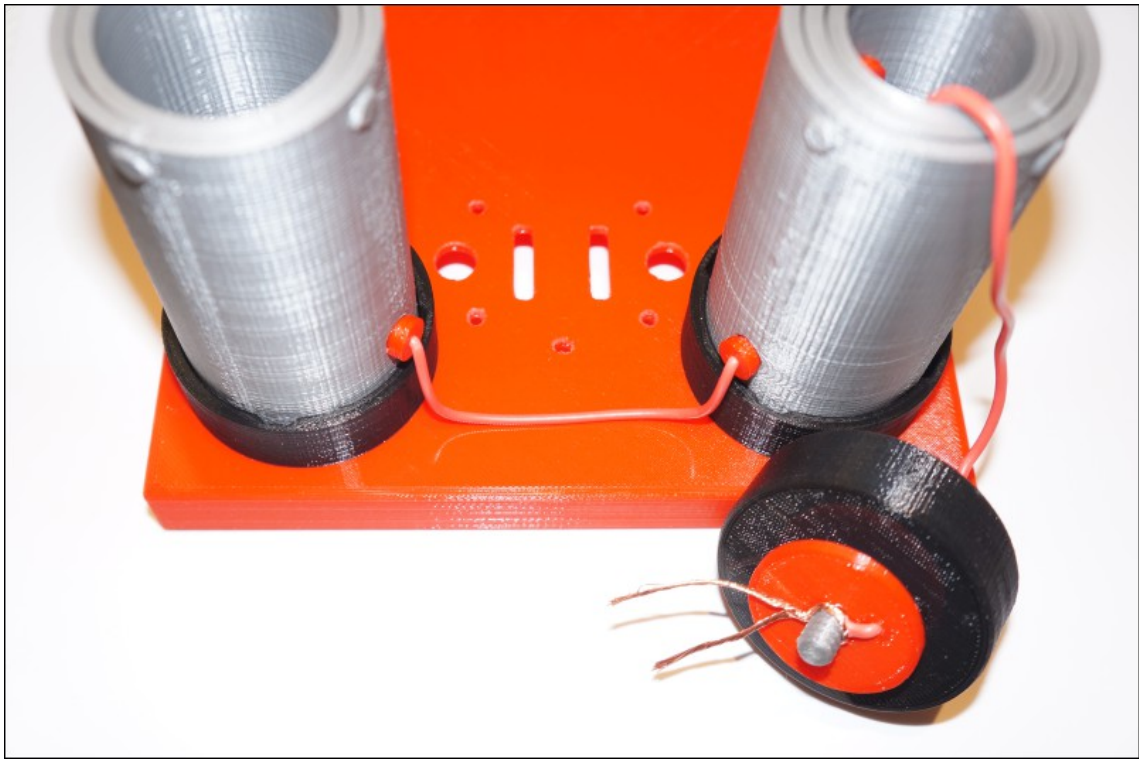
Smallest cylinder again with pin pressed into it but from the inside. The longer wire will be useful later to remove the top part of the leyden jar without breaking any connection.



fix aluminium foil or plate with a tape

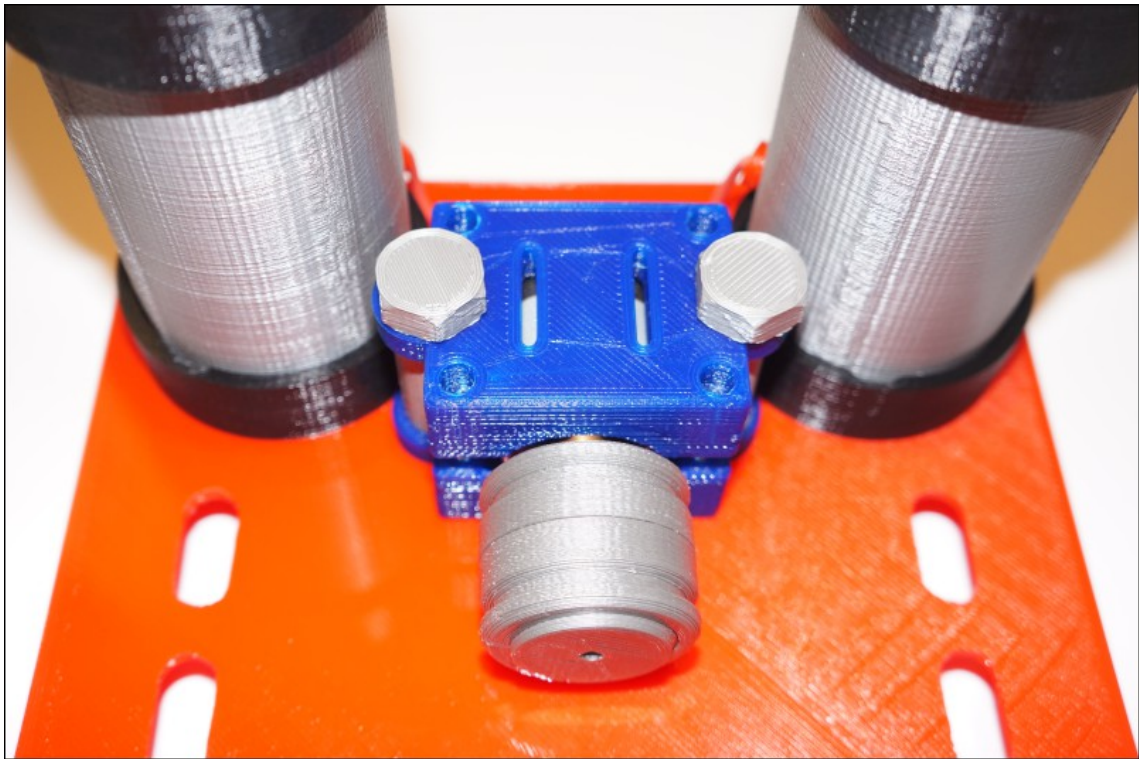


Slide the parts on the wire through the small holes as shown

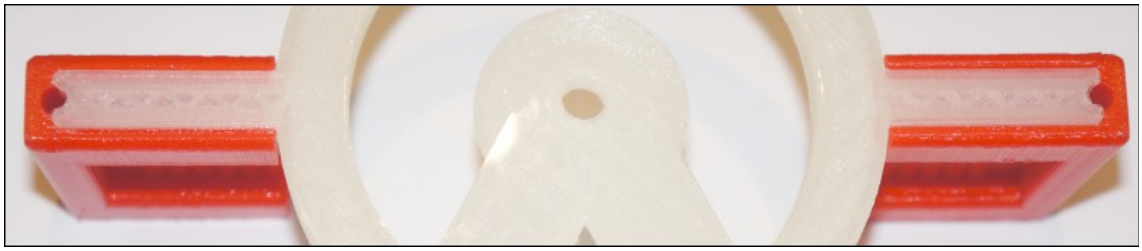


Use printed M8x20 from inside the jar top part and fix it with the nut very tight.
Remove isolation of wire and split wire into pair to wrap it together on the screw thread.

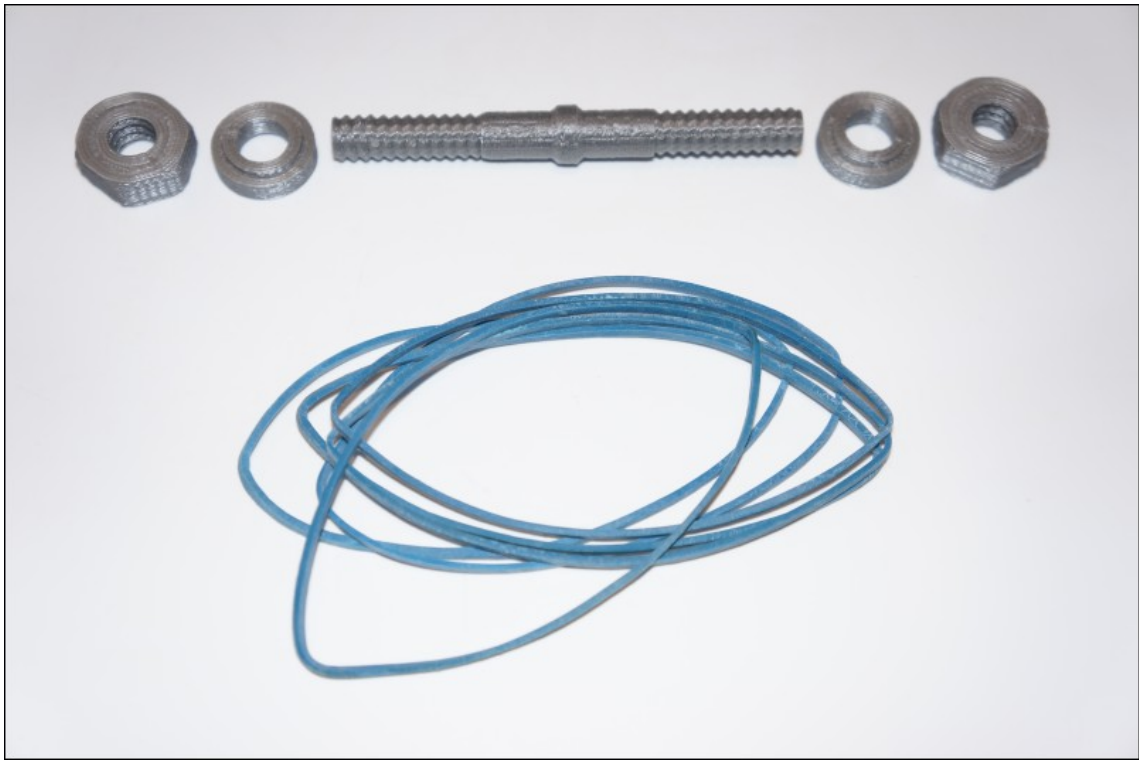
Completed leyden jar mount



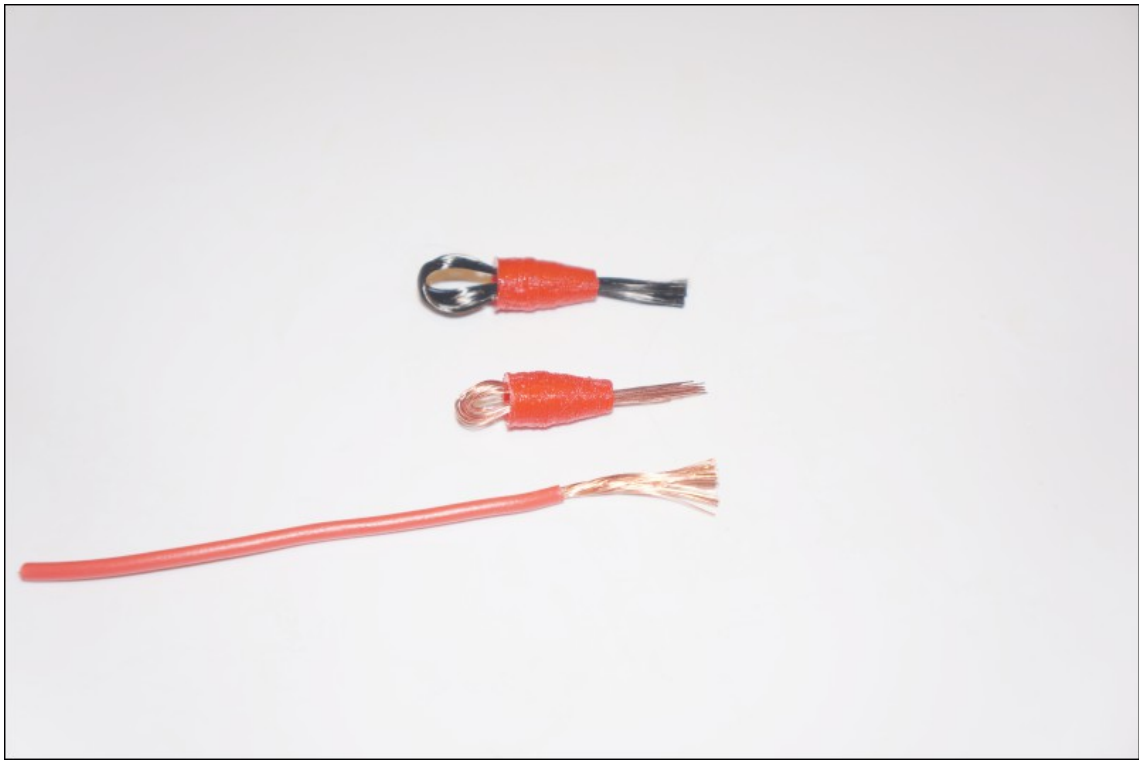
Add the motor to the base



Before we continue with the disc holder make sure the collectors (red) are sliding easy into the arm parts of the disc holder. It is important you do this with care. Put them into the provided grooves. As soon you feel they stuck remove them and sand the arm part or push the collector forward and backward several times in small steps. Finally the collectors need to be fully attached as shown above and it should be easy enough to be removed again.

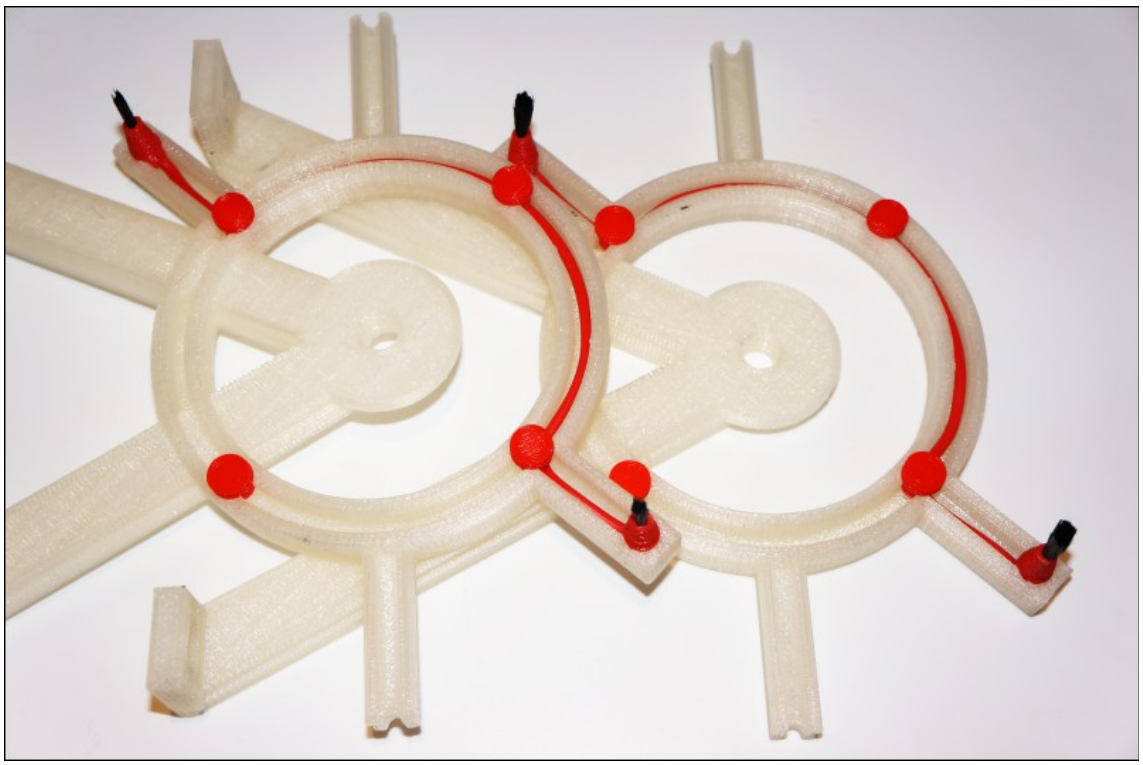


Two shafts are in the STL. One has a smaller middle part which decreases distance between the discs and was used for the building description. The picture above shows the smaller middle part which can lead to sometimes touching discs but provides higher voltages.

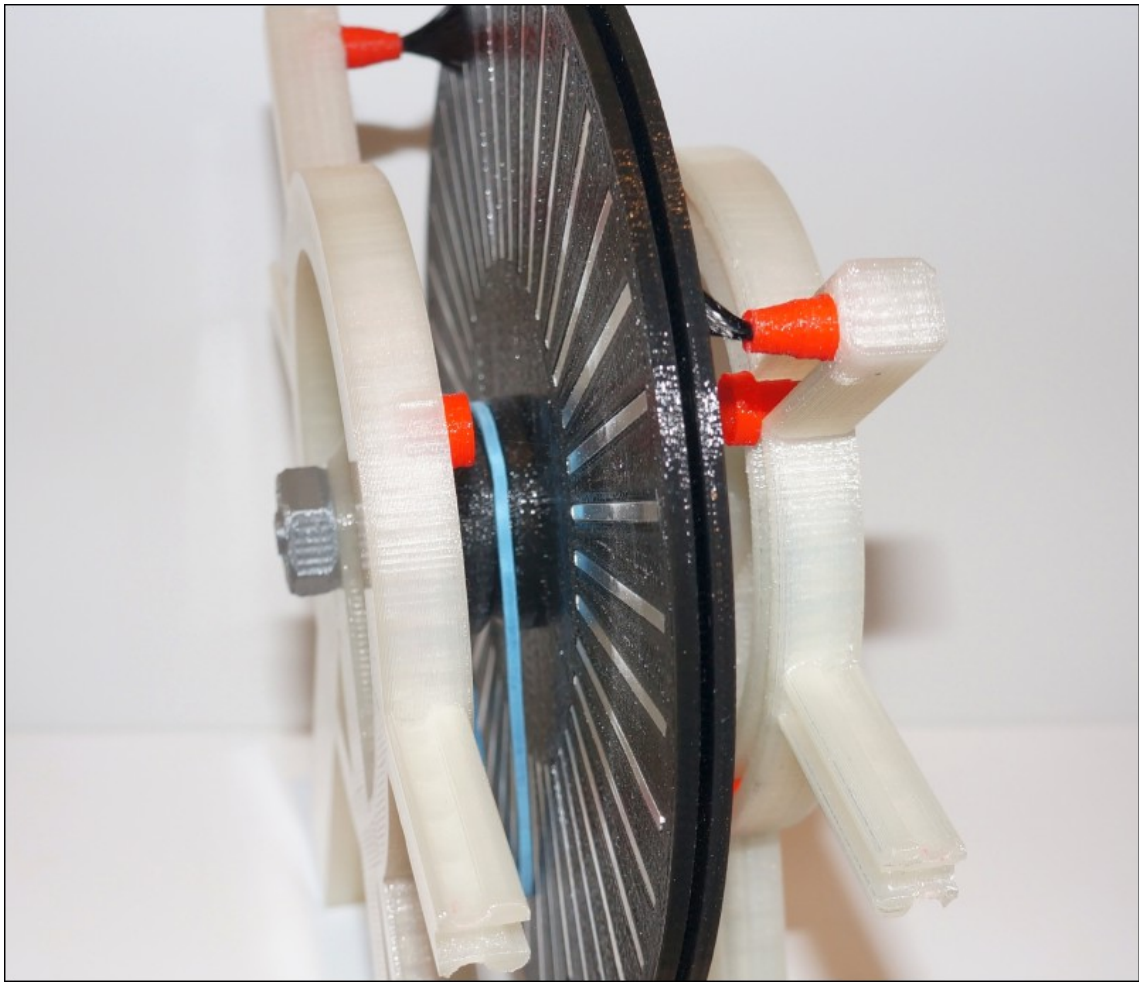


Either very thin stranded wire or carbon fiber (hobby shop) should be used to make the neutralizer connection.

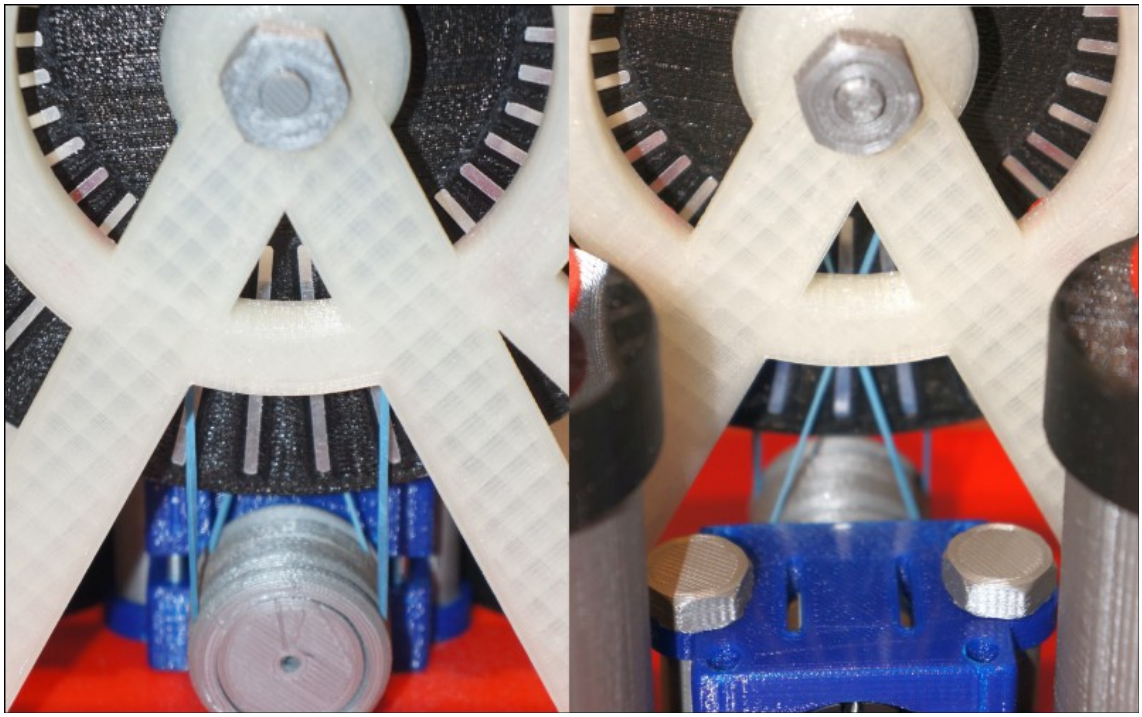
The red isolated part of the wire is about 19.5 cm. The brushes and pins connected and soldered.



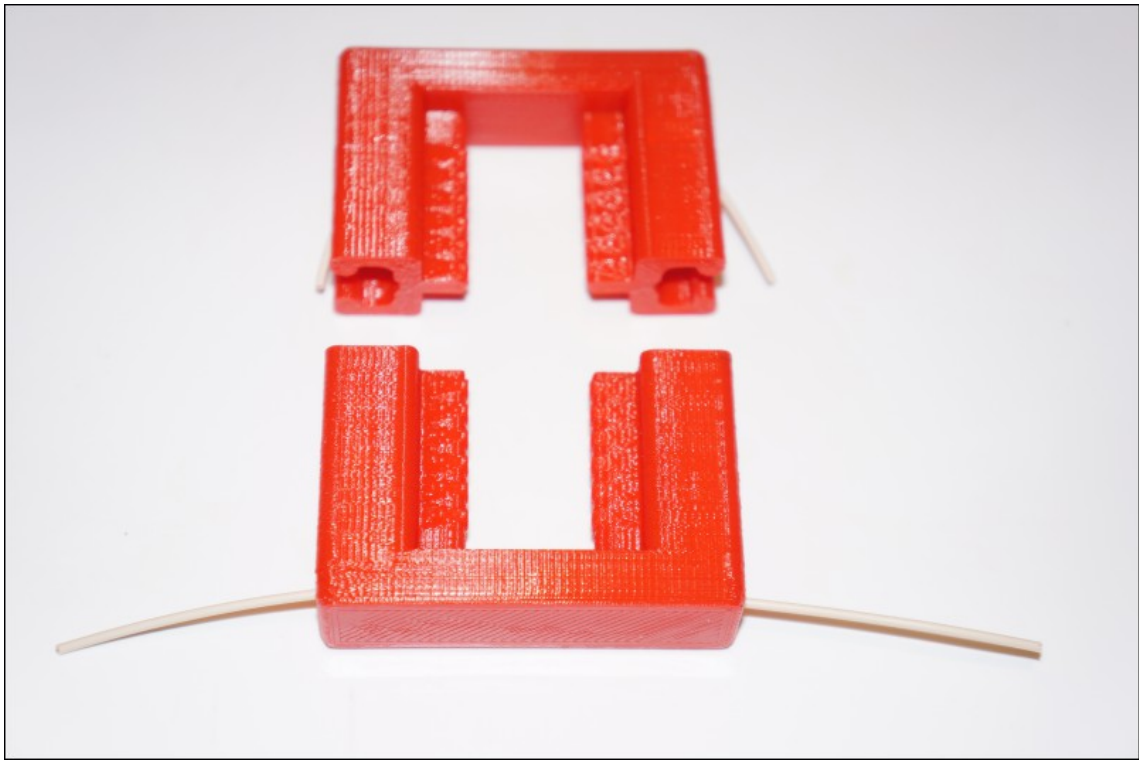
The neutralizer pins plugged into the disc holder. The wire is fixed with dummy pins.



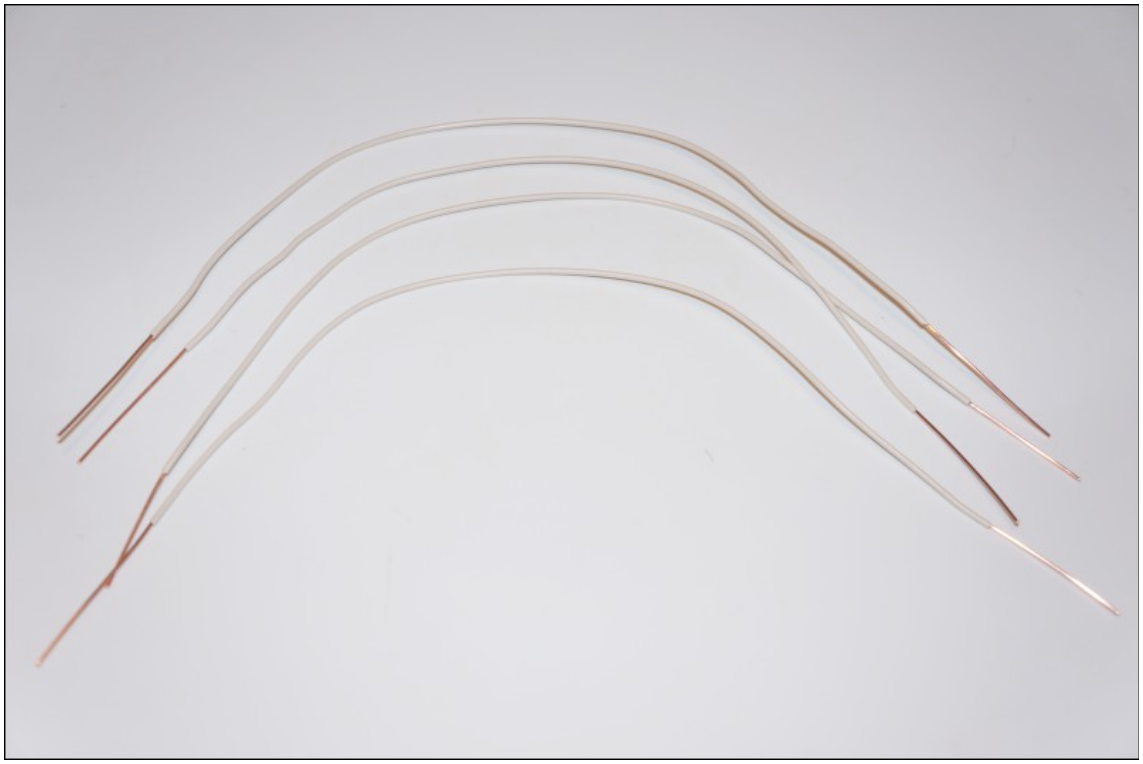
Add disc holders with discs and belts with the shaft. The distance rings have a smaller part pointing towards the ball bearing so the discs can move freely.



Added to the base with M3x20 screws. The belt on the backside is **crossed** to turn the disc in opposite direction.



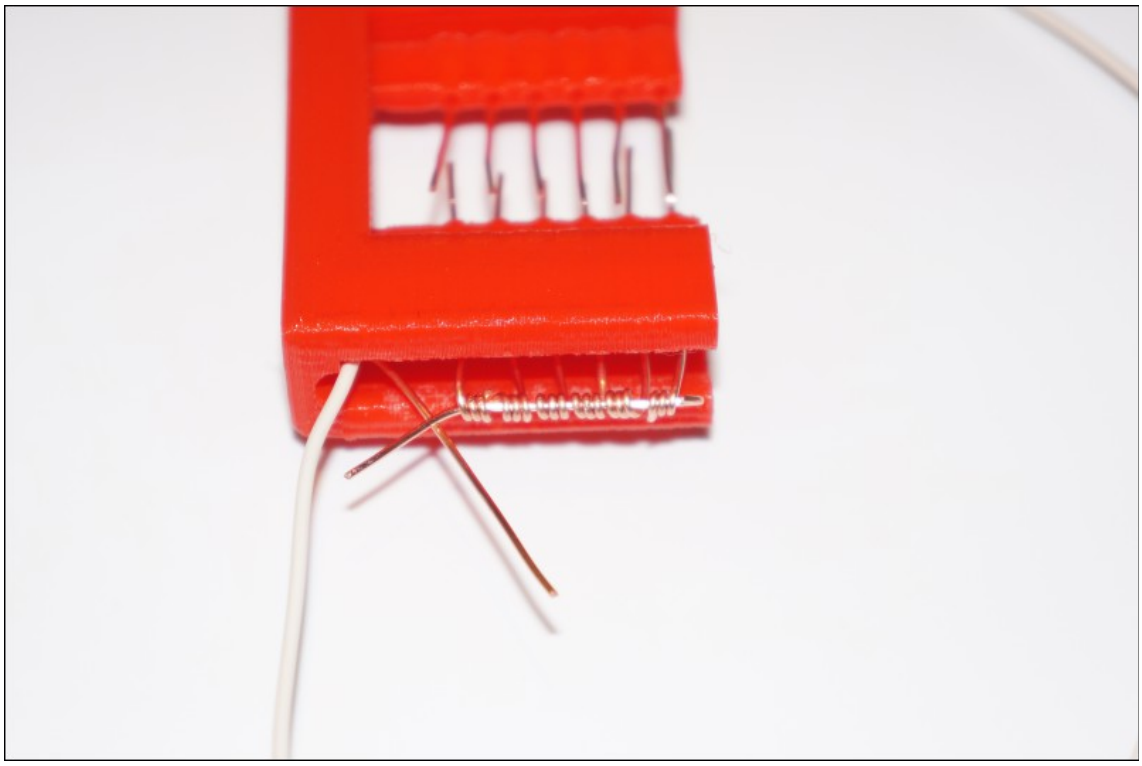
Take a single stranded (~1mm) wire and put it through the collector hole. Bend it to U-shape around the red collectors and cut it to find the right length. Then remove it again and remove the isolation



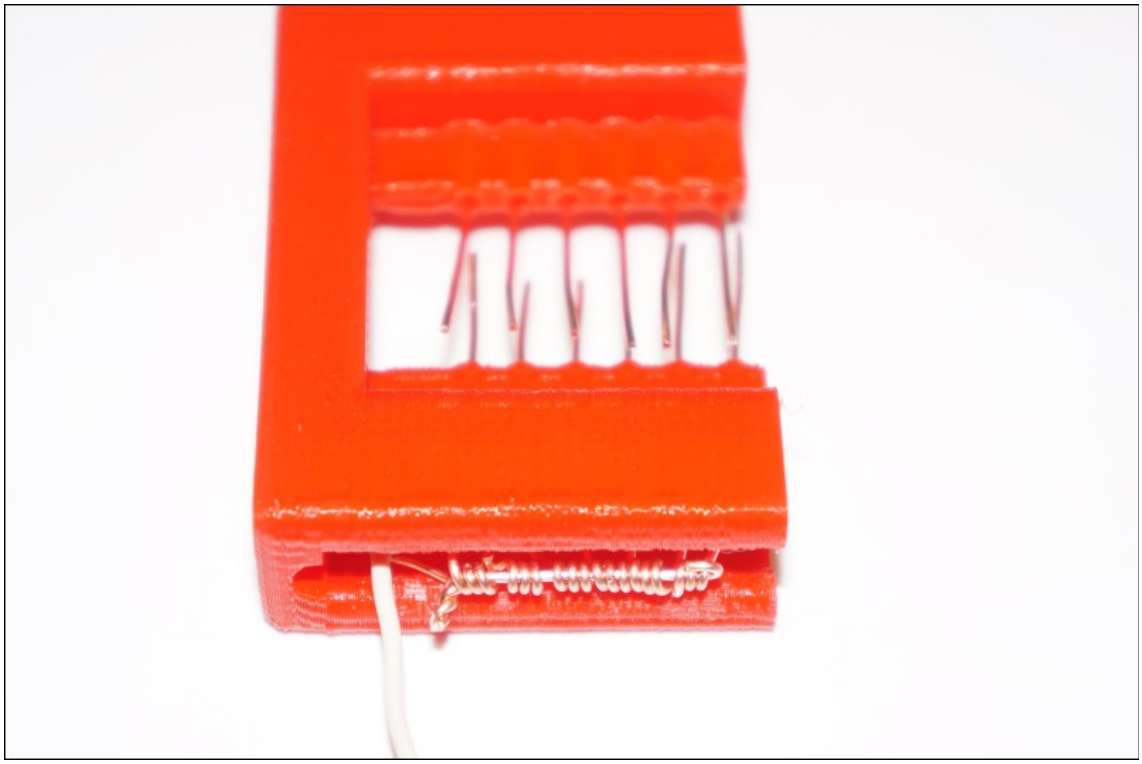
About 20-25 cm long wires will be used to connect the collectors with the leyden jars and the output poles

Connect them with the U-shaped wire and solder them

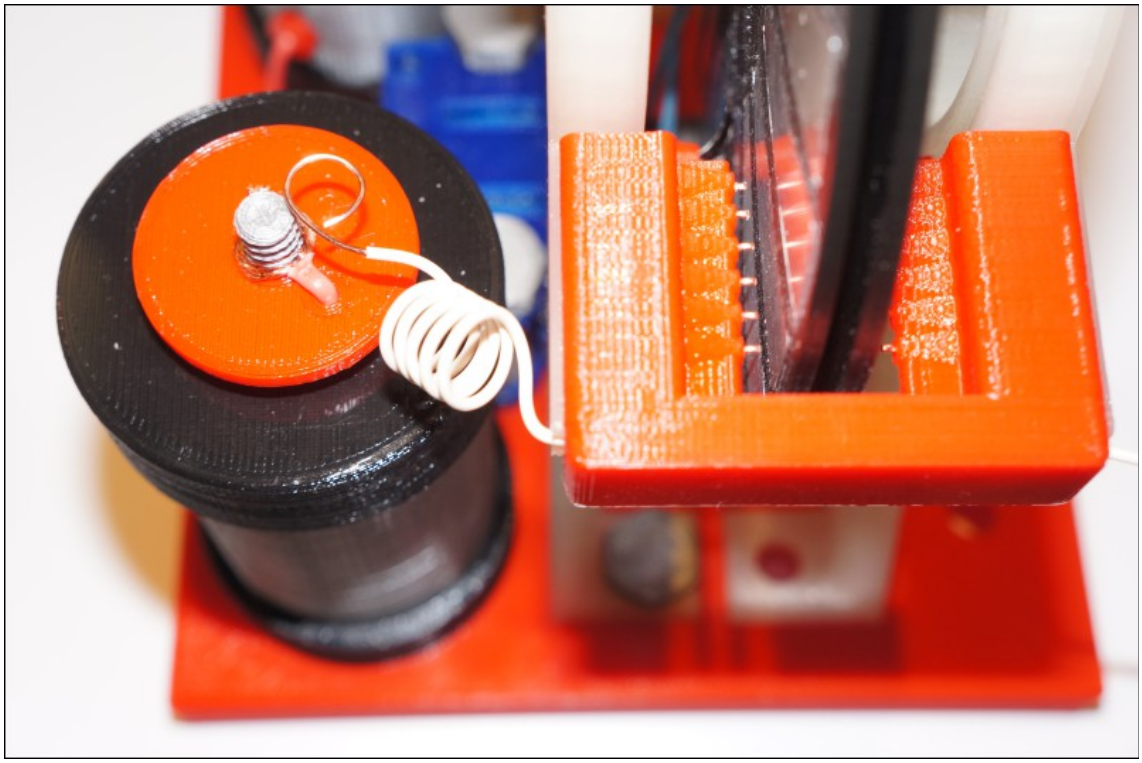
For the collector comb wind the wire around another wire to form small windings (~3 turns) and cut them as shown about.



Stick them through the holes in the collectors for the comb. Then thread the wires together

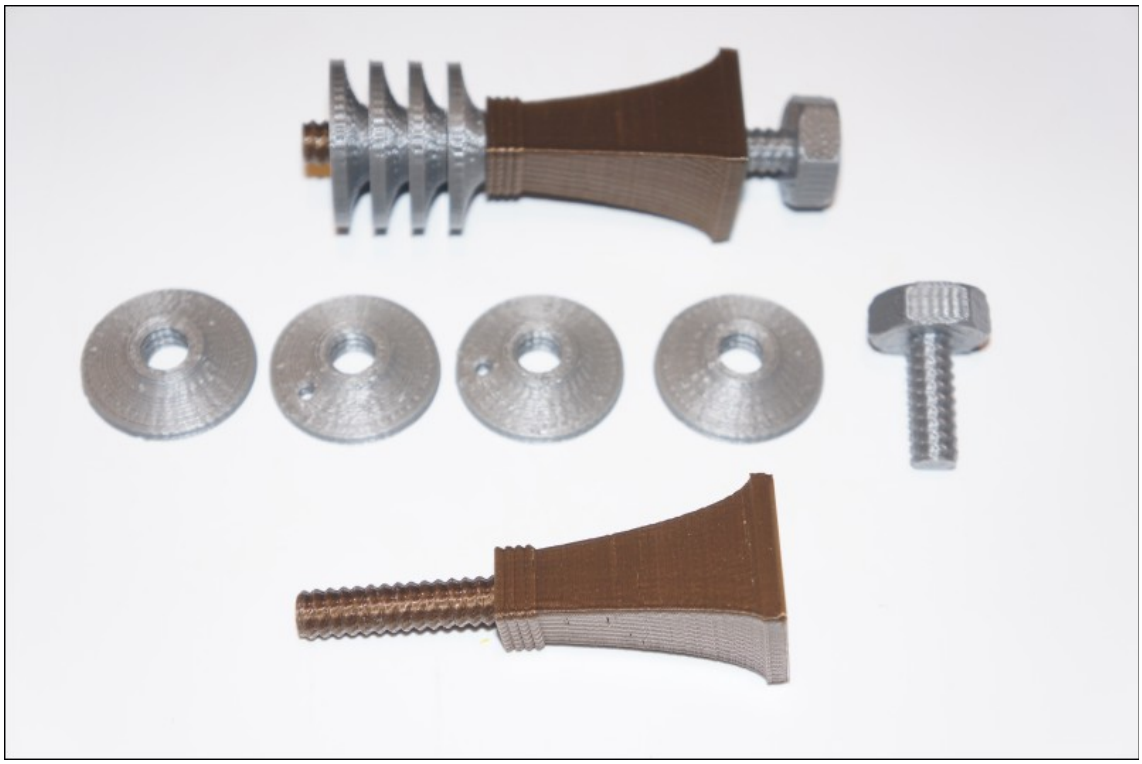


Connect the u-shaped wire with comb wires. Press the wire connections into the grove of the collector. You can pull on the comb wire a little bit. The final visible length of the comb wire should be ~2mm after cutting them of.

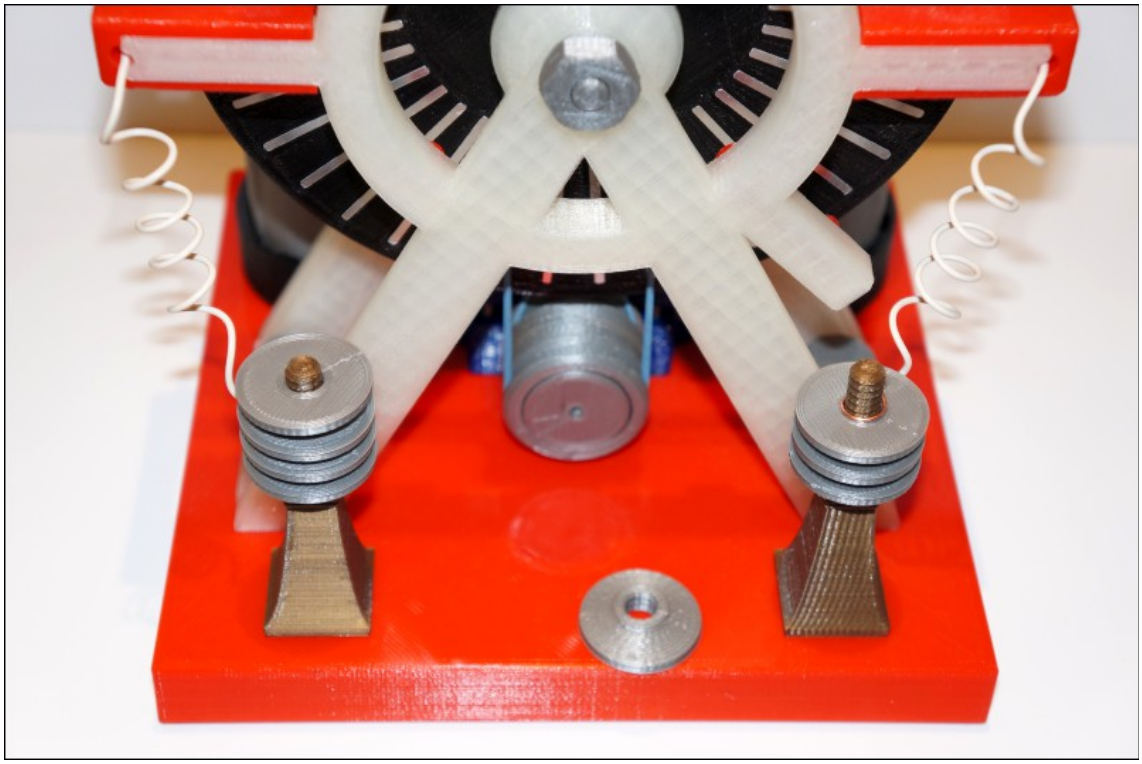


Make sure the comb wire is not scratching the surface of the disc. They should never touch the disc.

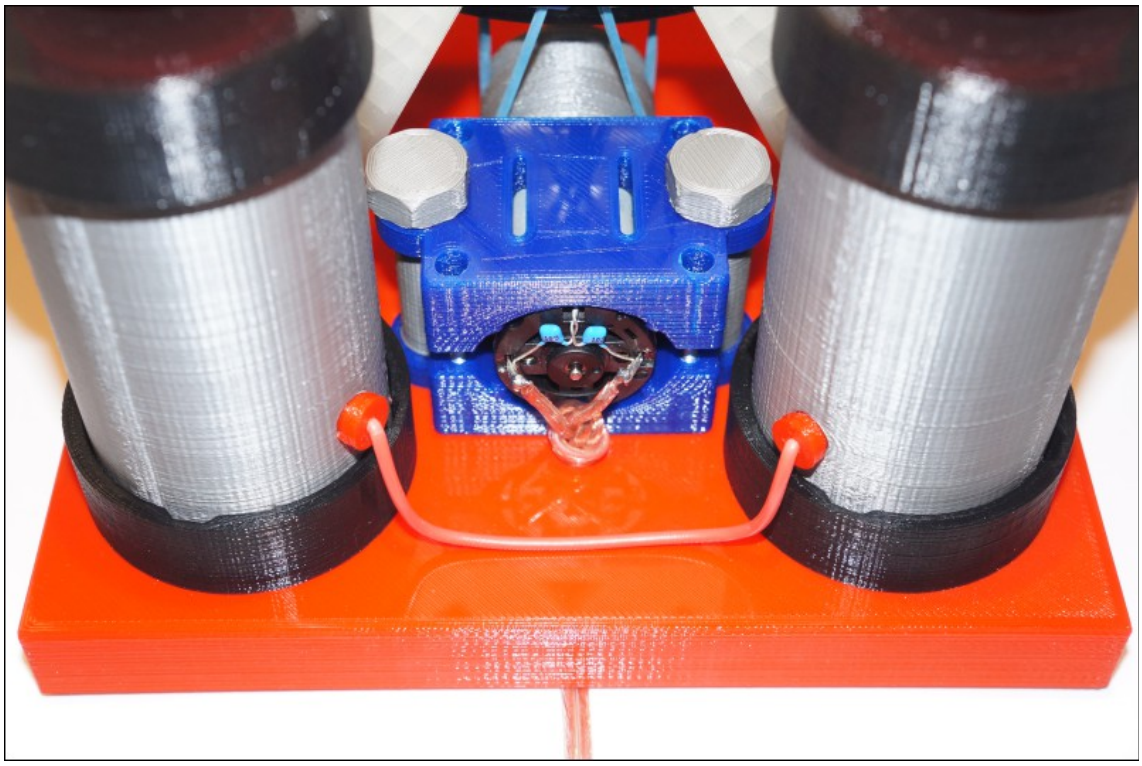
The collector output is connected with the leyden jar and fixed together with the second nut



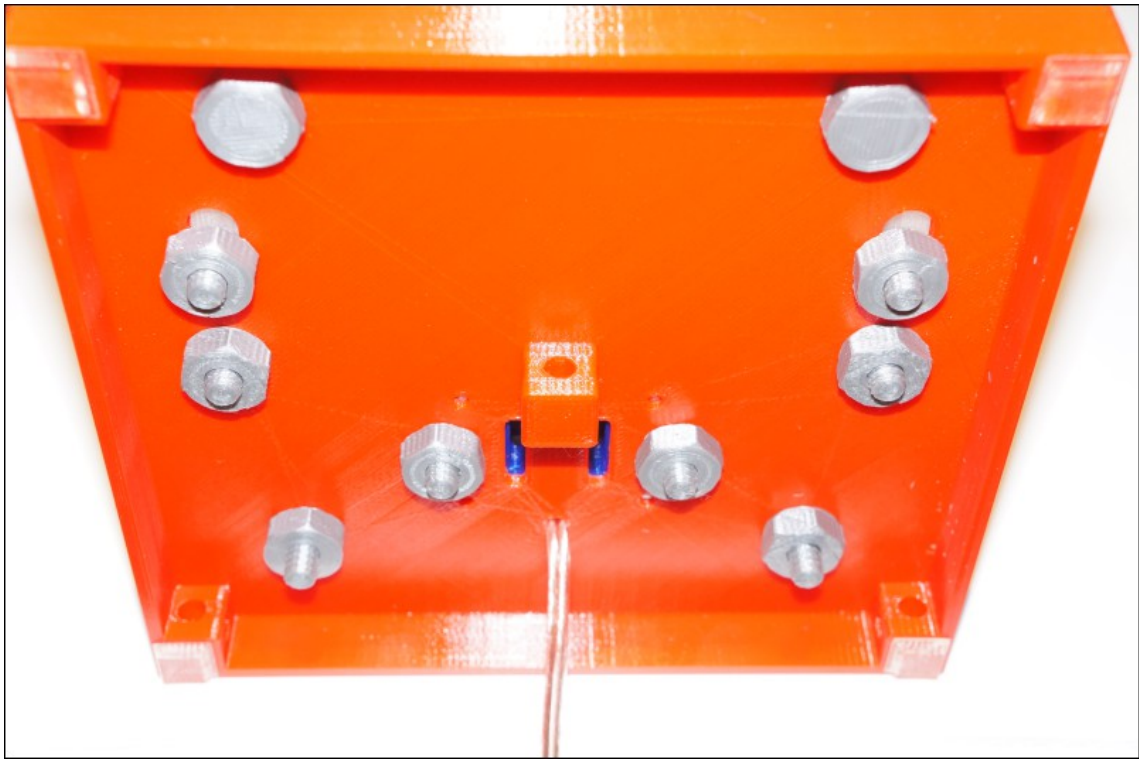
The output poles with the nuts. The two middle nuts have small holes for the collector wire.



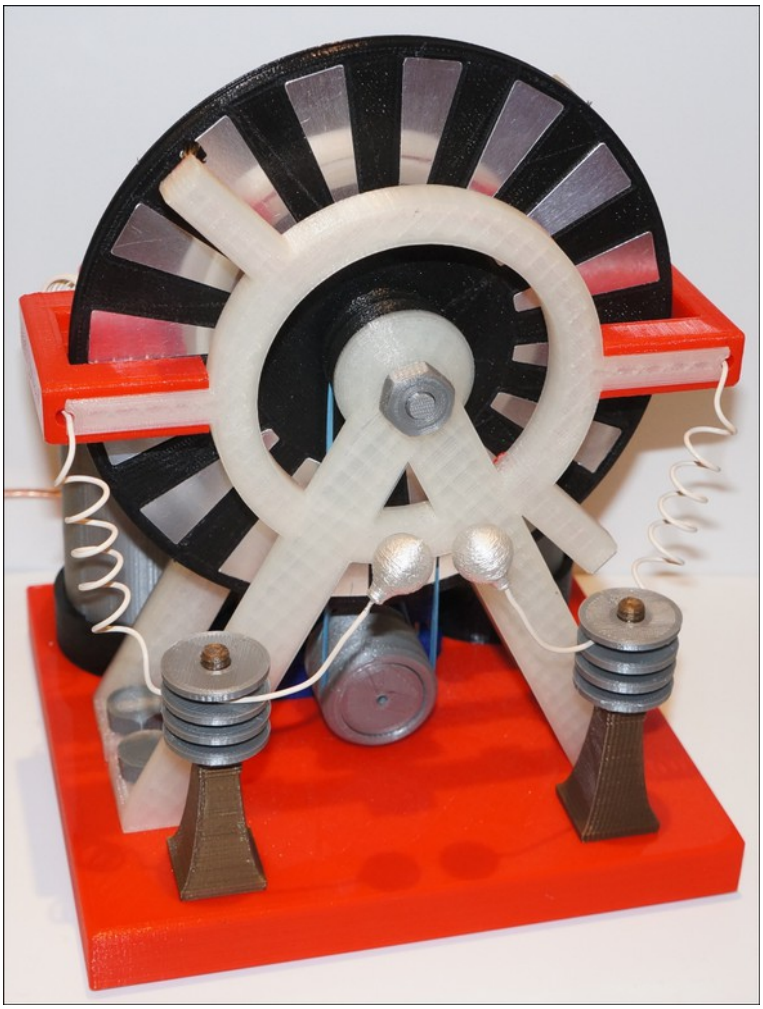
Slide the collector wire through the third (counted from bottom to top) nut and remove isolation. Wind the blank wire around the connector pole thread and fix it with the last nut on top.



Connect the motor. The on/off switch should be not to close to the machine



Final view of the bottom side



The disc with bigger segments generates lower voltage but higher currents which can be seen from brighter discharges.

A third wheel type is included but not tested.