



instructables

## Build a working fusion reactor model: the real life Arc Reactor



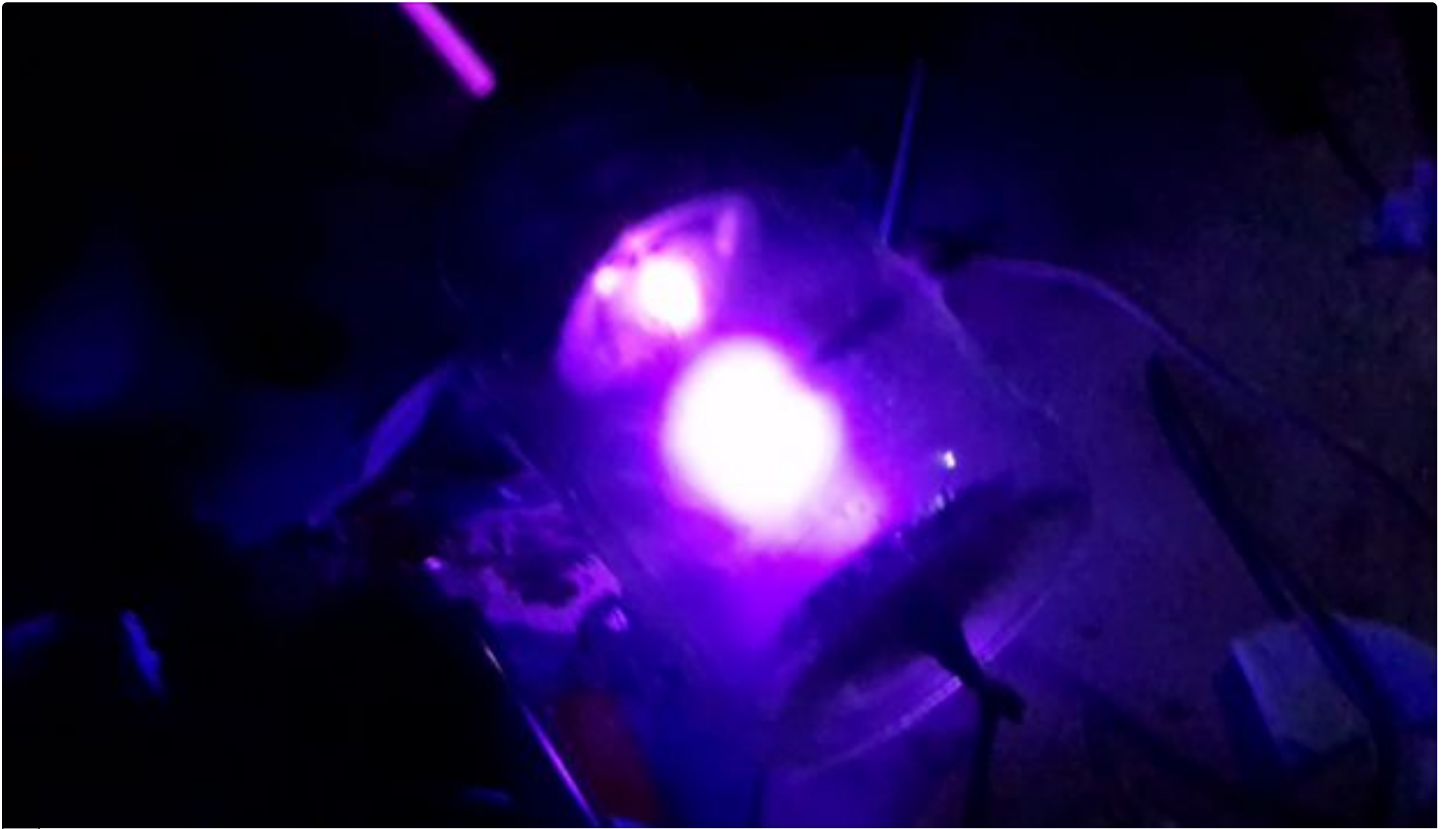
by Vitorbnc

I've always been fascinated by fusion: cool looking devices that hold the promise of one day providing green power to each one of us, while glowing like the one in Iron Man's suit. So, I started building models of them, precisely of the Fansworth IEC (Inertial Confinement Fusion) kind. (<https://en.wikipedia.org/wiki/Fusor>)

The fancy name just means that nuclei of atoms are accelerated and then collide with each other. If they're fast enough, the magic happens and we get helium and energy! The energy output in this design is lower than the amount required to make fusion happen, but it could be used as a neutron source and is the easiest one to build.

This model is different because despite not being actually fusing anything, it could do so by supplying deuterium gas. Besides, it was built with low cost materials, no expensive stainless steel chambers here. The most expensive part is the vacuum pump. Now, enough talking, let's get our hands dirty!





1.  
Our  
reactor  
running!

## Step 1: Materials

First, a warning: this project involves high voltage, in the order of tens kV, so be careful. You could get a big shock or be killed in case of heart problems, I'll take no responsibility.

But if you are brave and know what you're doing, let's proceed. **You will need:**

- About 40cm of thin wire with a high melting point, I used 0.5mm tungsten from ebay (<http://www.ebay.com/itm/10m-32-8-ft-99-95-Tungsten-W-Wire-Diameter-0-5mm-EAK-5-/171768152360?hash=item27fe2e0128:g:k24AAOxyuaFSMGG0>)
- 3/8" brass hose barb with male thread (like the one in the picture)
- Olives glass jar
- An O'ring with the same diameter of the glass jar opening (about 6cm)
- Some 3/8" rubber tubing to connect the vaccum pump to the jar
- About 5cm of 3/8" copper tubing
- At least 10cm of HV wire (I got mine from old TV flybacks)
- A TV flyback transformer (prefer DC type, as DC current is used for real fusion, but AC will produce the same visual effect, actually it may even glow more!)
- A ZVS driver (you could buy or make one). There are even kits with both zvs and flyback (<http://www.ebay.com/itm/ZVS-Tesla-Coil-Flyback-Driver-Marx-Generator-Jacobladder-Ignition-Coil-12-36V-/332034249975?hash=item4d4ec894f7:g:YjYAAOSw4GVYLHcd>) online.
- Silicone adhesive to seal any leaks (not shown here)
- Some ordinary power cord wire
- Some scrap metal to make the electrodes. I'll be using a piece of thin aluminum and two 5.6cm old speakers
- A glass marble (up to 2cm diam.) to make the central grid (this is not mandatory, but will help when coiling the wire)
- A vaccum pump (I'm using one for refrigerator service)

### Tools:

- A drill (like a Dremel) with bits for glass and metal
- Ruler, scissor and marker
- Hammer and plier









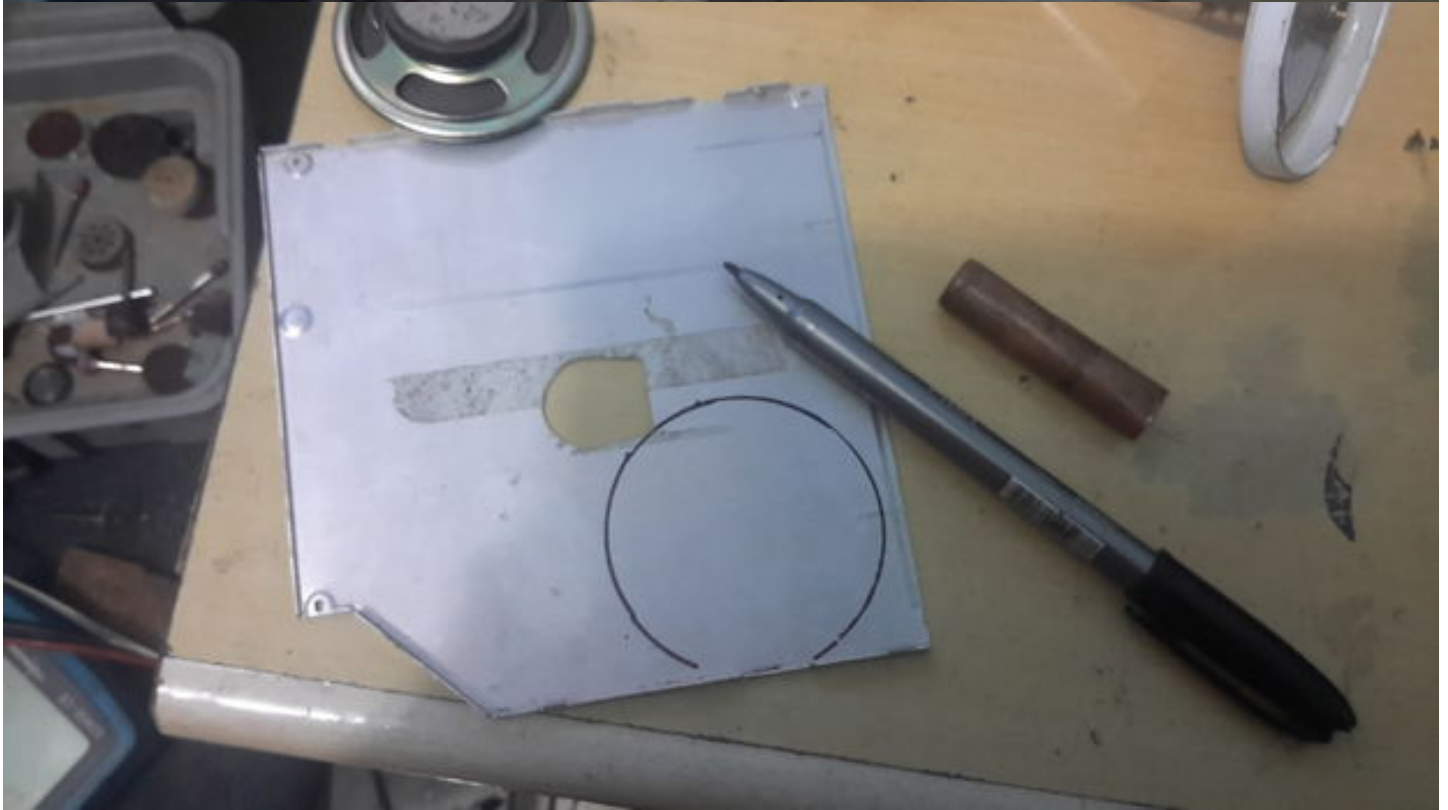
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## Step 2: Prepare the lid electrode

Using a marker, mark the shape of the speaker on the piece of scrap metal (here, I'm using aluminum), then cut it. Remove the magnet, coil and everything else but the armature of the speaker, then put the metal circle on top of it, you may glue it with silicone, super glue or whatever you need, just don't cover the top.

Now, grab the copper tube and put it on the speaker hole. If it doesn't fit, don't worry, smash it a little with a plier and once it's inside, smash it a little again.





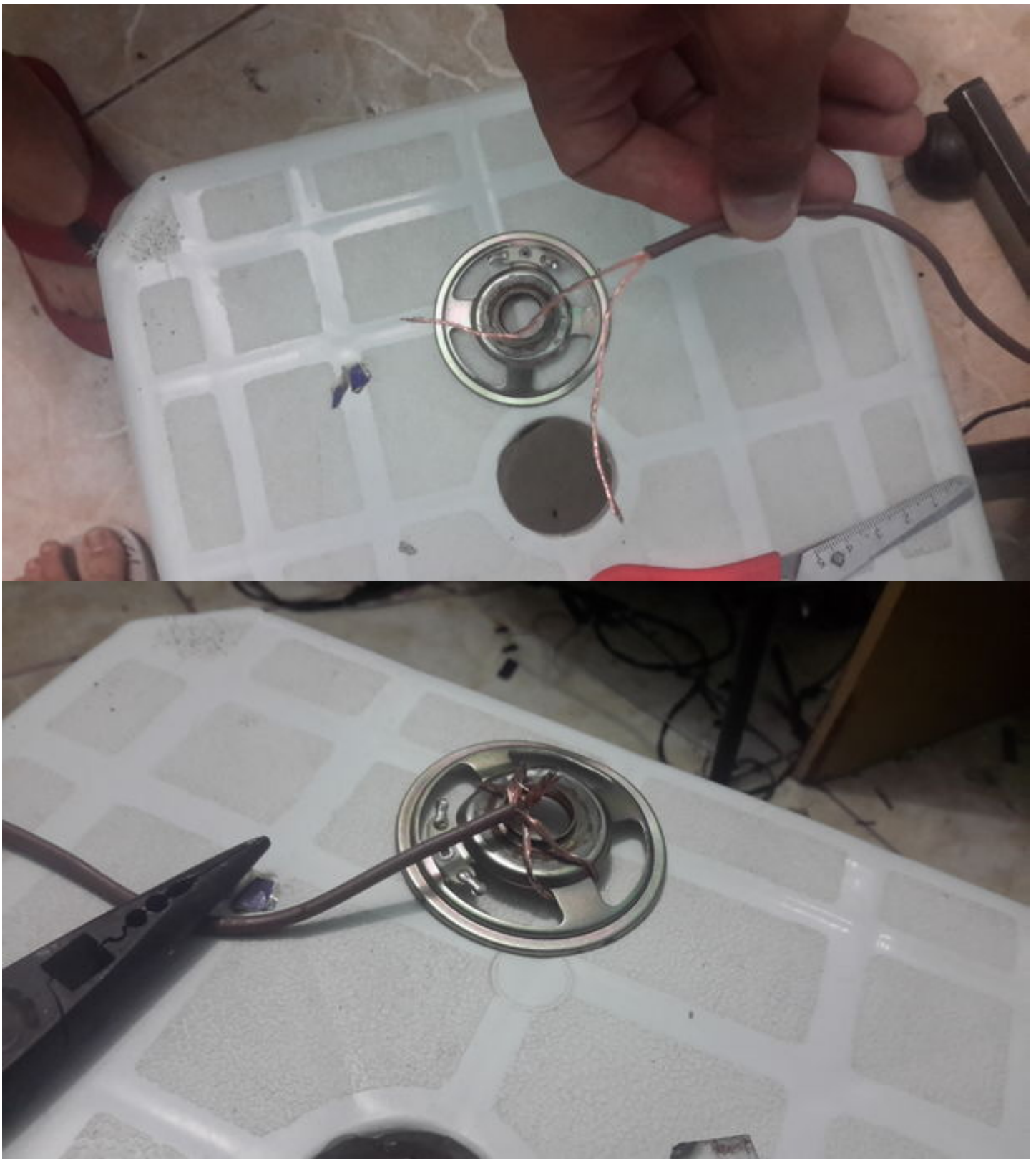


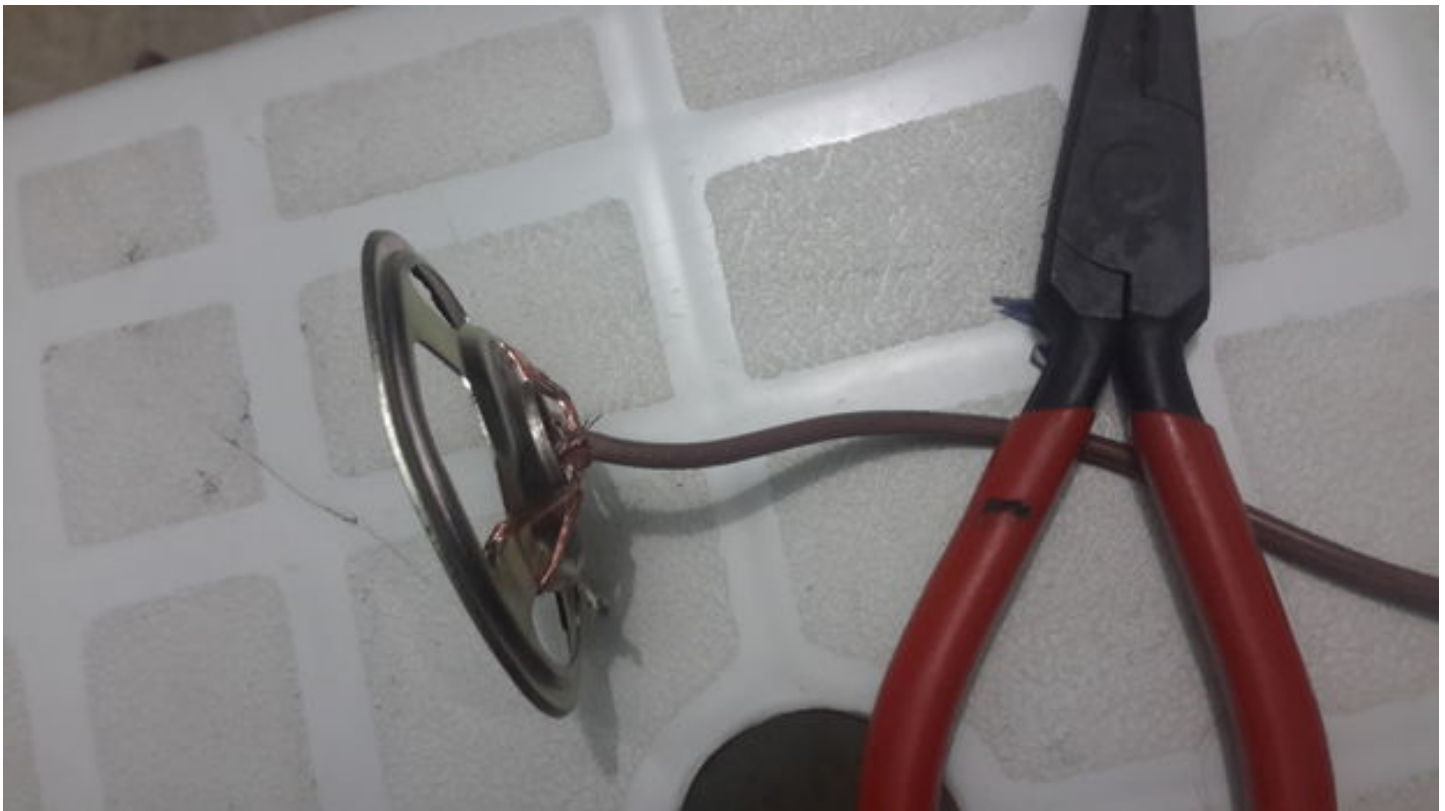




### Step 3: Prepare the bottom electrode

First, mark and cut a circular piece of metal just like before. But before putting it on the speaker, go get the regular copper wire and tie it to the speaker just like shown in the pictures. After tying, you may put the metal.





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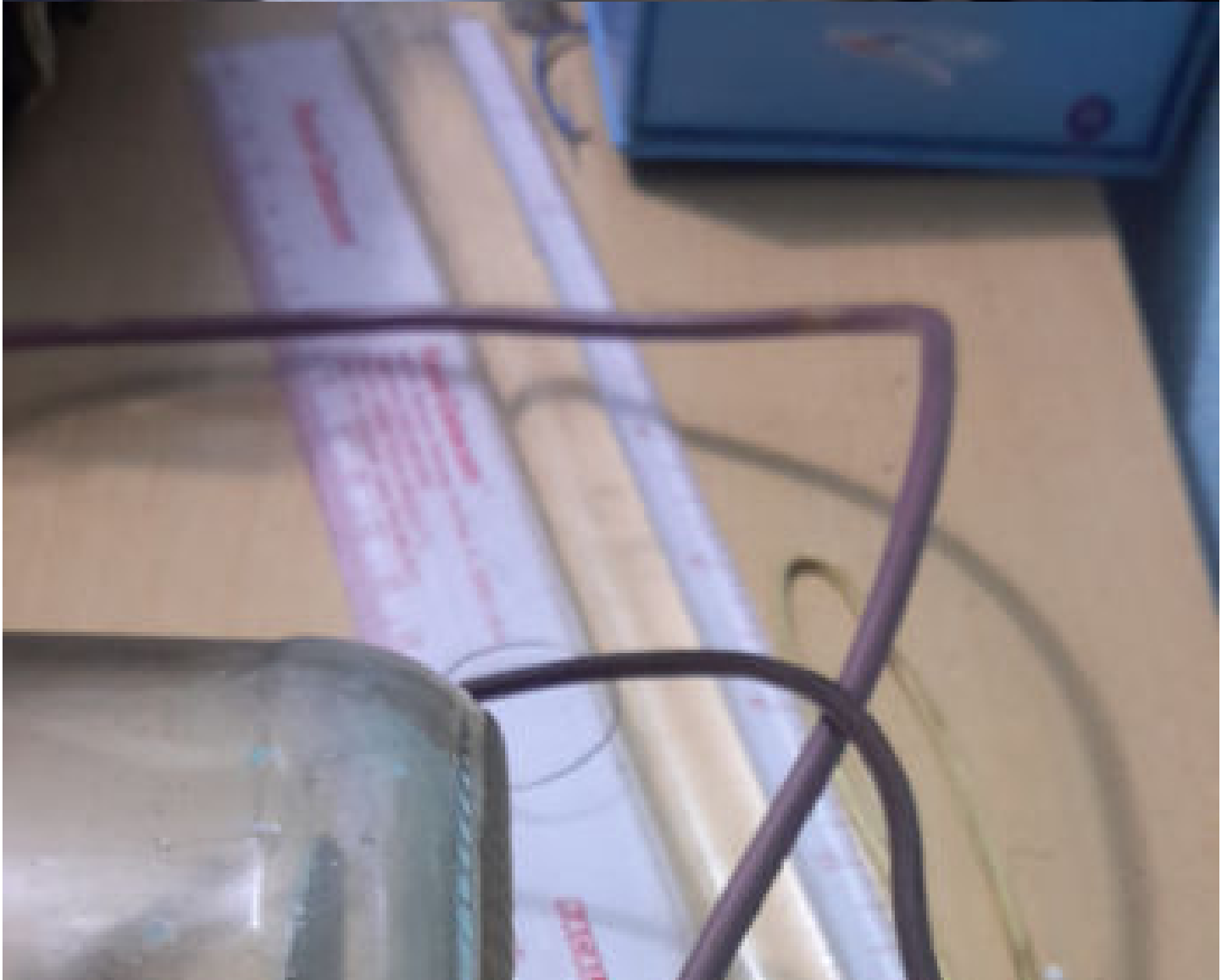
#### **Step 4: Bottom electrode and top o'ring**

Now, with your drill and the proper glass drill bit, drill a hole in the middle of the jar bottom, test the size to match the wire's, it shouldn't be too loose.

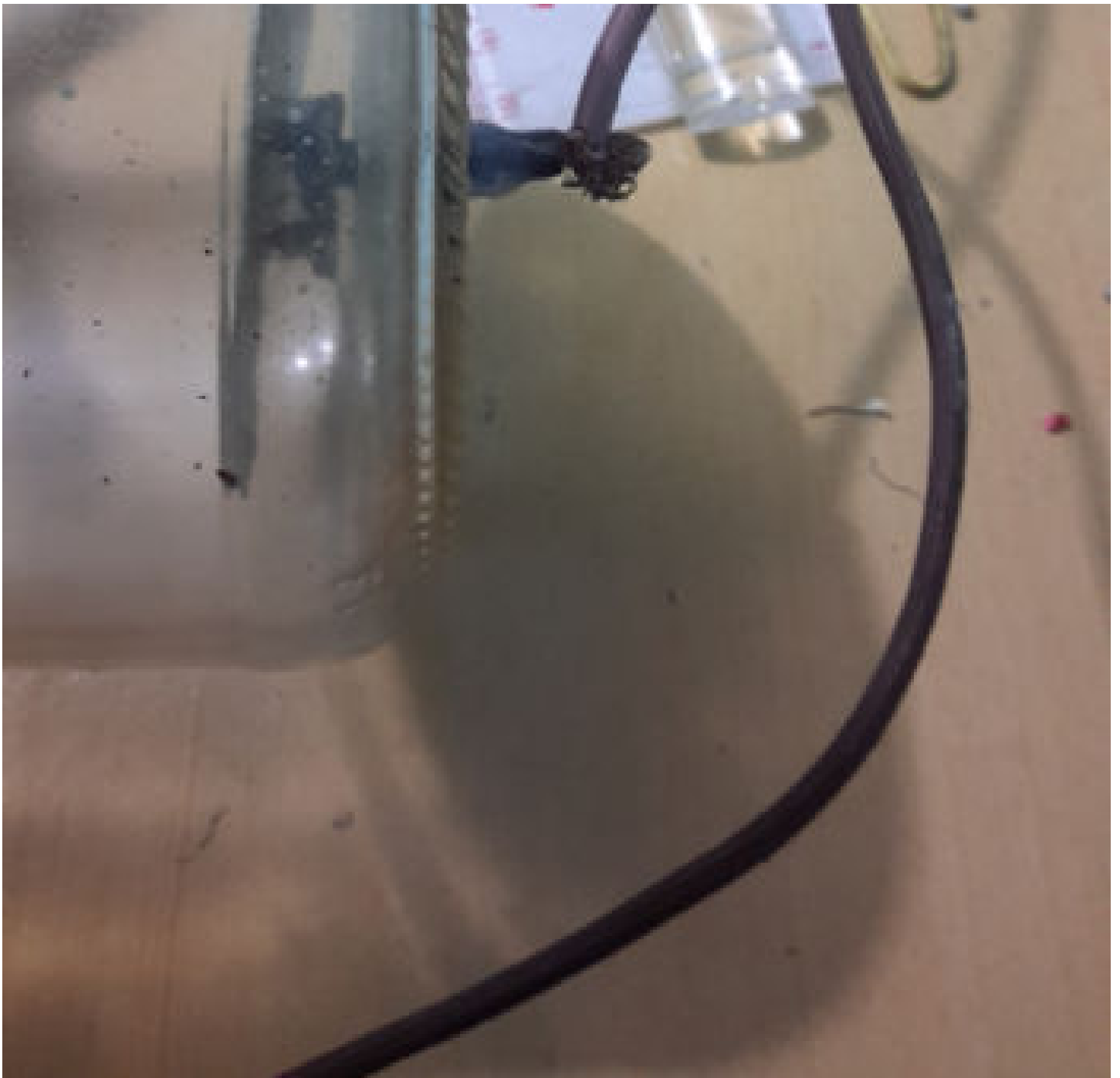
Take the bottom electrode and pass the wire through the hole, just like the picture (there's an older electrode there, but it's the same idea). Seal it with silicone adhesive and wait, it'll take some time to cure.

While you wait, grab the o'ring and put it on top of the jar, then seal it with silicone too, there can be no leaks!

**Leave the jar resting, note that some adhesives may require several hours begin to cure.**









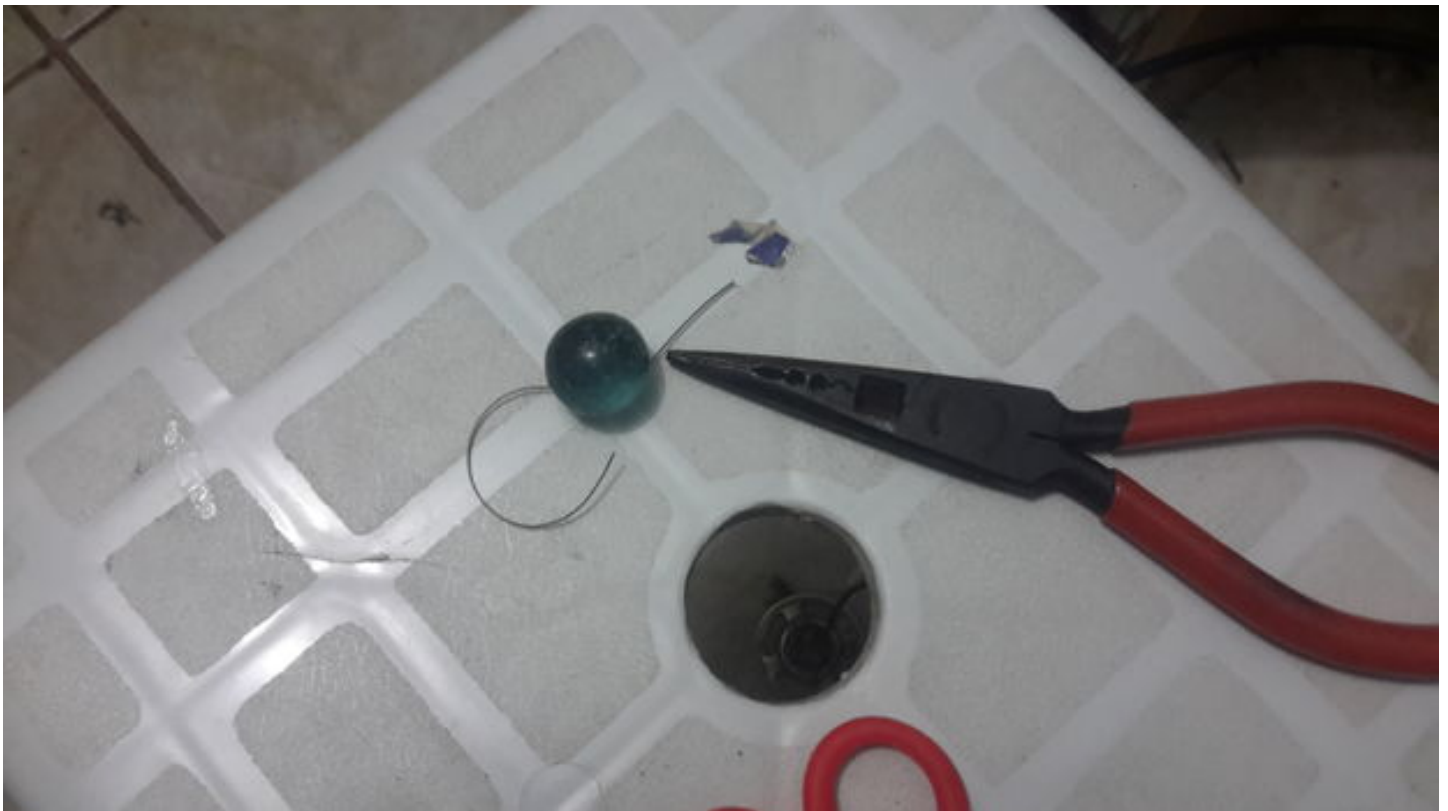
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### Step 5: The almighty grid!

Using the glass marble or some cilinder you have lying around, make 3 circles with the tungsten wire. For one of them, you may leave some extra wire to attach to the HV cable.

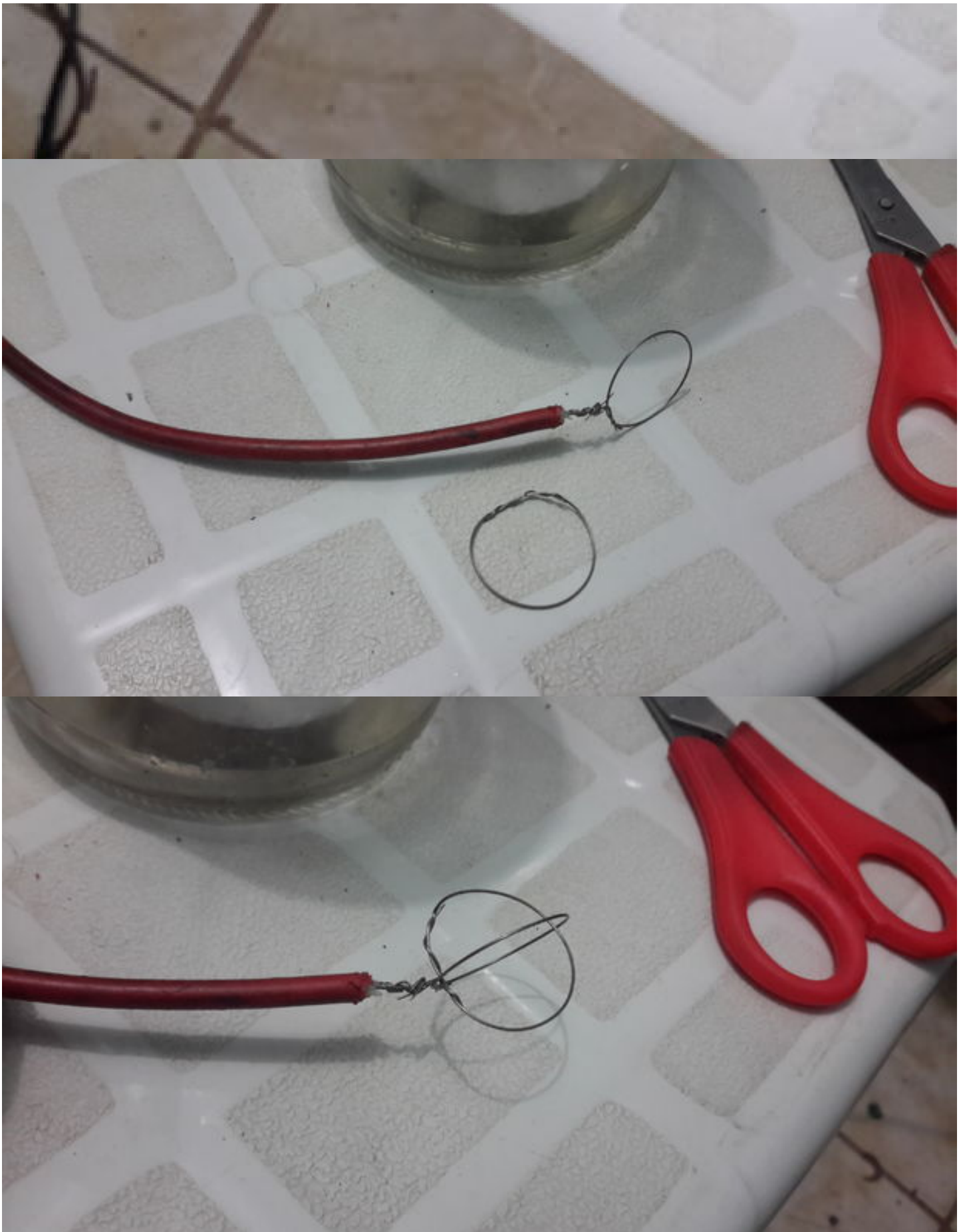
Aim for the small grid shown in the picture with the o'ring, remembering to attach the HV cable and isolate any exposed wire with tape and silicone, only the grid should be exposed.

When the grid is ready, drill a hole in the middle of the jar side wall and put the grid from the inside, just like we did for the bottom electrode, then apply silicone to seal any leak.











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### Step 6: The lid and final assembly

**Almost ready!** Use your drill to make a hole in the lid and screw the hose coupler into it. Then, screw the copper tube electrode on the coupler thread. The electrode end should match the jar wall mark (if your jar has one) or be at the same distance from the grid as the bottom electrode.

Put the lid on the jar, it should fit tightly, if that happened, **that's it, our little monster is finished!**



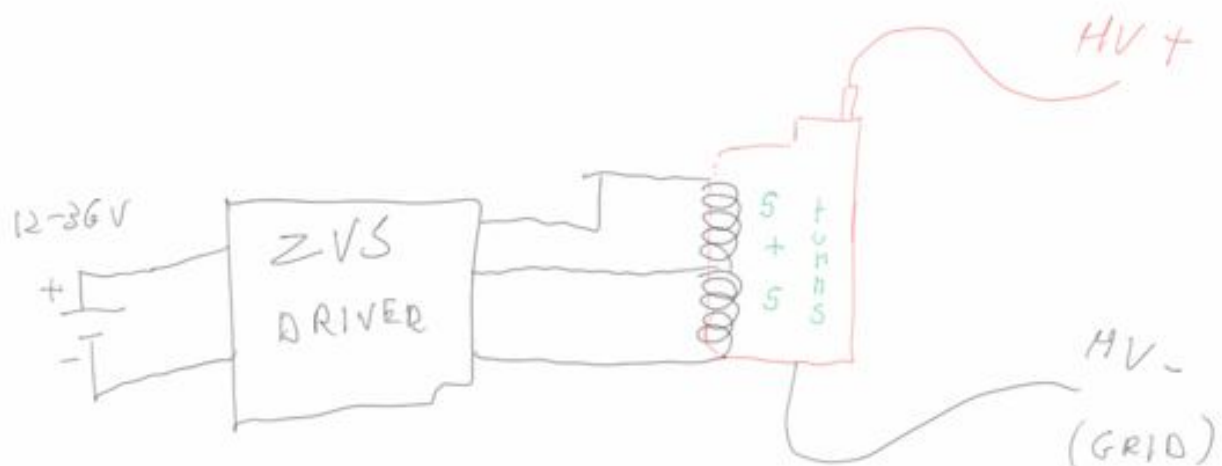






## Step 7: Machine food: the power supply

The power supply is also very important. Whether you choose to buy the zvs kit or build your own, keep calm and follow the images. The ZVS input voltage should be at least 12V and is rated to a 36V maximum. However, I like to take some risk and run my homemade version on about 50V! You may try it too, I just can't guarantee it will work forever (or work at all).



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## Step 8: Have fun!

Ladies and gentleman, we may now officialy start our reactor!

Connect the supply ground to the grid and the positive terminal to the two side electrodes.

Turn on the vaccum pump for a few seconds, then turn on the power supply. As the vacuum increases, the plasma between the electrodes will become a glowing ball in the grid, just like a **star in a jar**.

























