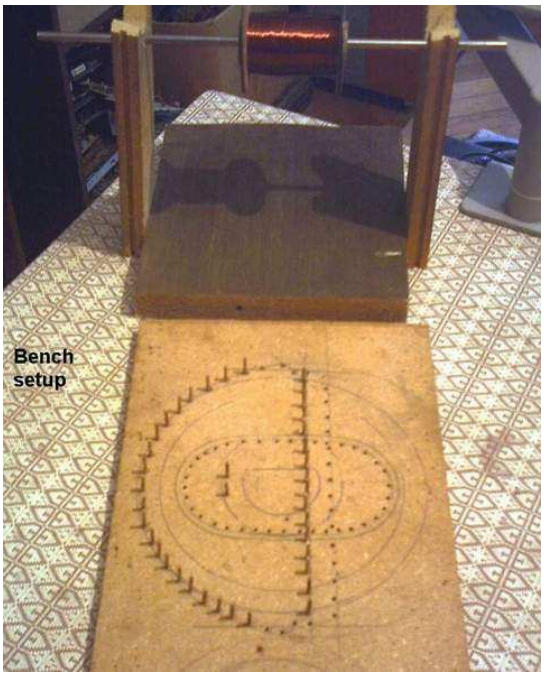
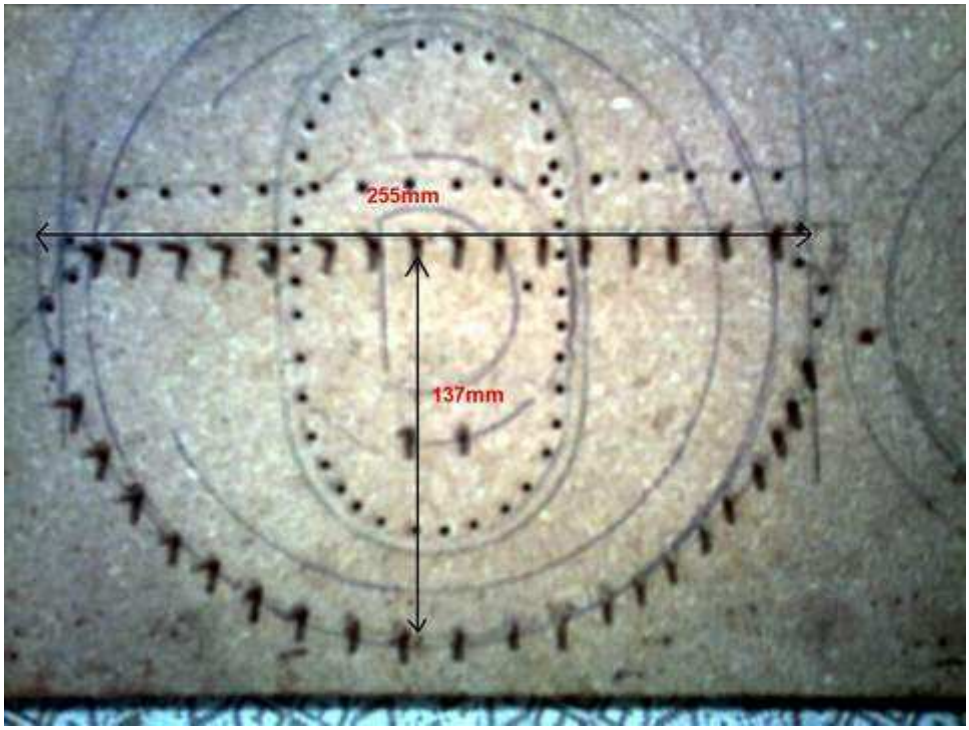
Making coil for TGSL

Well, i choosed 27cm DD coil to make. It is deep and good enough.

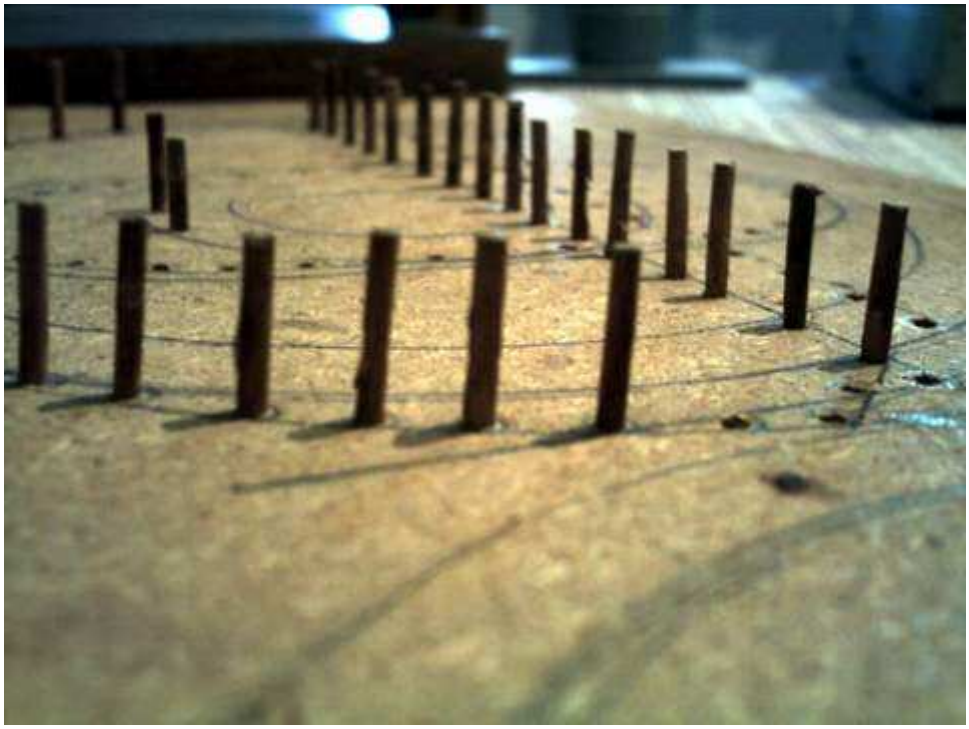
First, arrange setup in your workshop , so you can later have enough comfort in progress of making coil.



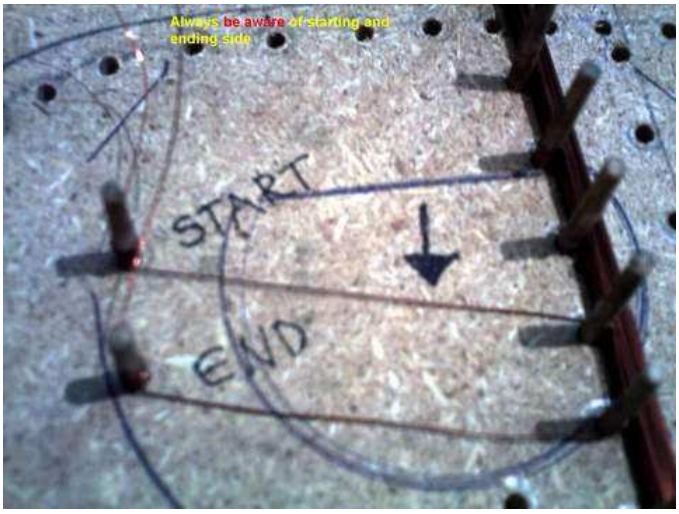
Former on photo has inner dimensions 255x137mm. Doesn't really matter to respect exact dimensions and shape, those can varry a bit.



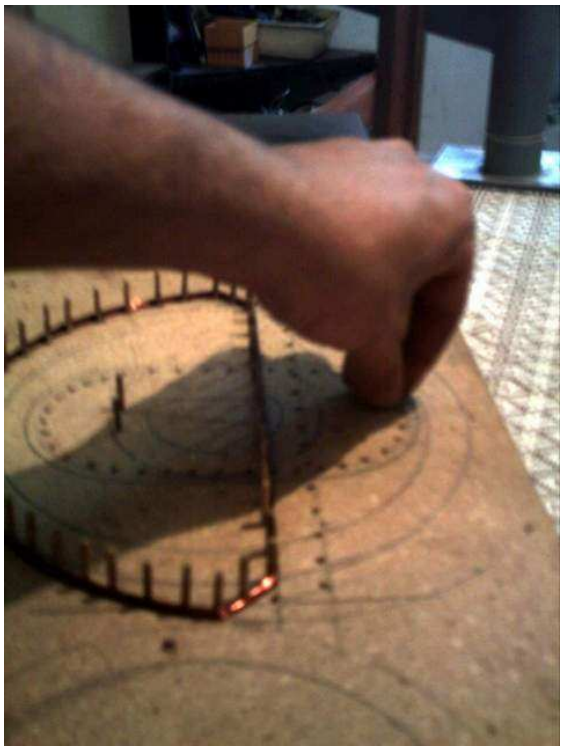
I used simple plywood piece and draw former shape. Than drilled holes and nailed wooden sticks.

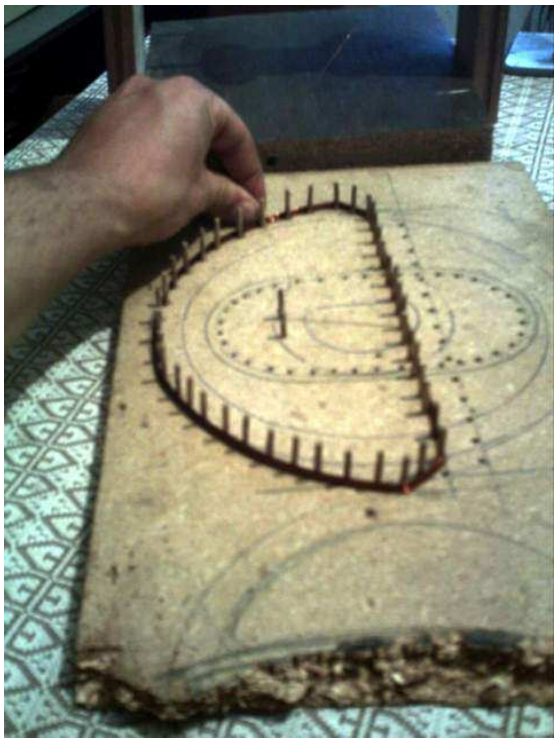


What is very important is to achieve proper inductances; TX=6mH and RX=6.5mH
Resistances are varying from 18 to 25 ohms, mostly depends on former dimensions, angles and later when wire windings are about to be more or less good constrained . Do makes difference if those are constrained stiff or not.
Keep in mind that constrained windings DO have a bit higher inductance later. So, to achieve proper inductances you must calculate this also. Dont bother, i will help you. On given former wound 5.7mH for TX and 6.3mH for RX. Later when constrained good and stiff, inductances will rise for about 0.2-0.3mH. Voila! :)
Always be awared on start and end of each coil. Both coils are wounded in same direction and with same mannner, later joined in some coil enclosure.

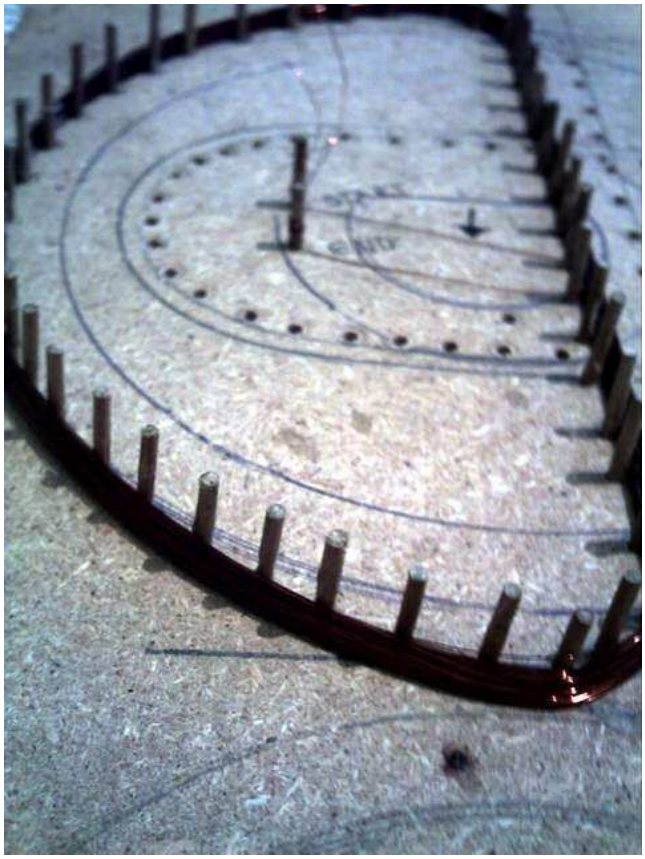


On next few photos you can see how i deal with wire and windings, pretty loosen.
Also always be aware of winding direction. I prefer clockwise. Both coils, of course!

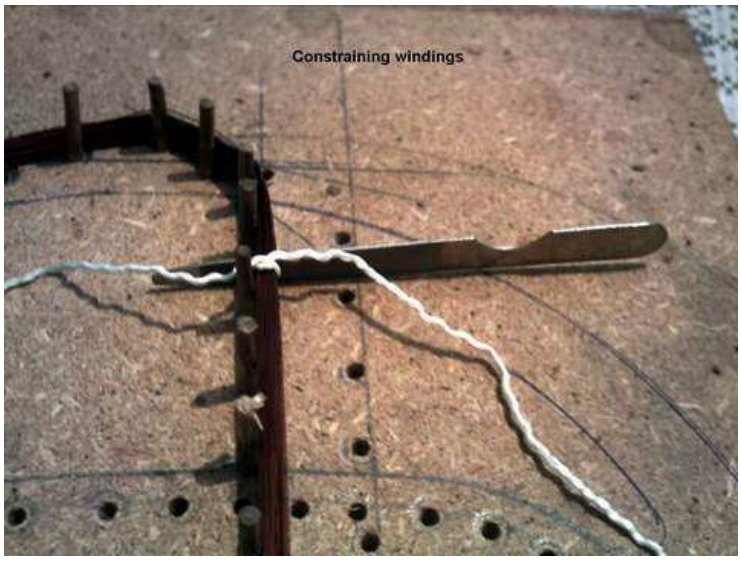




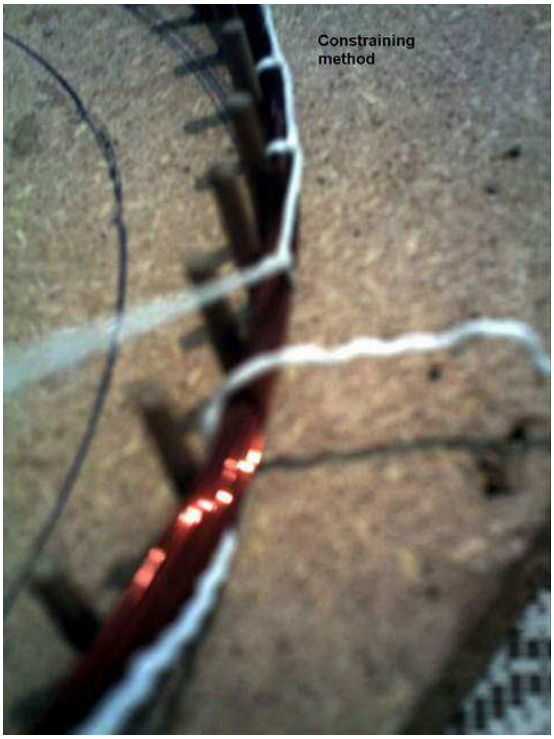
So, to finish this exact coil i need **<u>107 windings</u>** for **RX** and **<u>98 windings</u>** for **TX**. Wire at both coils is the same; 0.25mm Cu (0.27-0.28mm with resin layer).

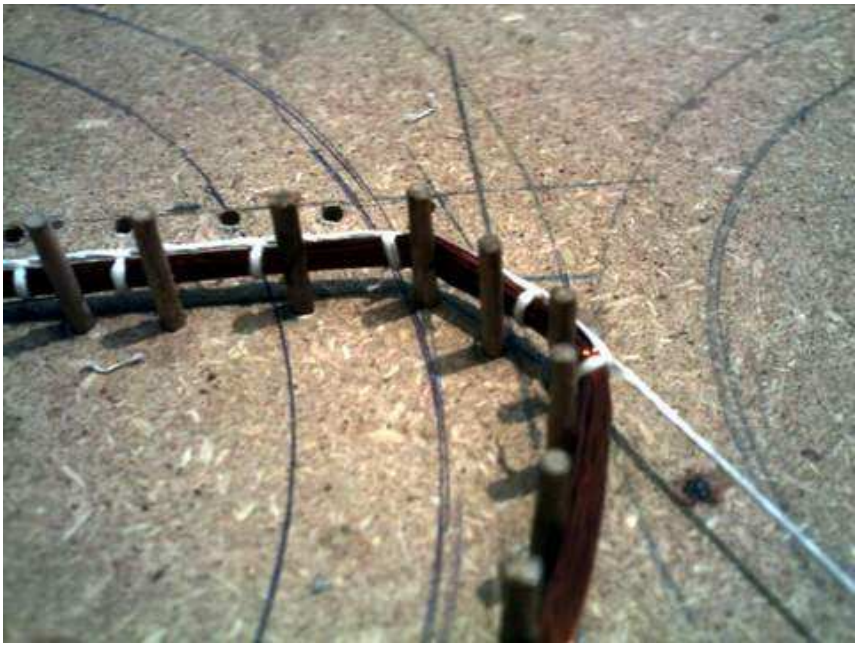


Windings are loosen. Not good. Now is time to constrain those as stiff as possible. Pay attention not to brake or peel resin layer !
To constrain windings you can use any other available method. I am using most simplest i could – yarn. But very strong and not to thick. (Fisherman's yarn)

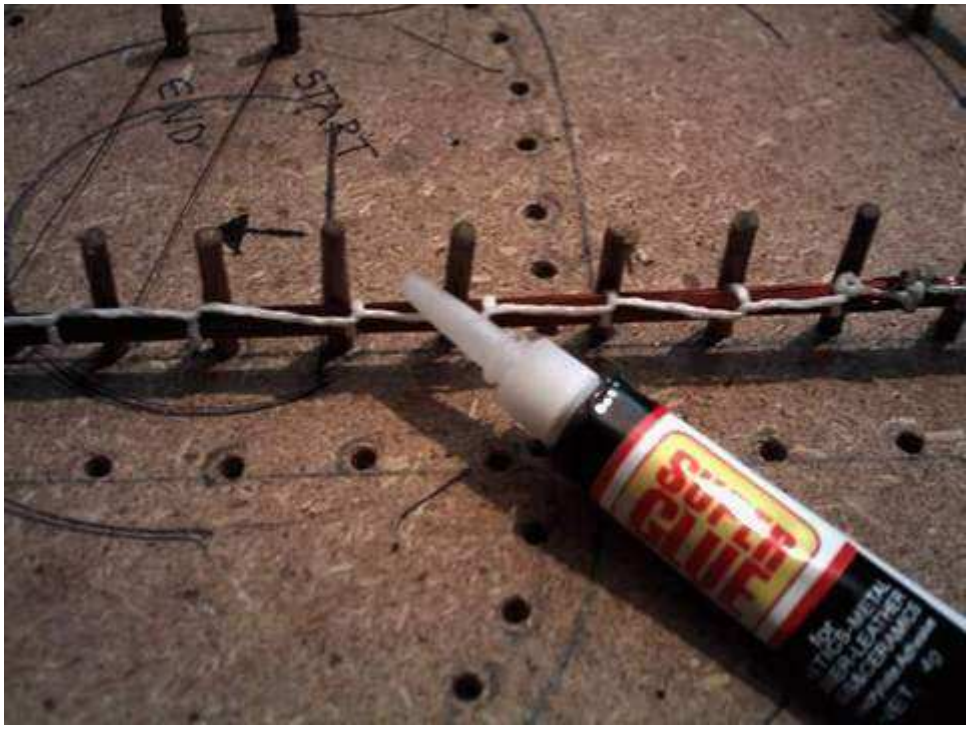


You may use any method of mixing and knoting with yarn. Best is when yarn does not occupies much of space over windings. Tiedown it good.

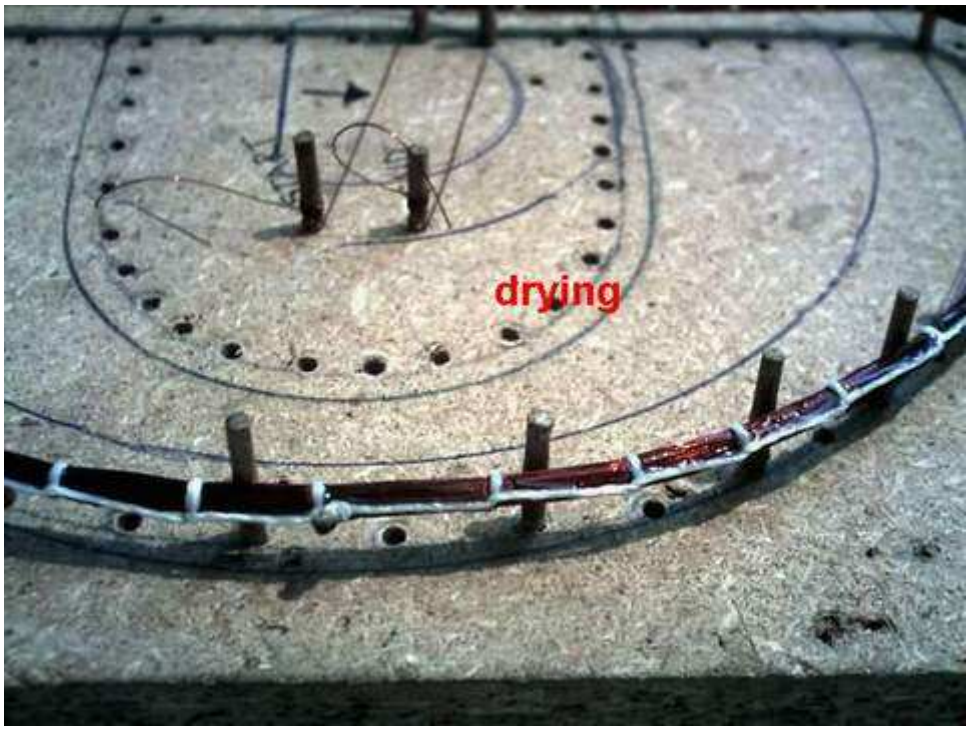




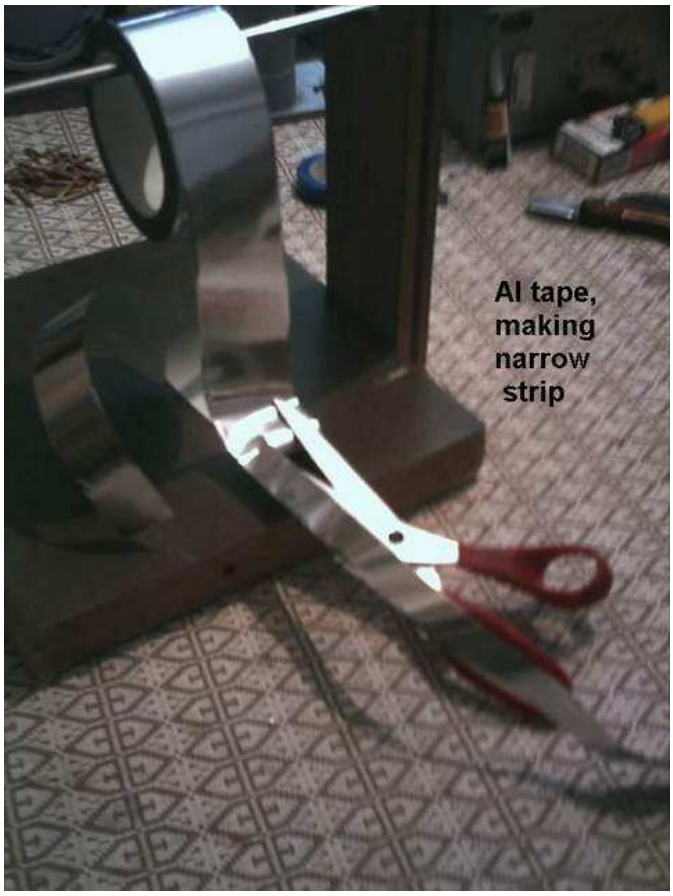
When constraining finished, use super glue and infuse it good between wires and yarn.

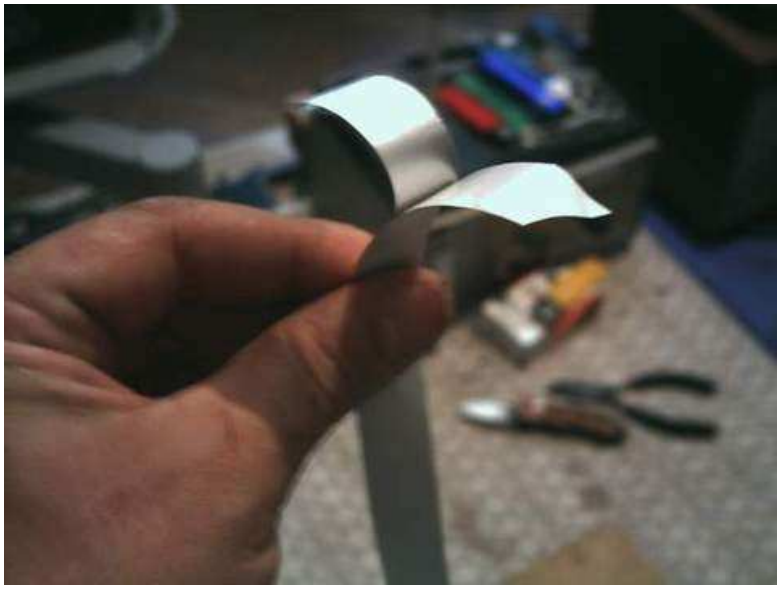


Let it to dry very good!

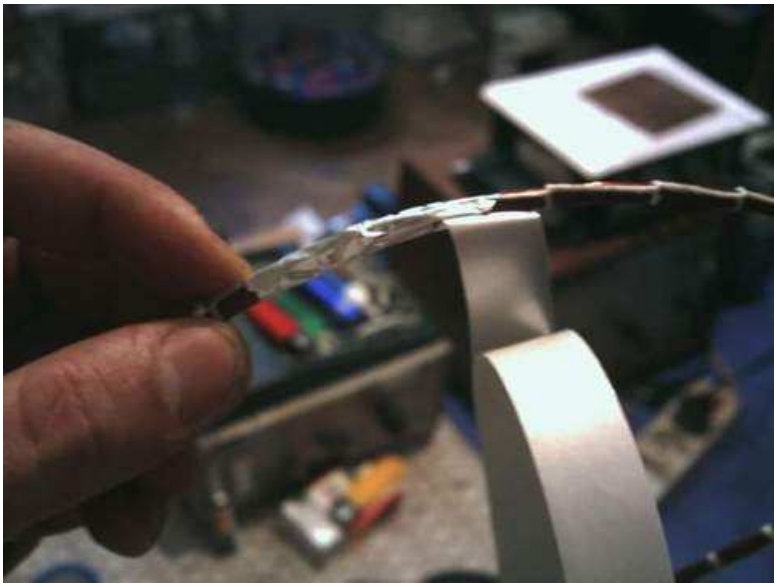


Now is time to apply Faraday shield over coil. Many ways to do that. My most favorite is Al tape. Self adhesive Al tape. Although, if you can’t obtain it, you may use ordinary kitchen Al tape too. Since i have only wide one, i must cut it into narrow strips. 15mm wide strips.



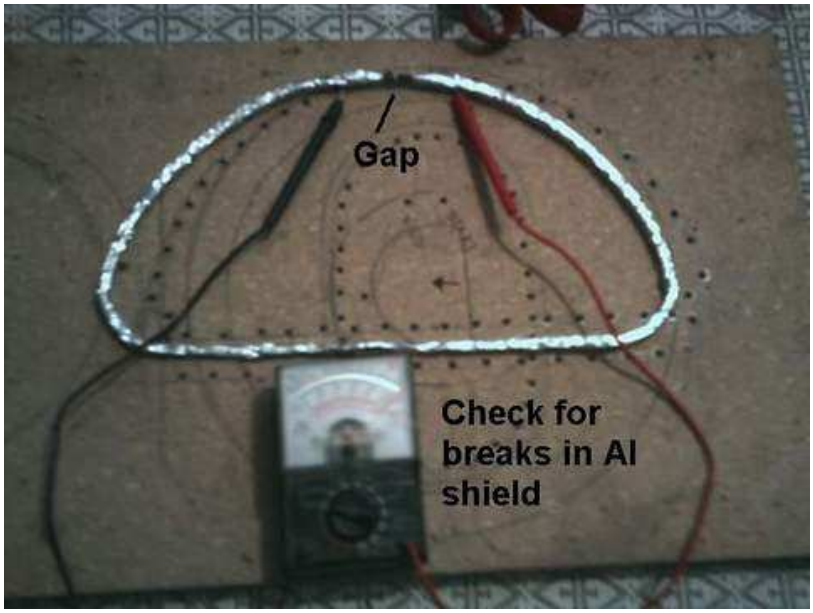


Now wrap tape stiff over coil. Wrap it and overlap for 2-3mm over each previous winding to form “closed” shield over coil.

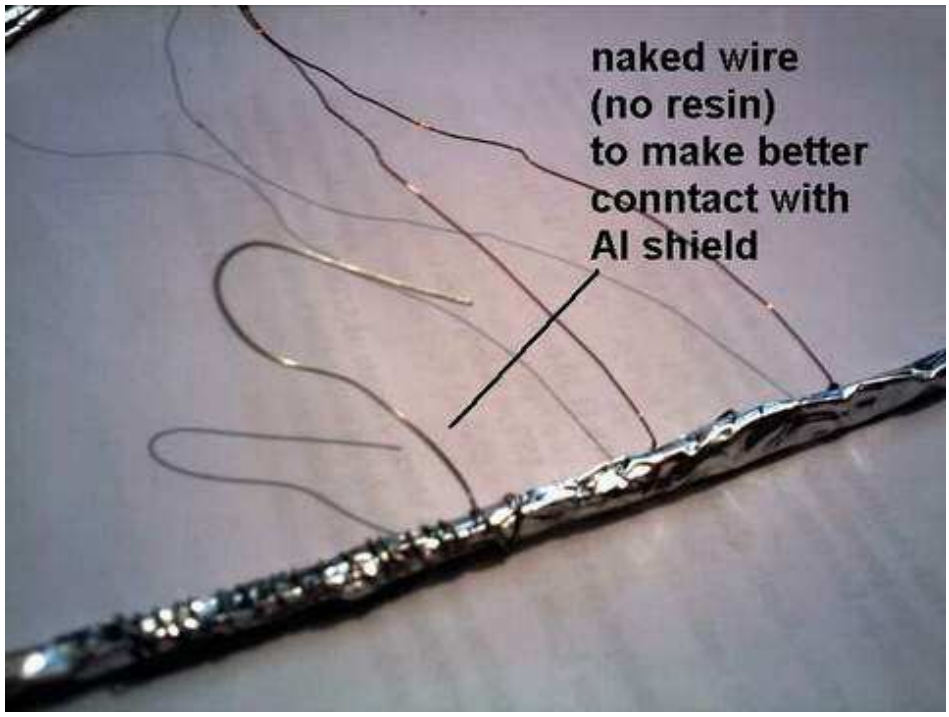


At the end leave 5mm to 1cm gap. **<u>This is OBLIGATORY!</u>** Without gap you get NO Faraday shield. Worth nothing!

Just in any case, do test continuity of Al windings with ordinary ohmmeter.

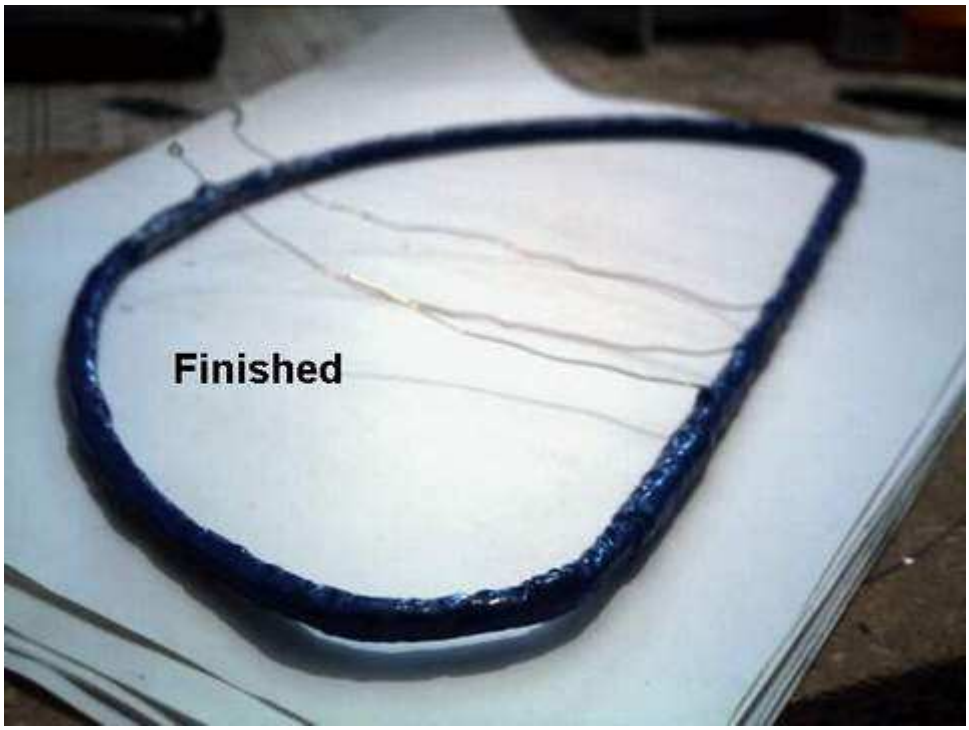


No benefit from Faraday shield if it is not included in circuitry. So we must connect it somehow. How? Simply, with naked (no resin) wire. Wrap pretty stiff and hard 20-30 windings of naked wire over Al shielded coil.

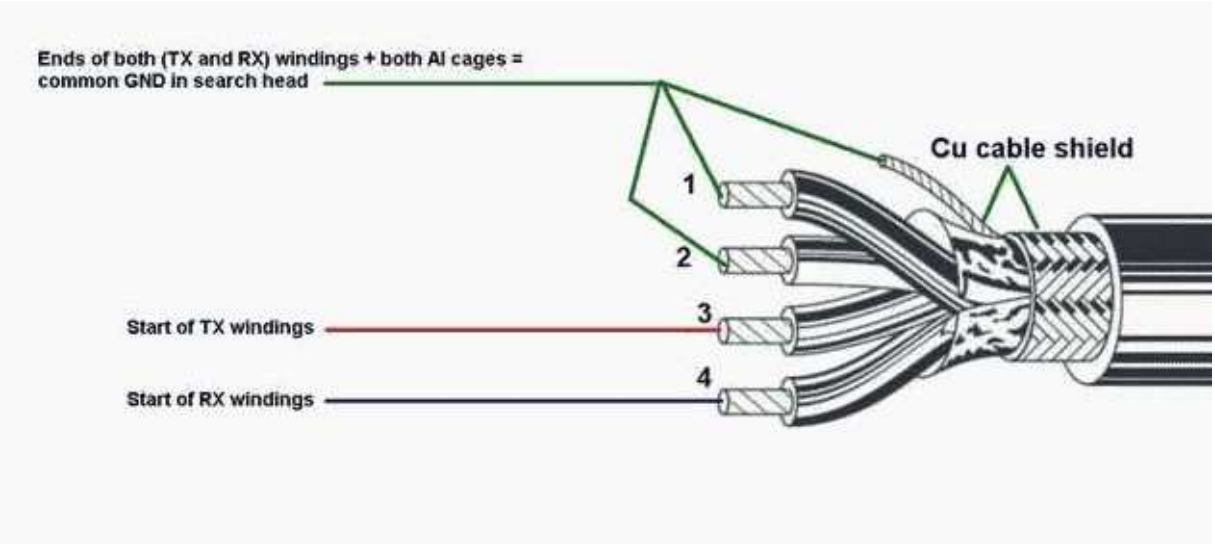


To secure good conntact of naked wire and Al foil, and also to prevent wider conntact of both coils (unwanted loops), further when put in enclosure; we must wrap ordinary Scotch tape over whole coil. Coil will have, than, 3 wires: **start, end and Al shield** (Faraday cage).

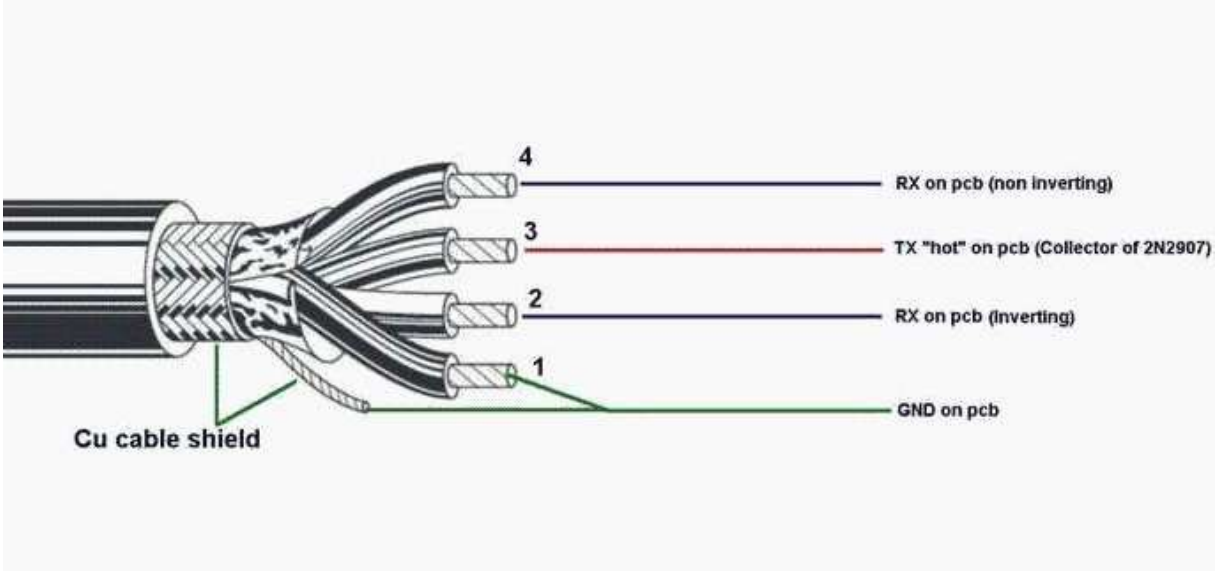
Finished....



Now..proper connection inside coil enclosure. We have RX,TX and 2 naked wires – Faraday shields on those coils.



On other side of the cable you may use any connector suitable for this purpose. I am using 5 pole female connector with srew.



This is the proper way to connect leads (via connectors) to pcb.

Here is one finished “D” part near previous coil.

Balancing – nulling

Balancing – nulling coils are already very well explained on Geotech forums. There are few quite different methods to do that. Find your self most suitable. I can only explain my method, maybe not most accurate, but for sure most suitable for me.
I am, usually, already puting both connected (to cable) coils in some previously prepared plastic enclosure. Than i usually connect only TX coil to pcb. Switch ON TGSL and get oscillations. Than i measure RX outputs with millivoltmeter at range AC ~ 200mV.
Moving coils close or away from each other i am trying to achieve minimal residual voltage, of course all the time observing measured voltage on millivoltmeter. Usually when gain 0.04 on mmeter LCD display of my unimeter (at range AC ~ 200mV) i know that coils are balanced optimal.
Than switch OFF TGSL and connect RX part to pcb. Again switch ON and check air depths and phase. Adjusting GEB on pcb to totally reject ferrite rod (10cm long) for 5cm away from coil surface and at the same time to accept (clean detection with smooth audio) small 1cm Ag (silver) coin.
Somehow i established proper position of GEB trimmer as exact spot where ferrite rod is rejected and silver coin is accepted. It is very critical “border” in phase, between that rod and that coin. I established that long time ago and now am using those each time when some new coil is about to be nulled or..when checking and adjusting phase at some simillar detector.
Nice and fast method in cases when you dont have scope and simillar instruments. Now i do have scope and many more instruments...but this method is so accurate and fast that i dont want to bug myself with to much “philosophy” ...
Well balanced coil detects 1e coin at 30-34 cm distance in air.
Last step is to fill coil enclosure with some hard mass. I am using two-component epoxy.
Enjoy!