Alternate Coils for the Iota Antenna.

The loading coils for the Iota antenna can be made in an infinite number of ways as long as they achieve the required inductance. The original coils used 14GA wire and could be stretched to lower the inductance. This article will present a method of making the coils using smaller diameter wire wound on a smaller form. It will also present a method for mounting the coils to the antenna in a plug in arrangement to make band changes much easier. Special thanks to W9PB for his help developing these smaller coils.

The following chart shows coil parameters for various bands using 18GA wire. It will also show the approximate inductance of the coils. The inductance can be used to determine the number of turns and length of a coil using different wire or form diameters. There are several online calculators like: https://www.daycounter.com/Calculators/Air-Core-Inductor-Calculator.phtml

CHART

Coil Chart

BAND	10M	17M	20M	40M
Center Coil Form Dia.	-	3/8"	3/8"	3/8"
Center Coil Turns	-	9	11	14
Center Coil Length	-	0.4"	0.73	0.67
uH	-	0.5	0.68	1.08
Loading Coil Form Dia.	3/8"	3/4"	3/4"	3/4"
Loading Coil Turns	5	10	14	43
Loading Coil Length	1/4"	0.8"	0.7	1.84
uH	0.2	1.24	3.14	15.7
Bandwidth	Entire Band	Entire Band	500 kHz	65 kHz

Notes:

1) Form diameters in this chart are true inch diameters. Not pipe diameter. Wood dowel rod is an inexpensive true inch size form.
2) Values shown in the chart are approximate and should be used as a starting point. Coils will need tuning. Spreading the windings apart reduces the inductance and increases the antenna's tuned frequency. Inductance was measured using the NanoVNA.
3) Tune the loading coils first to get the lowest SWR at the desired frequency. Then tune the center coil to obtain the lowest SWR possible.
4) The 10 meter board in this arrangement does not use a center coil.
5) Many factors will affect the inductance of a coil and therefore the tuning. They include location of the coils in relation to each other (inline or offset), and how much copper or other metal is near the coil.

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6) The 40 meter coils will be the most difficult to tune and have a very narrow usable bandwidth.
7) A power limit has not been tested. The coils shown have been successfully used at 100W with no issues.

Coil winding tips

Wire for tightly wound coils must be enamel coated “magnet wire” like used in electric motors. The 18GA wire shown in the photos below was removed from the stator of a small compressor motor.

Coil forms can be metal rod, wood dowel, or just about anything with the proper diameter. Cutting a slot across the end of the form to secure the end of the wire makes it easier to wind a tight coil.

Calculate the length of wire needed and add enough for a few extra turns. You will have to wind a few extra turns because the coil will tend to unwind a bit once tension on the wire is released. Therefore the final coil diameter will be slightly larger than the form. For example, a coil of 18GA wire wound on a 3/8” form will end up with a 0.44” diameter. The amount of unwind will depend on a lot of factors, mainly the stiffness of the wire. You may have to wind a few coils to get a feel for how your wire reacts. You can always trim off extra turns, but you cannot add more turns.

Cut your length of wire from the spool and clamp one end in a vice. Start winding the coil from the other end while holding tension on the wire. Slightly angle your form while winding so the windings are tight together.

Take time to straighten your wire as much as possible before winding. This will make for tighter coils. Small kinks and bends can be removed by dragging the wire between two pieces of plastic with small straight grooves cut in them. Clamp one end of the wire in a vice, sandwich the wire in the grooves between two plastic pieces, and drag them down the wire. Be careful not to damage the enamel coating.

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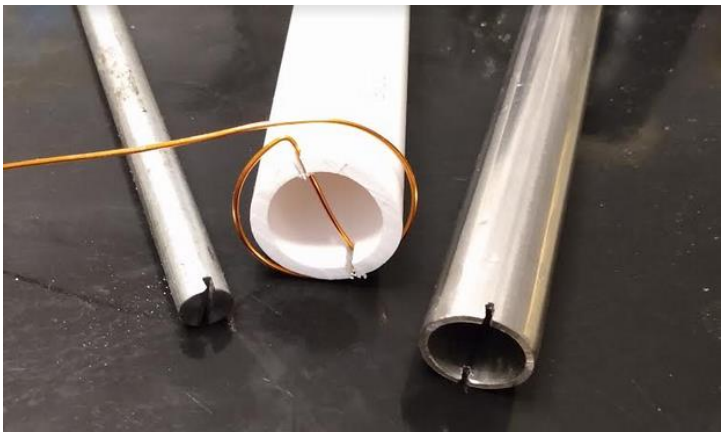
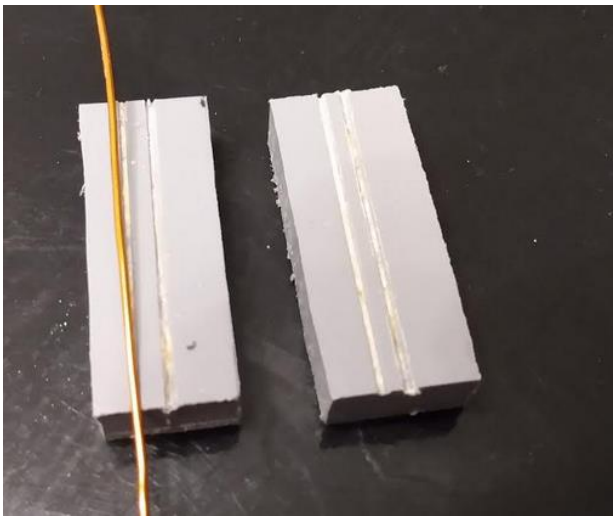


Coil forms - 3/8”, ¾”, and ¾” pipe



Wire straightening blocks

Motherboard

The plug in coil arrangement uses a mother board that is attached to the antenna, and a coil board that plugs into the mother board. The mother board contains the SO239 connector and the receptacles for the coil board. The plugs and receptacles are banana plugs that have a couple features that make them attractive for this use. They are stackable, so they have a receptacle for another plug on the opposite end from the plug. They also have a screw in top, normally used to attach a wire to the side, which is useful in mounting the banana plug to a thin board.

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Stackable banana plugs

The banana plugs used were purchased on eBay. Search for “stackable banana plugs”. About $8 for 24.

Dimensions for a mother board are shown below. Unless you are extremely accurate in laying out and drilling holes, the use of a template is suggested to make sure every coil is interchangeable and fits the mother board. Start by using a piece of scrap material and making a drill template that will be used to drill the holes in the mother board and every coil board. The template has just 4 holes in a line that match the dimensions for the locations of the banana plugs. A durable material is recommended since it will be used to drill several holes.

The following Motherboard drawing shows the basic dimensions.

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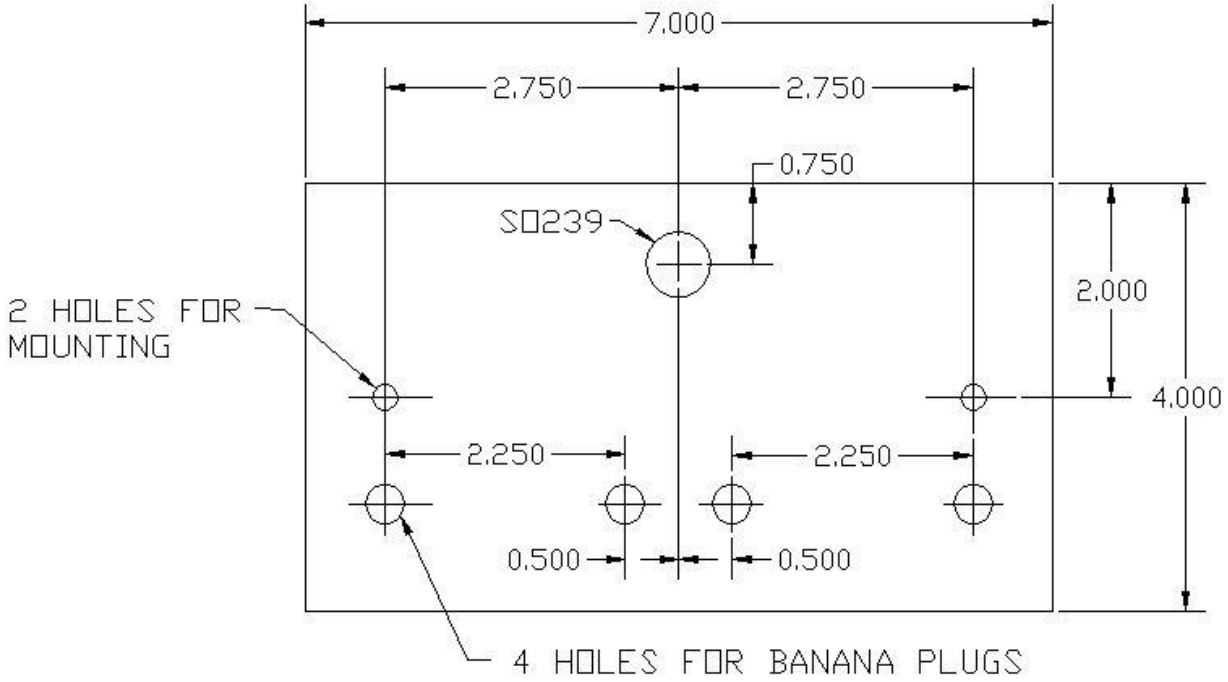
Mother board drawing



A Top Secret steel template for locating holes.

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Dew covered phenolic mother board. (Extra holes not required…) View rotated 90 degrees

Back side of mounted mother board. Wire was used for connection of the SO239 to the center receptacles. Small pieces of copper clad board or brass sheet were used to connect the ends of the loading coils to the antenna mounts. View rotated 90 degrees

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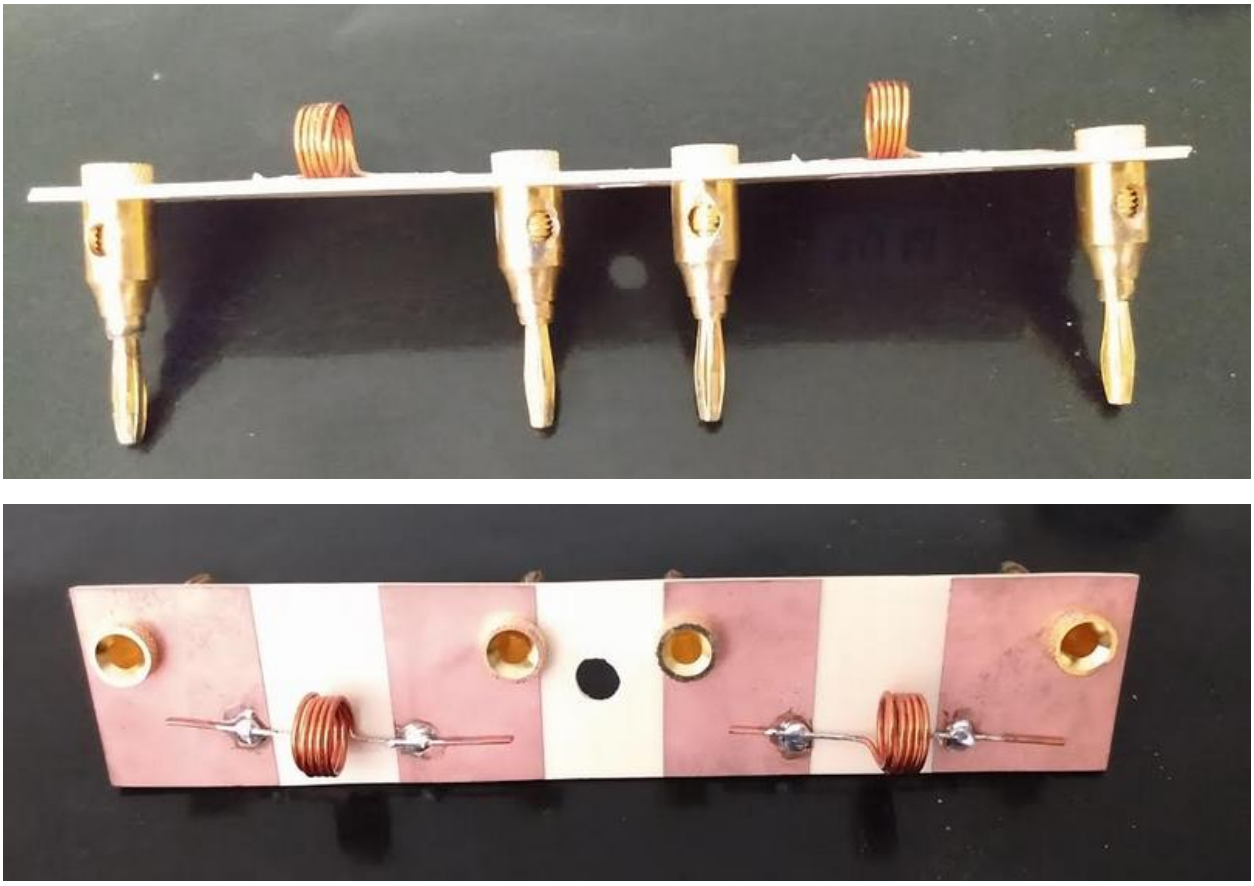
Coil Boards

Boards for the coils were adapted from W9PB's design. The coil boards are a relatively thin non-conductive material like phenolic or Plexiglas, with pieces of copper clad circuit board attached near the connection points. Coils are then soldered in place on the board. Heat while soldering can be an issue when using a material with low melting point. Alternatively, a piece of copper clad circuit board can be used with the copper removed between the connection points. (Boards shown use this method) There has to be enough space between the copper pads to avoid arcing. The idea is just to make a board that will hold the coils, make electrical connections, and mount the banana plugs.

Coil board photos



10M coil board top and edge views

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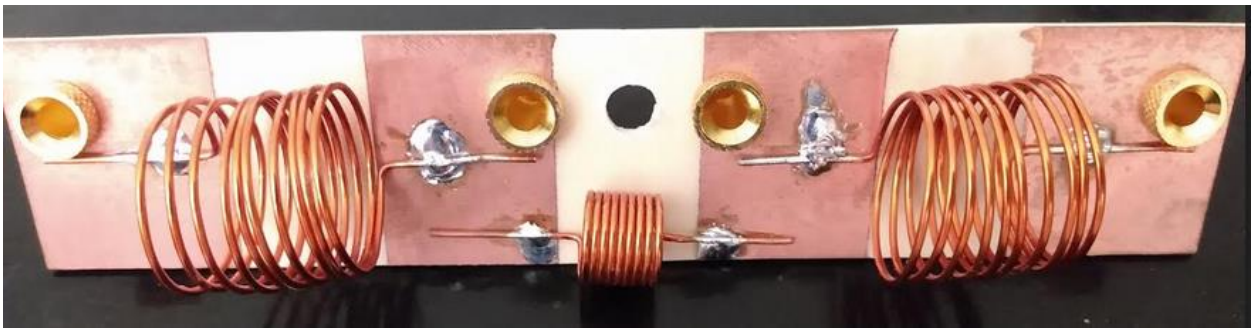
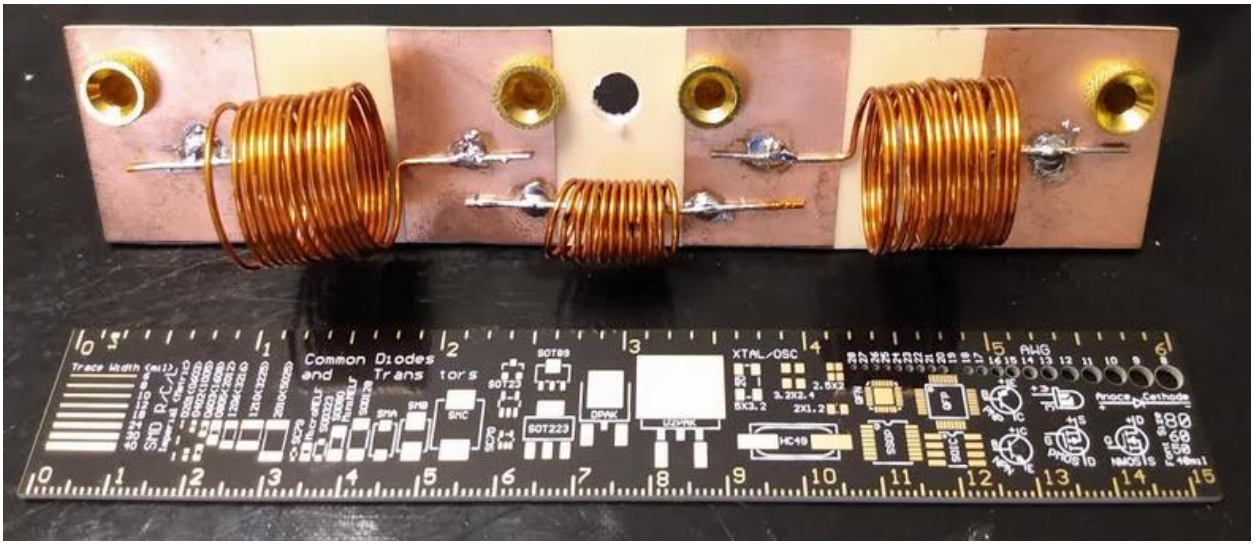
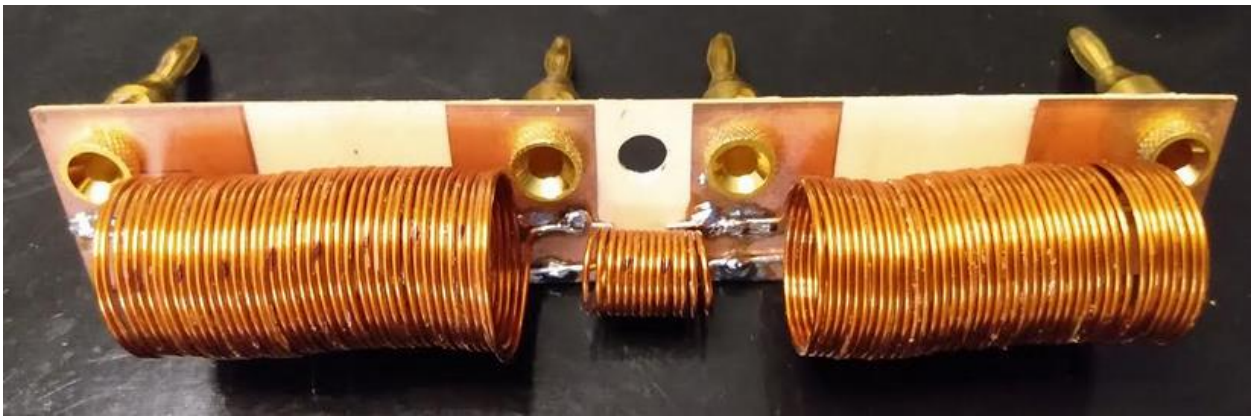


17M coil board



20M coil board



40M Coil board

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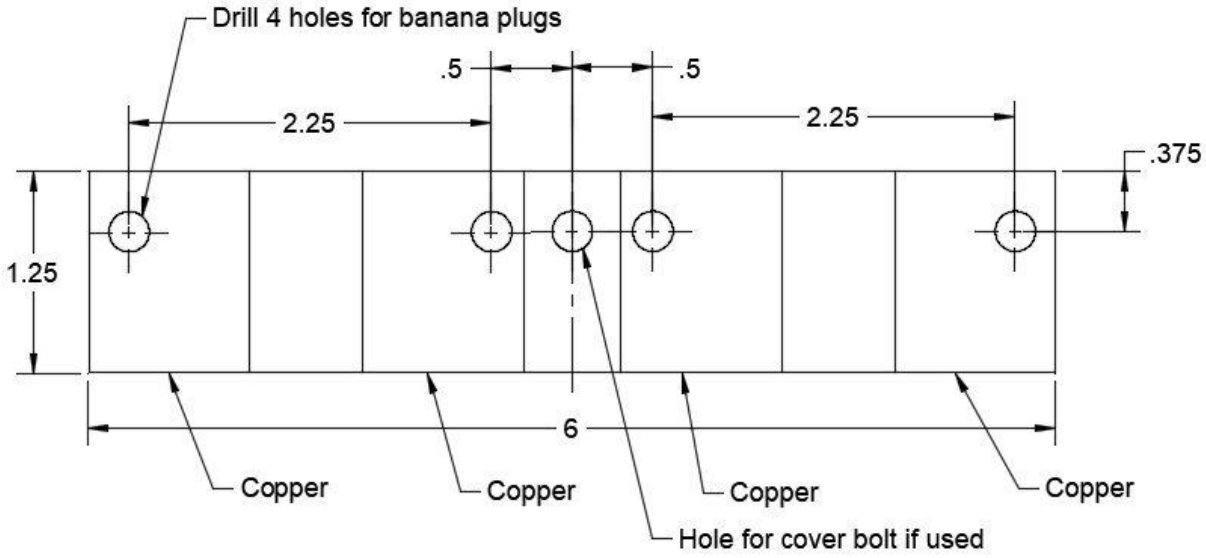
A coil board covered with a 3D printed cover to protect the coils from damage.

The following drawing shows the basic dimensions for the coil boards.



Coil board dimensions

You can also adapt the original stretch coil boards to be plug in boards as shown below.

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Original stretch coils adapted to the plug in design

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A coil board with 3D printed cover plugged into the mother board.

We are having a lot of fun developing various coils and learning about antennas with this project. Here is a sneak peek at a future set of coils. It uses roller inductors driven by a stepper motor from a controller in the shack.

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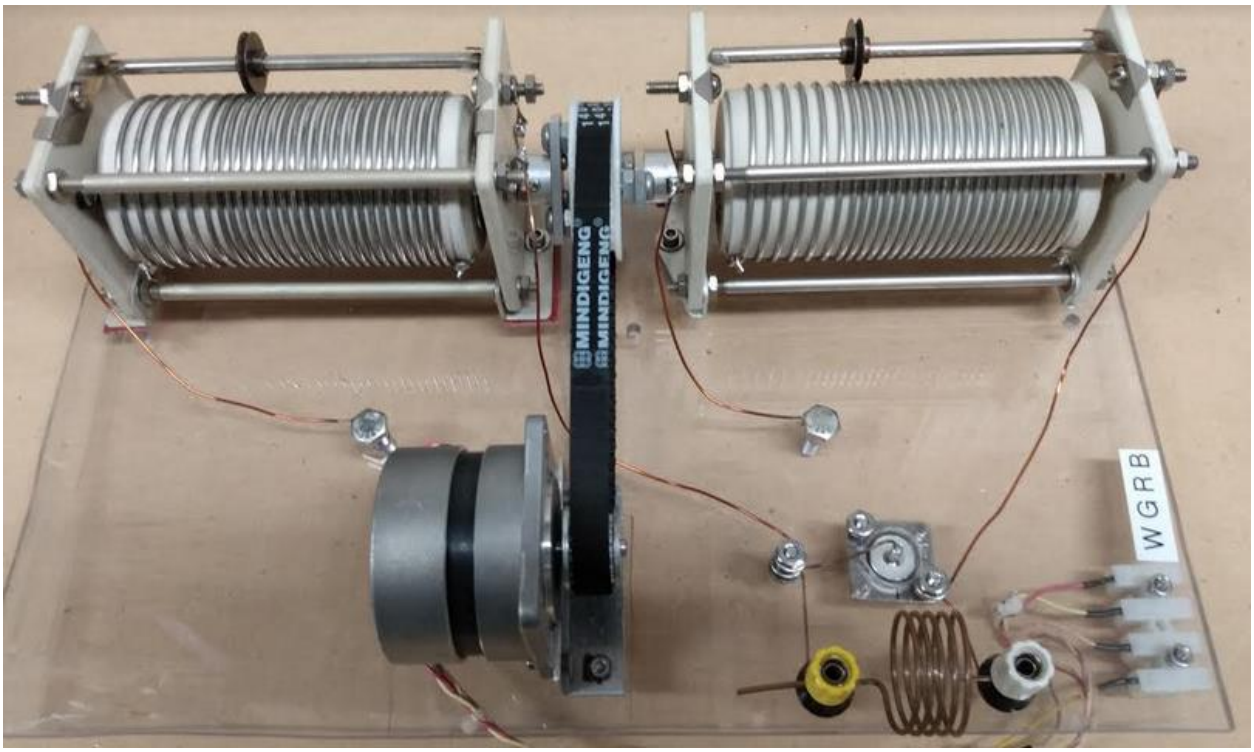

Roller inductor coils